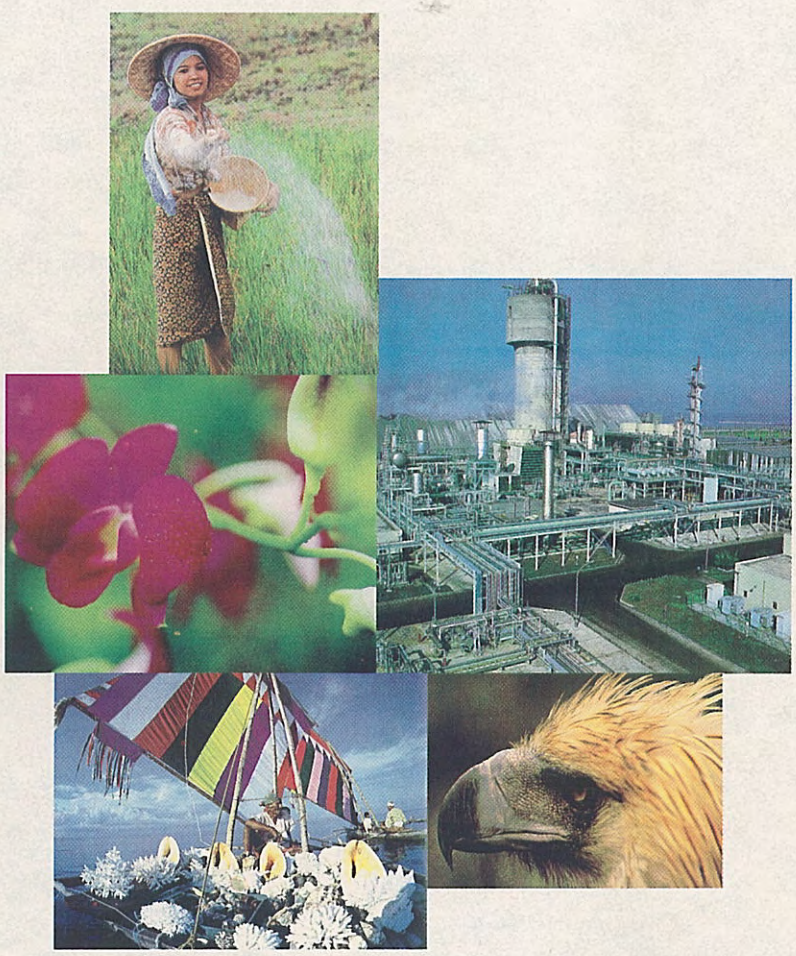
First ASEAN State of the Environment Report



UNEP

First ASEAN State of the Environment Report

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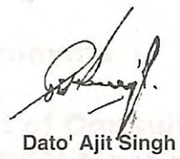
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Foreword

ASEAN recognises the importance of conserving the region's resources and protecting its environment as being crucial to sustaining the region's vigorous pace of development. ASEAN's commitment to addressing environmental issues was highlighted at the Fifth ASEAN Summit in December 1995 when the ASEAN Leaders called for the advancement of the economic prosperity and social well-being of the people in the region in a sustainable manner for the benefit of future generations and in the interest of ensuring a balanced ecosystem.

Realising that an integral aspect of preserving the ecologicai balance is the ability to assess and monitor the quality of the environment and in keeping with one of the key strategies of the ASEAN Srtategic Plan of Action on the Environment (1994-1998), the ASEAN Secretariat embarked on the preparations of the First ASEAN State of the Environment Report, with funding from the United Nations Environment Programme (UNEP). The Report covers a wide range of topics such as land, air, water, people, agriculture, industry, energy, transport, international trade and tourism, legislation and institutions as well as ASEAN's initiatives and future challenges. It constitutes what is hoped to be the first in a series of periodic reports on the state of the environment in the ASEAN region.

ASEAN's pursuit of sustainable development is a continuous process which involves both the ASEAN Governments and the peoples of the region. At the national level, the formulation of effective legal and regulatory frameworks is a fundamental task. In the long run, activities and processes geared towards sustainable development have to be institutionalised and integrated into all aspects of development to ensure that the balance between environmental protection and economic growth is achieved. In the regional context, on-going efforts under the directions set by the ASEAN Strategic Plan of Action on the Environment have to be further intensified. The First ASEAN State of the Environment Report will hopefuily contribute to these efforts by expanding the information base and identifying challenges that confront ASEAN in advancing its economic prosperity and social well-being in a sustainable manner.



Dato' Ajit Singh
Secretary General of ASEAN

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Chapter 1
Land

This chapter describes and analyzes the status of land resources in ASEAN. The discussion covers land use and the factors that influence its change; the history of and trends in forest utilization; and the growing concerns over wildlife and biodiversity conservation. Problems associated with deforestation, and loss of wildlife habitat, including their principal causes, are assessed. The chapter also describes the various ASEAN programmes and related efforts aimed at solving these problems and ensuring sustainable land resource utilization.

ASEAN Facts and Figures

Land area (1995)	338.7 million hectares
Population (1993)	406.5 million
Population density (1993)	1.20 per hectares
Cropland and pasture (1992)	78.5 million hectares
Forest and woodland (1992)	163.3 million hectares
Annual deforestation rate (1980-90)	2.5 million hectares
Forest plantations (1991)	9.9 million hectares
Protected areas (1993)	28.8 million hectares

I. LAND USE

Land use in ASEAN countries has changed significantly over the years. Forestlands have been converted to croplands, to permanent pastures and to other uses, mainly as a result of the food and shelter needs of a growing population.

From 1980 to 1990, forest and woodland areas in ASEAN decreased by 9%, while croplands increased by 13%, and pasture areas by 2%. Areas classified as "other lands" increased significantly by 12%. These include uncultivated lands, grasslands not used for pasture, wastelands, wetlands, and built-up areas, including roads. Since wetlands are relatively fixed, and built-up areas could not have increased by as much as 12% in 10 years, it is likely that a major part of converted forestlands went into uses that were neither economically productive nor environmentally sound. Compared to the whole of Asia, ASEAN's land use patterns have changed much more rapidly. For the same period, Asia's forests were reduced by 4.9%, croplands and pasture areas expanded by 10.8%, and "other lands" decreased by 4.6% (Table 1.1). In 1992, approximately half of ASEAN's total land area of 338.7 million hectares consisted of forest and woodland, almost 20% was used for agriculture, 4% was used for pastures, and the remaining 30% was used for a variety of other purposes.

Unplanned conversion is a major factor influencing land use changes. Encroachments by settlers and shifting cultivators have opened vast areas of forests, leaving them without adequate protection. As settlers did not have the means to use land properly, not all forestlands that have been settled or cultivated were developed into productive areas for agriculture. Vast tracts of what used to be forestlands have actually degraded into fire-prone bush and grassland areas.

In the past, land use planning in ASEAN was based on a hierarchy of uses. After allocating for human settlements, the best lands were reserved for irrigated agriculture, the next best for dryland agriculture, then for pastures, and finally what remained was set aside for forestry and wildlife conservation. Since forestlands were allocated as a residual, the tendency has been to take forest protection for granted.

Recently, a new set of values has begun to influence land allocation decisions. Land is now perceived to be part of a life sustaining ecosystem -- a limited resource that has to be conserved and sustained for productive use. Through a system of "comparative" land evaluation, the suitability of land for particular uses can be assessed and made a basis for its allocation. The integration of environmental considerations into land resources evaluation and development planning has also gained momentum throughout the region.

Table 1.1: Comparative Global Land Use Changes, 1979-91 (thousand hectares)

Region	Population		Cropland		Permanent Pasture		Forest and Woodland		Other Land	
	Land Area (million ha)	Density (1993) per 1000 ha	1989-91	%change since 1979-81	1989-91	%change since 1979-81	1989-91	%change since 1979-81	1989-91	%change since 1979-81
ASEAN	338.7	1,253	64,252	13.0	14,261	2.0	163,305	(9.0)	96,882	12
Asia	2,679.0	1,229	457,204	1.3	759,367	9.5	531,722	(4.9)	930,704	(4.6)
Africa	2,964.0	237	181,125	5.0	900,428	0.9	684,664	(3.8)	1,197,734	0.9
S. America	1,752.9	177	113,709	12.7	493,930	4.4	829,386	(5.1)	315,900	3.5
World	13,041.7	427	1,441,423	1.8	3,357,292	2.4	3,897,998	(7.8)	4,345,007	5.5

Sources: WRI, 1994; ESCAP, 1994; ASEAN Secretariat, 1997
Figures in parantheses represent decreases



Mixed cropland and woodland in ASEAN

II. FORESTS

A. Importance and Use

Tropical forests are repositories of irreplaceable genetic resources. A quarter of the earth's plant species, along with the largest variety of animals, can be found in the tropical moist forests of Southeast Asia. Three of the 12 "megadiversity" countries in the world, where half of the earth's plant and animal species can be found, are in ASEAN: Indonesia, Malaysia and the Philippines (ADB, 1995).

Many indigenous groups in ASEAN live in forests. These include the Penan of Kalimantan and Sarawak, the Mrabri of Thailand, the Negritos of the Philippines, and the Kubu of Sumatra. Most of these groups have retained a way of life that is independent of the agriculture-based economies of the lowlands. For them, the forest is not only a source of food but also of other products such as building materials, fibers, medicinal herbs, gums, resins, and essential oils. Even tribal groups that have become primarily dependent on agriculture for their basic needs still derive important medicines, fibers, and supplemental foods from the forests (IUCN, 1991).

Until the early 1970s, the economies of most ASEAN countries relied heavily on wood exports for foreign exchange. Notwithstanding the industrialization that has taken place in ASEAN countries in recent years, the export of timber products continues to be significant in Indonesia and Malaysia. In 1992, ASEAN exports of wood products were valued at US$7.0 billion, accounting for 3.8% of total export earnings (ADB, 1995).

In recent years, people no longer considered forests as simply a timber resource. Forests have become an important revenue source for tourism. Non-timber resources have become an important source of livelihood for poor rural communities -- providing raw materials for small scale cottage industries such as furniture, handicrafts, basket-making, honey collection, and the processing of medicinal herbs. In recent years, ASEAN's trade in non-wood forest products was valued at US$2.0 billion.

Indirect benefits from forests are also growing in importance. They protect watershed, low-land agricultural areas from erosion and abrasion; help assimilate human, agricultural and industrial wastes; and help to regulate microclimates. ASEAN tropical forests also play an important role in maintaining regional and global climates by serving as a natural sink for carbon dioxide and other gas emissions.

B. Forest Extent and Distribution

Tropical moist forests once covered nearly all the land in ASEAN. Over thousands of years, alluvial flatlands once covered by swamp forests were gradually replaced by rice fields. The development of shifting cultivation soon opened up the hilly areas, followed by the spread of commercial logging and the introduction of plantation agriculture. More recently, government-sponsored

Table 1.2: Comparative Global Forest Cover (thousand hectares)

Region	Extent of Natural Forest 1990	1980	% change
ASEAN	156,473	182,258	14.15
South Asia	63,931	69,442	7.94
Tropical Southern Africa	145,868	159,322	8.44
Tropical Southern America	802,904	864,639	7.14

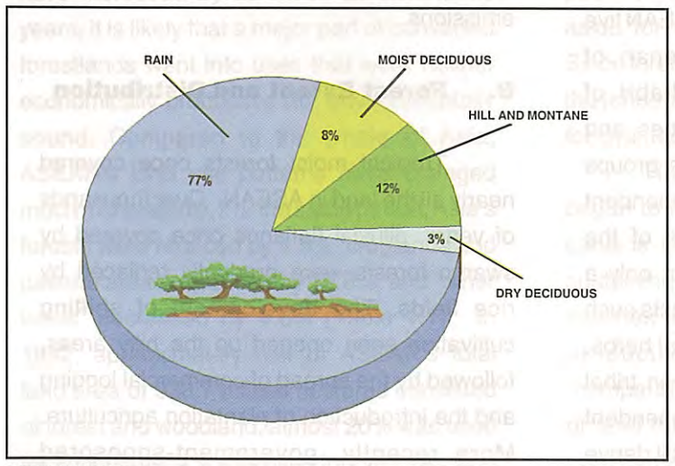
Source: WRI, 1994

resettlement programmes, have resulted in substantial reduction of what was once a vast expanse of forests.

In 1990, the extent of ASEAN's forest cover was about 156 million hectares, compared to 182 million hectares ten years earlier, or a reduction of 14% (Table 1.2). In that year, ASEAN accounted for about 9% of the earth's tropical forests estimated at 1,756 million hectares. Indonesia alone accounted for 70% of ASEAN's tropical forests and 6.2% of the world total.

The Food and Agriculture Organization (FAO) divides tropical forests into lowland forests, and hill and montane forests. Lowland forests are further subdivided into five categories based on rainfall and vegetation type, namely: rainforest; moist deciduous; dry deciduous; very dry deciduous; and desert (FAO, 1993). Seventy-seven percent of ASEAN forests are classified as rainforest, 8% as moist deciduous forest, and 12% as hill and montane forests. Dry deciduous forests comprise only 3% of ASEAN forests and are found mainly in Thailand and parts of Vietnam (Figure 1.1).

Figure 1.1: Types of Forest Cover within ASEAN, 1990 (percent)



Sources: FAO, 1993

ASEAN tropical forests are located in a region botanists refer to as Malesia. This bio-geographical region consists of the Malay Peninsula and the vast group of islands that straddle the Indonesian and the Philippine archipelago. The tallest tropical rainforests in the world and the largest volume of timber stock per unit area can be found in this region.

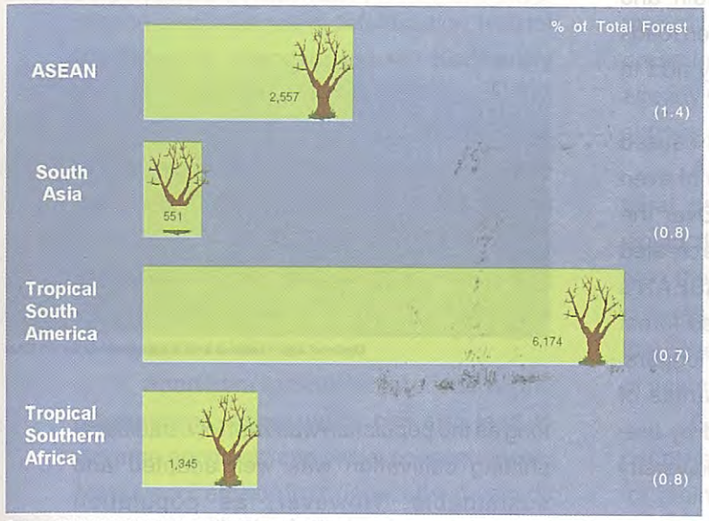
C. Deforestation

1. Deforestation Rates and Extent

Deforestation is defined as the permanent depletion of the crown cover of trees to less than 10% of the surface area (WRI, 1994). Based on this definition, ASEAN's annual deforestation rate from 1980 to 1990 was about 1.4%, (Figure 1.2). Over the course of a decade, the forest areas shrank by about 25 million ha, equivalent to 7.5% of the region's land area. From 1988 to 1993, the annual rate of deforestation even increased to 1.8% (ASEAN Secretariat, 1997). Thirteen percent of the annual deforestation was accounted for by the removal of forests from the more fragile hilly and mountainous areas.

Reduced dependence on timber-based export industries in recent years however, has slowed down the rate of deforestation. Indonesia, Malaysia, and the Philippines, which previously accounted for 90% of log export revenues in Asia and the Pacific, have

Figure 1.2: Comparative Global Deforestation Rates, 1980-1990 (thousand hectares)



Sources: FAO, 1993; WRI, 1994; ASEAN Secretariat, 1997

currently restricted their exports of timber.

2. Causes of Deforestation

Forests are susceptible to natural as well as human disturbances. Natural disturbances include fires, landslides, insects and diseases, while human disturbances include logging, and land clearing for settlements, agriculture and urban development. Human factors are mainly responsible for deforestation in ASEAN. The region's growing population continues to exert pressure on the forests in the form of increased fuelwood requirements, spontaneous migration into forest lands, and more agricultural land required to expand food production. Commercial logging, shifting cultivation, fuelwood extraction, and the lack of land security for upland dwellers, have caused serious damage to ASEAN's forests since the beginning of the century.



Deforestation in ASEAN

Timber has been the major product from ASEAN's forests -- about 80 million cu m of roundwood are harvested annually for commercial uses. The forests of the region, in particular those in Malaysia and Indonesia, still provide the largest source of dipterocarp hardwoods in international trade (WRI, 1994). ASEAN's forests are also harvested for non-timber products such as rattan, bamboo, ornamental plants, herbs, spices, and a variety of oils and gums.

Timber harvested for commercial use has depleted most of ASEAN's forest in critical proportions. Most commercial logging, particularly in Malaysia and Indonesia, still occurs in primary forests. At current rates of exploitation, including conversion to other uses, virtually all of ASEAN's primary forests would be logged over within a decade or two. From then onwards, their productivity will depend on how well the logged over (or "secondary") forest areas are managed for sustained yields. Of greater concern is whether the logged over areas can be protected from conversion to other uses by migrants, illegal loggers and shifting cultivators.

Over the past decades, commercial logging within ASEAN has been largely characterized by inadequate measures to protect logged over areas and to ensure sustained yields. A study conducted by the International Institute for Environment and Development (IIED, 1988) reported that less than 1% of natural forests in Southeast Asia undergoes silvicultural management. The use of heavy machinery (e.g., bulldozers) to open up forests and transport logs has also caused

heavy residual damage to the terrain and surrounding vegetation. Poorly designed roads and careless felling practices usually add to the problem.

Compounding the destruction caused by the logging activity itself is a train of even more destructive indirect effects. Over the past 40 years, logging operations have created vast road networks throughout ASEAN's forests. These networks have opened forest areas to incursion by settlers, illegal loggers, and shifting cultivators. Over wide areas of ASEAN, forests have been replaced by fire-prone grasslands with very little biodiversity and very low productivity.

With careful management, it is possible to produce timber yields from natural forests on a sustainable basis. Except when the original virgin forests contains over-matured and diseased trees and subsequently managed improperly, timber output from secondary forests will not equal past harvests from the original primary forests. If badly managed or left unprotected, the forest degrades progressively into wasteland.

Agricultural and settlements expansion, both planned and unplanned, has also contributed to forest degradation and loss. Increasing evidence suggests that the biggest threat to tropical forests is uncontrolled fuelwood collection and unsustainable agriculture (ADB, 1995). An estimated 240 million cubic meters of fuelwood are cut annually from ASEAN's forests. However, it is logging that usually starts a train of events that lead to forest degradation and eventual forest conversion.

The use of forests for shifting cultivation of various kinds is a predominant occurrence in ASEAN countries and dates back to the beginning of the agricultural era in the region. Various systems of shifting cultivation have evolved over time. Essentially, the basic system involves the rotation of fields rather than crops, in which a fallow period allows nutrients to be restored and future crop cycles to be made. As



Upland Agriculture and Settlements in ASEAN

long as the population was kept low, traditional shifting cultivation was well adapted and sustainable. However, as population increased, shifting cultivation became destructive. Tribal peoples who still rely on the system have been forced to adopt shorter and shorter fallow periods because of increasing population with less areas to cultivate. Compounding the problem are cultivation practices of migrant lowlanders that are harmful to forest soil.

In the absence of appropriate instruments to protect and secure land rights and tenure, settlers have very little incentive to take good care of the land. Most settlers tend to exhaust as much land in the shortest time possible, after which they move on to other areas. ASEAN forest lands are mostly public lands, but governments lack resources to protect and regulate private use of these areas. Uncontrolled access brought about by lack of protection has promoted forest misuse.

3. Consequences of Deforestation

Some of the well-known consequences of forest degradation and loss are: massive soil erosion; increased sedimentation of lakes, reservoirs and irrigation systems; reduced recharge to groundwater; flooding and the destruction of agricultural lands and coastal areas. The loss of tropical forests is of global significance because it affects regions rich in biodiversity that needs to be preserved.

The rate of biodiversity loss is not merely proportional to the rate of deforestation. Habitat loss, and its attendant impact, biodiversity loss, occurs much faster than what deforestation rates alone would imply. This is due to the effect of forest fragmentation -- the division of the forest area into patches -- that often occurs after logging or clearing for agriculture. A fragmented forest will support less biodiversity than a continuous forest area of the same total size.

Apart from its detrimental effects on the environment, deforestation can also lead to adverse economic and social consequences. Massive soil erosion from denuded watersheds has caused siltation in major rivers, lakes and reservoirs, thus reducing the benefits from investments in irrigation and increasing the costs of maintenance. Higher runoff volumes combined with reduced capacities of silted waterways have exacerbated flooding, resulting in increased costs of infrastructure maintenance and the need for additional investments in flood control. What is more important, flooding has destroyed lives and property and has caused damage to agriculture, fishery and industry.

Physical deterioration of the uplands from deforestation has affected the productivity of both lowlands and coastal areas, and in turn, their capacity to support an expanding population. As more people are driven into the uplands, further forest degradation results from unsuitable cultivation practices. A vicious cycle of destruction follows. As the uplands' productive capacity declines, and as the remaining areas recede into inaccessible slopes, the pattern of migration could reverse toward the coasts. Once this happens, added pressure on vulnerable coastal systems, already suffering from overuse, could result in serious ecological damage.



Land Erosion in ASEAN

ASEAN forests are home to millions of tribal people. Forest degradation and loss would disrupt not only their livelihoods; but also their distinctive ways of life and unique cultures. Indigenous forest-based economies that have evolved and survived over thousands of years face the risk of disappearing.

Globally, deforestation has had a negative impact on the sequestration of carbon for maintaining the climate. Deforestation in Asia as a whole is estimated to have contributed 6% of the recent increase in global atmospheric concentration of carbon dioxide (WRI, 1994).

D. Forest Protection and Reforestation Efforts

Most ASEAN countries allocate their forest lands for various categories of use, namely: production forests; conversion forests; protection forests; and totally protected parks and reserves. Production forests are areas designated for logging, which are managed in such a way that theoretically, they will be able sustain harvests on a 25 to 70 year cutting cycle. Conversion forests are areas identified as having potential for agricultural development.

Protected forest areas are of two types: i) totally protected forests, and ii) protection forests. Totally protected forests are the most secure. They are the the most biologically rich sites, and are often protected by legislation or are set aside as a commitment to international conventions. Areas classified as protection forests are those used as water catchments for irrigation and hydropower facilities and for the protection of the physical environment.

However, while protected forests have been delimited on maps, few resources are available to effectively protect them on the

Box 1.1
ASEAN HERITAGE PARKS AND RESERVES: BRUNEI DARUSSALAM

Tasek Merimbun National Park

The Tasek Merimbun National Park is a unique area of outstanding natural beauty within reasonably close proximity to the country's main population centers. It covers over 78 sq km and is relatively easily accessible to the general public.

The National Park encloses the catchment and small river systems to the south that feed into the Tasek Merimbun lakes. Due to large fluctuations in rainfall, the extent and depth of the lakes vary enormously. When full, the two lakes have surface areas of approximately 100 and 120 hectares. They are separated by a narrow strip of land which at one point is broken by a narrow channel which permits water to flow between the lakes.

The park is over 80% drained swampland, made up of deep peat soils that are sometimes overlain with a shallow grey soil and alluvial soils in the valley bottoms. The undulating hilly land in the eastern part of the park is comprised of reasonably well-drained soils with clayey or loamy textures that could become seriously eroded if the natural vegetation was cleared.

The major part of the park is comprised of mixed dipterocarp forest especially to the south of the lakes. Freshwater swamp forests are found around both lakes and in the Medit swamp at the eastern edge. Between these is a large expanse of mixed peat swamp forest extending to the Sungai Tutong in the northeast. Some land within the park was cleared in the past and made subject to shifting cultivation.

The park is rich in fauna. It provides a habitat for the treeshrews, flying lemurs, bats, pangolins, and even-toed ungulates. Important primates include the slow loris, Bornean gibbon, long and pig-tailed macaque, and western tarsier. Other animals are the sun bear, Malay civet, banded palm civet, short-tailed mongoose, clouded leopard, lesser mouse-deer, red muntjae, and others. Perhaps the most notable of the fauna are the birds, of which more than 183 species have been recorded at the park.

A management and development plan has been prepared for the park to preserve its fauna and flora in perpetuity. Other objectives are to promote research, educational and recreational values. To meet these objectives, the park has been divided into three broad management zones: high, medium and low land use zones. Currently, the government of Brunei Darussalam is constructing research and providing public recreation facilities within the High or Intensive Visitor Use Zone scheduled for completion in early 1997.

Source: ASEAN Secretariat

ground. In many cases, these areas are still exposed to timber poaching and agricultural encroachment.

Sustained yield management of tropical forests is technically feasible, as long as proper management and sound logging methods are used. In addition, perennial agricultural tree crops such as rubber trees could be an alternative source of timber. In Malaysia, for example, around 1.2 to 1.5 million cubic meters of rubberwood are lately being used for the production of furniture. Similarly, coconut trunk is being used as a wood source in the Philippines and other ASEAN countries.

Indonesia and Malaysia, which have large forest areas, have allocated a major part of their permanent forest estates to sustained timber production. On the other hand, Thailand, following its decision to ban logging, has decided that all remaining forests should be protected and that timber should be sourced through either imports or from plantations. In the Philippines, efforts are being directed at establishing alternative forest plantations to replace primary forests which have been extensively logged. Secondary forests, many of which are in poor condition are being assigned for management by local communites Legislative proposals for a total commercial logging ban, or an alternative selective area

ban, in natural forests are being considered.

Forest plantations offer an alternative source of timber from natural forests. Because many of the accessible natural forest stocks have been used, the future supply of most wood and wood products would have to come from plantations. From 1981 to 1990, an average of 1.2 million hectares of forest plantations have been established each year throughout ASEAN, mostly in Indonesia and Vietnam (FAO, 1993 and ESCAP, 1995). By 1990, ASEAN forest plantations covered close to 10 million hectares, representing one-fourth of the 40 million hectares of forest plantations established worldwide.

Potential wood production rates from plantations exceed that of natural forests. Natural forests under sustained yield management usually produce only one to two cubic meters of timber per hectare annually. In contrast, plantations of fast growing species in the tropics produce from 20 to 70 cubic meters per hectares annually. The World Bank has estimated that the world's industrial timber requirements by the turn of the century could be met if at least 5% of the tropical forests existing in 1980 were converted to forest plantations. Theoretically, one million hectares of forest plantations of fast growing species in the wet tropics could supply the world's projected total pulp and paper requirements (i.e, using known tree varieties and plantation management techniques).

The Asian Development Bank (ADB) has invested heavily in plantations of *Acacia mangium*, a fast growing species, in Indonesia, Peninsular Malaysia and Sabah. Multinational companies such as Mitsubishi and Shell are investing in plantations in Indonesia. Similar private sector initiatives to establish plantations can be found in Malaysia, Thailand and the Philippines.

ASEAN countries have adopted the Tropical Forestry Action Plan (TFAP) prepared by FAO in 1985 that emphasizes the importance of establishing national networks of protected forest areas. The overall objective of TFAP is to restore, conserve and manage forest lands to sustain their benefits. Since the formulation of TFAP, multilateral banks and development aid agencies operating in ASEAN have extended priority to tropical forest conservation activities. In November 1992, an Asia-Pacific regional workshop on TFAP was held in Bangkok to discuss the programme's operating guidelines based on country experiences.

III. BIODIVERSITY AND WILDLIFE

A. Importance to the World and ASEAN

Biodiversity is the overall complement of plants and animals as species, and together, as components of ecosystems. Biodiversity is defined at three levels: genetic diversity, species diversity and ecosystem diversity. Genetic diversity is the variation of genes within a given species, while species diversity refers to variation among plants and animals within a region. Ecosystem (or community) diversity refers to the variation of habitats (e.g. forestland and grasslands).

Beyond its value as a natural heritage, biodiversity is the foundation of nature's delicate balance and upon which human survival ultimately depends. Economically, genetic diversity is important because it is the basis for the improvement of breeds for agriculture (e.g., pest resistant crops) and the development of biotechnology. Species diversity provides a host of wild and domestic plants and animals that are used for medicines, industrial products, food, and building materials. Diverse ecosystems, in turn, provide important functions in cycling water, nutrients and other materials.

Most of the world's biodiversity is located

in the tropics. Tropical forests provide home to 40% up to 90% of the world's species, many of these endemic (i.e., found nowhere else). Many of the world's crops and other economically important plants and animals came originally from the Asia-Pacific region. Southeast Asia, for instance, is the center of diversity of wild and domestic oranges and other citrus fruits (76% of the 33 genera). Only a small number of these wild citrus species have been used.

Thirty crops feed most of humanity, and about one hundred play a dominant part in world trade. A concern is that the genetic base of the major crops now in use is very narrow and therefore susceptible to pests and diseases. The wild species of their ancestral relatives are potential sources of new and more resistant breeds although these are increasingly being threatened by habitat loss.

B. The Status of Wildlife

Flora

Southeast Asia's forests are rich in plant variety and its numerous products. Malesia, that part of Southeast Asia consisting of the Indo-Malayan archipelago, is a distinctive floristic zone containing 25,000 species of flowering plants -- about 10% of the world's total. Peninsular Malaysia alone contains nearly 8,000 flowering plants belonging to 1,500 genera. About 40% of the genera found in Malesia, and an even greater number of species, are endemic.

Indonesia, like no other country in the world, is endowed with enormous biodiveristy. It occupies only 1.3% of the world's land surface, and yet it contains an estimated 10% of all plant species, 12% of mammals, 16% of reptiles and amphibians, and 17% of birds. Many species are found nowhere else (IUCN, 1991). Table 1.3 gives estimates of the number of endemic and threatened plant species within ASEAN.

Southeast Asia is a rich center of genetic variation in fruit trees and their wild relatives, only 30% of which have been cultivated so far. The genus *Mangifera* is the source of the cultivated mango, 39 species of which are found in the tropical forests of West Malaysia. *Mangifera caesia*, which originated in Sumatra and Malaya, is now widely cultivated throughout ASEAN. Most cultivated bananas are derived from *Musa acuminata* and *M. balbisiana* which originated in this region. Manila hemp, an important commercial fiber, is derived from *Musa textilis*, another native of the region.

Southeast Asia is also the center of diversity of oranges and citrus fruits. Sixty-eight percent of the 204 species of the *Aurantioid* subfamily (of the *Rutaceae* which in cludes these fruits) are native to the region. Malaysia alone has 50% of the species. These species are potential sources of material for the genetic improvement of cultivated citrus, an important trade crop. Other important fruit trees derived from Southeast Asia's forests are the durian, rambutan, mangosteen, illepe nut, and longan.

Bamboos and rattans abound in the region. Thailand has over 750 square kilometers of bamboo, distributed among 41 indigenous species while Indonesia and Malaysia have 125 and 70 species, respectively. The greatest concentration of rattan species is found in Peninsular Malaysia and Borneo (106 and 151 species, respectively). Exports of rattan from Southeast Asia is worth about $1.5 billion per year, mostly in the form of natural cane collected in the wild. Both Indonesia and Malaysia have recently established rattan plantations. Despite efforts to source rattan from plantations, rattans continue to be depleted in the wild as a result of forest clearing operations.

Table 1.3: Endemic and Threatened Plants in ASEAN

Country	Number of Plant Taxa	Number of Endemic Flora	Endemic Flora as % of Total	Number of Rare and Threatened Species	Threatened Plant Taxa as % of Total
Indonesia	24,375	15,000	62	283	1.16
Malaysia	15,500	4,500	29	490	3.16
Philippines	8,931	3,500	39	198	2.21
Thailand	12,625	NA	NA	0	0
Vietnam	10,500	1,260	12	357	3.40

Sources: WRI, 1994
na = not available.

Box 1.2
ASEAN HERITAGE PARKS AND RESERVES: INDONESIA

Kerinci-Seblat Reserve

This composite of reserves is part of the southern half of the Barisan range in Sumatra, with Mount Kerinci rising to some 3,800 meters in altitude. Kerinci is a volcano, although it has not been active since the turn of the century. The reserve covers an area of 14,846 square kilometers, and is still covered by vast stretches of undisturbed forests. It forms the catchment for two of South Sumatra's largest rivers: the Sungai Musi and the Sungai Batang Hari. In the middle of the reserve is a populated valley, about 70 km long and 900 to 1,300 meters in altitude.

A unique feature of the Kerinci-Seblat is the presence of mountain lakes. The largest of these lakes is the Danau Kerinci, about 60 square kilometers in size, located in the central valley. The next largest, which is about 10 square kilometers of filled-in volcanic crater, is the Danau Gunung Tujuh. At about 2000 meters altitude, the Danau Gunung Tujuh is the highest lake in the reserve.

The reserve is rich in fauna. It provides a habitat for the Sumatran rhinoceros, elephant, tapir, tiger and clouded leopard. Important primates include the siamang, the dark-handed gibbon and the macaque. Other important animals include the slow loris, the western tarsier, the barking deer, the sambar, and the serow. A total of 140 species of birds have been recorded in the reserve. In all, the biota of the reserve represent a major untouched storehouse of genetic resources.

Leuser National Park

This park is located in the northwest tip of Sumatra's Barisan range. It is a composite of mountain ranges and volcanic plateaus with deep gorges and narrow valleys, mostly above 600 meters altitude. Rich wildlife in the area attracted the attention of conservationists as early as the turn of the century. In 1980, the mountain complex became a national park covering an area of about 10,000 square kilometers.

Leuser national park has a rich and diverse list of animal species. There are 105 species of mammals (comprising about 60% of the total mammalian species in Sumatra), 313 species of birds, and 76 species of amphibians. It is believed that half of the total fauna of Sumatra is represented in the Leuser National Park.

Lorentz Nature Reserve

This reserve, located in Irian Jaya, is the largest single protected area in Southeast Asia. The park covers an area of more than 16,750 square kilometers excluding the settled areas. It includes Mt. Jaya, at 5,000 meters, the highest mountain peak east of the Himalayas and the only area in the region with a glacier. The reserve features a complete spectrum of New Guinean ecosystems, from mangrove forests along the coast to montane and alpine forest in the high altitudes.

Along the coastal part of the park is a very broad belt of mangrove forests covering the river deltas. Further inland is an equally broad belt of brackishwater and freshwater swamps, as well as peat swamps. In the rolling terrain of the reserve's middle part, evergreen rainforest predominates. The reserve as a whole is almost entirely undisturbed, in part because of its inaccessibility, and as such forms the largest block of pristine reserve in Southeast Asia.

The flora in the reserve shows a very high degree of endemism. The fauna is just as exotic. Some 350 species of birds have been recorded in the reserve, which represents more than half of the total number of avian species in New Guinea. The mammalian fauna of the Lorentz Park is strongly Australian related, which include wallabies, one species of tree Kangaroo and ten species of other marsupials. Crocodiles are very common in the swamps.

Source: ASEAN Secretariat

Table 1.4: Endemic Animal Species in ASEAN

Country	Mammals		Birds		Reptiles		Amphibians		Freshwater Fish	
	K	E	K	E	K	E	K	E	K	E
Indonesia	515	166	1,519	356	511	302	270	100	NA	29
Malaysia	264	14	501	4	268	69	158	39	NA	6
Philippines	166	6	395	172	193	158	63	44	NA	21
Thailand	251	6	616	2	298	35	107	16	NA	13
Vietnam	273	5	638	12	180	39	80	26	NA	4

Sources: WRI, 1994
K = known species, E = endemic species

Fauna

ASEAN forests are also rich in fauna. Many animal species can be found there and considerable numbers are endemic in the region (Table 1.4).

Asia-Pacific forests are rich in wild relatives of domesticated animals (IUCN, 1991). The most important are the ungulates, including pigs, deer, antelopes and cattle. The rare pig babirusa (*Babyrousa babyrussa*) found only in Sulawesi is now threatened by habitat loss. Also vulnerable in Indonesia is the Javan warty pig (*Sus verrucosus*) which is confined to Java and the small adjacent island of Bawean where very little of its forest habitat remains. Several species of deer, including the Calamian deer (*Cervus calamianensis*) and the Visayan spotted deer (*C. alfredi*), are threatened in the Philippines. Ungulates and deer are the primary targets of hunting. Though less numerous than in Africa, antelopes and gazelle species are also found in the region. A notable species is the serow (*Capricornis sumatraensis*) which is now endangered in Sumatra.

Southeast Asia is the home of the wild cattle which are the closest relatives to domestic cattle, and hence of considerable importance for stock breeders. These include the banteng (*Bos javanicus*), the wild water buffalo (*Babalus bubalis*) and the tamaraw (*B. mindorensis*). Wild relatives of cattle that abound in the region are now in danger of losing their natural habitats.

Of considerable importance to ASEAN's natural heritage are the species of carnivores, reptiles, rhinoceroses, elephants and primates. The carnivores include the Javan small-toothed palm civet (*Arctogalidia trivirgata trilineata*), the clouded leopard of Sumatra, the otter civet (*Cynogale bennettii*) and the Sulawesi palm civet (*Macrogalidia musschenbroekii*). The most famous cat is the tiger, presently endangered in Sumatra and Malaya, and now extinct in Java and Bali. The status of less well known cats, such as the baby cat of Borneo (*Felis badia*), is also cause for concern.

The swampy and coastal areas of ASEAN contain various species of crocodiles. Four species are found in Indonesia, where the breeding of crocodiles in special ranches has developed into thriving businesses for rural residents. The small islands off Flores in Indonesia are home to the world's largest lizard, the famous Komodo dragon (*Varanus komodoensis*).

More than 20 species of rhinos once roamed the earth, but only five exist today. Two of them are found in ASEAN. The Javan rhino (*Rhinoceros sondaicus*) was once found in various places--- Assam, Burma; Vietnam; Sumatra; and as far as East Java. Today only two populations of the Javan rhinos are known



An endangered species in ASEAN

Box 1.3
ASEAN HERITAGE PARKS AND RESERVES: MALAYSIA

Kinabalu National Park

Mount Kinabalu, a 4100 meters high granitic mountain, is the centerpiece of the Kinabalu National Park in Sabah, Malaysia. It is the highest mountain in the Sunda shelf and its cultural importance in the region is very highly regarded. At hardly more than two million years old, Mount Kinabalu is one of the youngest mountains in the world.

Situated in a region of high rainfall, Kinabalu National Park is very wet and misty. This makes the area very rich in tropical vegetation. The mountain itself is considered a botanical paradise. The most notable plant groups are orchids, Rhododendrons, Nepenthes and the Rafflesia. Orchids are the most diversified species adapted to a very broad range of altitudinal environment --- from 1,500 to 3,000 meters. Nearly 1,000 orchid species have been recorded in the park. Rhododendrons, the next most common group, are found between 2,000 to 3,000 meters and are noted for their distinctive flowers. The pitcher plants (Nepenthes) are best grown in the 1,700 to 3,600 meter altitudes. The Rafflesia, considered the largest flower in the world, is found at altitudes up to 1,000 meters.

The fauna of Kinabalu is equally impressive. Most of the animal species are tree dwelling or nocturnal. Notable mammalian species include various species of bats, the flying lemur, treeshrews, the Slow Loris, the Tarsier, the Grey Leaf and Red Leaf monkeys, the Borneo Gibbon and the Orang-utan. Carnivores include the Malay Bear, civets and the Leopard. Perhaps, the most notable of the fauna are the birds, of which nearly 30 species have been recorded at the park.

Mulu National Park

The Mulu National Park lies in the northeast of Sarawak. The area consists of varied geological formations dominated by a large sandstone mountain, the Gunung Mulu, which rises to some 2,376 meters in altitude. The park's varied terrain provides an array of land types, the most impressive of which are the dramatic limestone pinnacles and its awe-inspiring caves.

The high rainfall in the region (more than 5,000 milimeters annually), with its erosive power, has created natural wonders on the topography of the park --- a very extensive network of rivers and tributaries; impressively curved pinnacles in the limestone hills; deep gorges and enormous caves in the karst region. These features together make the park one of the most spectacular in the region. Specifically, the limestone caves which numbers 14 with more than 50 kilometers of cave passages, have made the Mulu Park world famous.

Still largely pristine, the Mulu national park has a great diversity of plant and animal life. The limestone caves abound with cave life. The Gua Payau, the park's most spectacular cave, is home to nearly a million bats and tens of thousands of swiflets. The guano on the cave floor is some 30 meters thick, and this, in turn, supports a thriving ecosystems of various cave animals (beetles, millipeds, spiders and cave snakes).

The abundant rainfall and the variety of landforms have also created a great diversity of vegetation types. Nearly all the major inland vegetation found in Sarawak are represented in the park.

Taman Negara National Park

Taman Negara is the largest of the Malaysian heritage parks. Situated in the center of Peninsular Malaysia, it features a wide range of ecosystem that are rich in wildlife. The park covers an area of 4,340 square kilometers. The western third of the park is dominated by the Gunung Tahan massif, the highest mountain in Peninsular Malaysia which rises to 2,187 meters. A large central portion of the area is hilly and flat lands (about 58% of the total area) with altitude below 330 meters. Lowland dipterocarp forest is extensive in Taman Negara.

Many of the large mammals associated with the Peninsula are also found in the park. These include the Selandang (*Bibos gaurus*) and the highly endangered Sumatran rhinoceros. Other endangered species found in the park are the Tapir, the Sambar deer, the Serow and the tiger.

Other vegetation types are also present which include: the padang vegetation, the riverine forest and the limestone forests. Endemism has been reported high in these mentioned habitat types. Some 60% of Malaysian endemic mammals occur in the park. In fact, the fauna of the park is regarded as being highly representative of that of the entire peninsula. Taman Negara is believed to contain all the inland birds of Peninsula Malaysia.

Source: ASEAN Secretariat

to exist. According to the latest survey in 1993, about 50 individuals are found in Ujungkulon National Park, West Java, Indonesia; while about 5 to 15 individuals are found in Nam Cat Tien National Park, Southern Vietnam. In early 1980s, the number of Sumatran Rhinos (*Diceerorhinus sumatrensis*) was between 425-800 individuals, with lesser numbers in peninsular Malaysia, Sabah and Sarawak. Nowadays, viable populations exist only in Gunung Leuser National Park, Kerinci-Seblat National Park and Bukit Barisan National Park in Sumatra. Captive breeding for the Sumatran rhino has been initiated at the London Zoo and Ragunan Zoo (Jakarta), but so far without success. This underscores the importance of *in-situ* conservation for both Sumatran and Javan rhinos in the national parks to protect these species.

The Asian elephant found in Sumatra and Malaysia has also been the subject of extensive conservation efforts. Unlike in Africa, the threat to these elephants is not from ivory-hunters but from loss of habitat and breakup of migration routes. Much of the present conservation strategy involves preventing conflicts with farmers and livestock tenders who have encroached into traditional elephant migration paths. World Wildlife Fund (WWF), through its Indonesia office, has carried out surveys and prepared strategic plans for the elephants of Sumatra.

Important primates in the region are the gibbons and the orangutan of Borneo and Sumatra, and the variety of macaques and leaf eating monkeys that are found in Malaysia, Indonesia and the Philippines. Of the 44 species of primates known to exist in Southeast Asia, 33 have lost at least half of their range in the region (Mackinnon and Mackinnon, 1986). The primates have been the subject of comprehensive conservation plans such as those under the sponsorship of the IUCN

Table 1.5: Threatened Animal Species in ASEAN

Country	Mammals		Birds		Reptiles		Amphibians		Freshwater Fish	
	K	T	K	T	K	T	K	T	K	T
Indonesia	515	49	1,519	135	511	13	270	0	NA	29
Malaysia	264	23	501	35	268	12	158	0	NA	6
Philippines	166	12	395	39	193	6	63	0	NA	21
Thailand	251	26	616	34	298	9	107	0	NA	13
Vietnam	273	26	638	34	180	8	80	1	NA	4

Sources: WRI, 1994
K = Known species, T = Threatened species

Species Survival Commission, involving basic survey work and consolidation of protected areas. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) now prohibits trade in primates in the region. Table 1.6 gives estimates of the number of threatened animal species in ASEAN.

Most birds in ASEAN are forest adapted. In the Sunda shelf countries of Southeast Asia, over 78% of about 500 resident bird species live in closed canopy forests. Within ASEAN, the closed canopy moist forests have shrunk by 40% from their original extents. Most of the threatened birds are residents of lowland rain and monsoon forests. Around 7.5% or 277 species of the known bird species in ASEAN may be considered threatened (Table 1.5).

Deforestation has had a devastating impact on the diversity of bird species. The number of bird species was about 40% lower in logged over forests than in the primary forests of Peninsular Malaysia (IUCN, 1991). Deforestation is also the main threat to the Philippine Eagle (*Pithecophaga jefferyi*) which now numbers not more than 200 birds. Besides the effect of deforestation on bird habitat, trade in birds also exacts a heavy toll. Although there is no definitve evidence of recent extinctions, some species are now extremely rare. By international criteria, a species is considered extinct if it has not been sighted for the last 50 years. The difficulty with this criterion

Table 1.6: Habitat Extent and Annual Loss in ASEAN: 1980-1990

Country	All Forests		Rain Forest		Hill Montane	
	Extent 1990 (000 has)	% Annual Change (1981-1990)	Extent 1990 (000 has)	% Annual Change (1981-1990)	Extent 1990 (000 has)	% Annual Change (1981-1990)
Brunei	458	(0.4)	458	(0.4)	0	0
Indonesia	109,549	(1.0)	93,827	(1.0)	12,083	(1.1)
Malaysia	17,583	(1.8)	16,339	(1.8)	1,244	(1.8)
Philippines	7,831	(2.9)	3,728	(3.1)	2,690	(2.6)
Singapore	4	0	4	0	0	0
Thailand	12,735	(2.9)	3,082	(3.3)	1,263	(2.7)
Vietnam	8,312	(1.4)	2,894	(1.4)	1,084	(1.4)

Sources: WRI, 1994
Figures in parantheses represent decreases

is that much of the widespread destruction of habitat in tropical areas, and its effect on the extinction of species, has occurred relatively recently.

C. Conditions and Threats

Habitat loss is the biggest current threat to biodiversity (Table 1.6). This threat takes several forms. An area used by wildlife species could be lost outright, for example, by forest clearing. Even if this is not the case, however, degradation of habitats could seriously limit their capacity to support wildlife due to pollution, siltation, or soil nutrient depletion. As early as the mid-1980s, an IUCN-UNEP study (using vegetation maps and satellite imagery) found that over two-thirds of the original wildlife habitat in the Indo-Malayan bio-geographical region have been lost. Among the ASEAN countries, Brunei Darussalam has maintained intact 70% of its original wildlife habitat. Worldwide, about 12% of mammal species and 11% of bird species have been classified as threatened (WRI, 1994).

A form of habitat loss that is receiving increased concern is area fragmentation, in which native species are squeezed into small patches surrounded by areas cleared for agriculture and other purposes. In most cases, the area fragments are too small to support viable breeding populations. Related to fragmentation is the phenomenon of "edge effect", or the inability of wildlife to survive along fragment edges because of exposure to wind, sunlight, predators, and other factors. Habitat fragmentation is now an even greater threat to wildlife than direct area clearing itself. A 1993 study in the Brazilian Amazon Basin found that of the total habitat affected by forest

Table 1.7: Trade in Wildlife and Wildlife Products as Reported by CITES, 1990

Country	Mammals				Birds		Reptiles		Plants	
	Live Primates (no.) Imports	Export (no.)	Cat Skins (no.) Imports	Export (no.)	Live Parrots (no.) Imports	Export (no.)	Skins (000's) Imports	Exports (no.)	Live Orchids (000's) Imports	Export (no.)
Indonesia	0	10,909	0	2	0	58,271	0	1,305,988	0	5,265
Malaysia	2	0	NA	NA	0	2,030	0	438,804	0	350
Philippines	0	3,109	NA	NA	545	0	0	24,424	3,853	0
Singapore	0	6	1	0	5,399	0	0	1,177,225	0	2,005
Thailand	7	0	0	2	234	0	0	1,036,752	0	519,089
Vietnam	0	50	NA	NA	0	900	0	5,549	NA	NA

Sources: WRI, 1994
NA -- data not available

conversion from 1978 to 1988, 60% was attributable to fragmentation and edge effects.

Forest plants and animals found in ASEAN are traded locally and internationally. ASEAN is a net exporter of wildlife and wildlife products (mammals, birds, reptiles, and plants). Trade in birds from the Southeast Asia, particularly live parrots, is a major activity. In 1990, CITES reported that as many as 58,000 live parrots were exported from Indonesia, mostly from the Moluccas. In that year, Indonesia and the Philippines exported about 14,000 live primates, destined mostly for bio-medical research. Fourteen percent of the international export trade in reptile skins comes from Indonesia. Thailand is a major exporter of live orchids, accounting for nearly 40% of global trade (Table 1.7).

D. Protecting Biodiversity and Wildlife

There are generally two approaches to biodiversity and wildlife conservation. One approach is to protect individual species and populations. Another approach is to protect habitats. The first approach involves providing legal protection status to threatened species, developing conservation plans targeted at protecting them, or preserving them *ex-situ* (i.e., in zoos or botanical gardens). The second approach involves designating protected areas, that is, setting aside predominantly natural areas for purposes of conservation.

Protecting a species' natural environment or habitat is preferable to *ex-situ* conservation. Nevertheless, the importance of zoos and botanical gardens for protecting biodiversity and wildlife is increasing. Breeding programmes and techniques for genetic identification enable zoos to preserve rare or endangered animals. The main objective is to maintain a secure reserve stock of these animals as a safeguard against extinction. Zoo-bred animals are increasingly being used to reintroduce populations into the wild. Zoos, of course, contribute substantially to raising public awareness and concern for wildlife. Zoos in Singapore, Kuala Lumpur and Jakarta are increasingly becoming more involved in local conservation and education efforts.

Botanical gardens, on the other hand, are used for research on, and conservation of, plant genetic diversity. The loss of natural habitat is threatening the genetic base of the major crops now under cultivation, as the wild populations of their ancestral species needed to reinforce cultivated breeds are disappearing.

The main objective of botanical gardens and seed banks is to store the germplasm of endangered species. In tropical countries especially, maintenance of natural reserves is preferable to conventional long-term storage in low-temperature seedbanks. Out of about 100 major botanical gardens in Asia-Pacific (and some 1500 throughout the world), 21 are within ASEAN, most of them in Malaysia and Indonesia.

Ex-situ conservation in zoos and botanical gardens have been relatively successful. Despite this however, the most effective way of protecting biodiversity and wildlife is still the preservation of natural environments. *Ex-situ* conservation serves mainly as an insurance against loss of genetic and species diversity. But no zoo or garden can substitute for the natural habitat of a species and the ecosystem that encompasses it.

The bulwark of conventional habitat conservation in ASEAN is through protected areas in the form of nature parks and reserves. Traditionally, such areas are restricted to human activity. However, the need to accommodate people and at the same time safeguard biodiversity have led to a re-thinking of exclusive protection areas. Conservation combined with development is now evolving to be the preferred approach. This approach seeks to reduce human impact on protected areas by providing local populations with income generating opportunities that are not in conflict with conservation objectives.

Box 1.4
ASEAN HERITAGE PARKS AND RESERVES: PHILIPPINES

Mount Apo National Park

The 728 square kilometers Mount Apo National Park is found in the island of Mindanao. Within the park is located Mount Apo, the highest mountain in the Philippines with its peak at 2,954 meters altitude.

The park is one of the richest botanical mountains in the region. The genera is highly diversified with a high rate of endemism among the flowering plants. The Pandanus for instance is represented by nine species in Mount Apo, eight of which are endemic. Other well diversified genera found in the park have anywhere from four to ten endemic species in each. The early isolation of the Philippine archipelago from the rest of southeast Asia could account for such high floral endemism.

Though not as diversified as the plant species, the fauna of the park is also rich. A total of 84 species of birds have been recorded in the park. Among the three species of hawks and relatives in Mount Apo, the most spectacular is the endangered Philippine Eagle (*Pithecophaga jefferyi*) --- the second largest eagle in the world and found only in the Philippines. There are also at least 10 species of doves, five species of parrots, and three genera of hornbills. Mammals include the Flying Lemur, the Philippine Monkey, the wild pig, the Philippine deer, civet cat and the PhilippineTarsier. Although the number of species is not as high as in other ASEAN heritage parks, most of these species are found nowhere else in the region.

Iglit-Baco National Park

The Iglit-Baco National Park is located in the island of Mindoro and is about 755 square km in size. The topography is mountainous, dominated at the center by Mount Baco which rises to 2,300 meters.

The park contains one of the most important habitats of the endemic Tamaraw (*Annoa mindorensis*). Another interesting and important feature of the park is that it is home to four Philippine minority tribal groups --- the Botangans, the Hinunuo, the Mangyan and the Bangon. These tribal peoples practice shifting cultivation of upland rice and are also natural hunters. They are therefore heavily dependent on the Iglit-Baco ecosystems for their sustenance.

The western part of the park has a large coverage of grasslands, while the eastern part supports mainly forests. The park offers one of the most unique scenery with its high mountains of grassland.

Source: ASEAN Secretariat

The World Conservation Union or otherwise known as the International Union for the Conservation of Nature and Natural Resources has developed a system of national protected area classification according to various management objectives (including provision for human needs). Categories I and II refer, respectively, to strict nature reserves and national parks that are, by definition, protected from human exploitation. Categories III to VII accommodate sustainable forms of human activity or land use. For example, multiple use areas (category VII) provide for outdoor recreation and even timber production.

The ASEAN Heritage Parks and Reserves' Programme was launched in 1984, and its main objective is to develop and promote a regional network of protected areas notable for their outstanding wilderness quality and biological diversity. In 1985, ASEAN Member Countries agreed to conserve the habitats of rare and threatened species through the establishment and maintenance of protected areas by signing the Agreement on the Conservation of Nature and Natural Resources.

The total area covered by national protection systems within ASEAN is 28.8 million hectares or 8.5% of the land area. Of this total, about 70% (approximately 18.6 million hectares) fall under WCU categories I, II and



Botanical Garden in ASEAN

III, and may be regarded as fully protected areas. The remainder (about 10.2 million hectares) fall under categories IV and V, and may be regarded as partially protected (Table 1.8). Many of these protected areas were originally forest reserves established to regulate commercial exploitation and to safeguard soil and water resources, and were subsequently designated as national parks.

Protected areas in ASEAN include the Taman Negara, Malaysia's largest protected area that is home to 14 endemic mammal species out of the total 264 mammal species found in the country (WRI, 1994). In Thailand, the protected areas system provides refuge for 93% of its 595 forest bird species. Singapore's Green Plan provides for 5% (3,100 ha) of the country's land area for protection as nature conservation areas. In fact, the establishment of nature reserves has a tradition in ASEAN countries that dates back to nearly a century ago. As early as 1929, Indonesia, had established 55 nature reserves in Java, totaling 130,000 hectares. Traditional sultans established well over 500,000 hectares of reserves in Borneo and Sumatra. As of July 1996, Indonesia has set aside about 19.4 million hectares as terrestrial parks and reserves, and another 30.3 million hectares as permanent protection forests to safeguard important watersheds.

Actual on-ground protection for existing protected areas appears to be inadequate, even where coverage appears to be adequate. Overall, current conservation efforts are limited by weaknesses in supporting legislation and by inadequate resources.

Another issue concerns the size of existing protected areas considered too small or too fragmented to maintain viable populations of the species they were intended to house. In the Philippines, for example, eight of the 21 parks and reserves have areas less than 10,000 hectares. The great diversity of species in tropical forests implies that each species tends to have relatively few individuals in any given area. As such, substantially large areas are needed to ensure that there are sufficient numbers of individuals to allow for viable breeding populations. Hornbills are a case in point. Being large fruit eaters, they fly long distances for food. It has been estimated that areas at least 200,000 hectares in size are needed to preserve hornbill populations.

Fragmented areas, even if large in aggregate size, are not effective in conserving species. Early models of species extinction have shown that when only 10% of a habitat is preserved as a single undivided area, about half of the species confined to that area will eventually disappear (IUCN, 1991). As a rule, the smaller the habitat, the smaller the wildlife populations it can support, and the more vulnerable these populations are to factors that lead to their loss (e.g., disease, hunting).

A third issue concerns the representativeness of the protected areas. Important habitats often occur in varied ecosystems that need to be adequately represented. The Bali Declaration signed during the 1984 Third World National Parks Congress sought to ensure that tropical rain and monsoon forests are comprehensively represented within protected area systems.

In the face of mounting human pressures, current models of protected area systems are attempting to link protection areas with rural development and livelihood projects. The approach is to establish buffer zones where the resources can be managed to benefit the local populations. These buffer zones create surrounding multiple-use areas that serve to protect an undisturbed core area rich in biodiversity. Indeed, the concept of protected areas may soon be replaced by the concept of integrated development and protection areas

Table 1.8: National Protection of Natural Areas, 1993

Country	All Protected Areas Number	All Protected Areas Area (000 ha)	Totally Protected Number	Totally Protected Area (000 ha)	Partially Protected Number	Partially Protected Area (000 ha)
Brunei Darussalam	na	na	na	na	na	na
Indonesia	186	19,339	108	13,910	78	5,426
Malaysia	48	1,487	38	897	10	589
Philippines	27	573	14	226	13	347
Singapore	1	2	0	0	1	2
Thailand	106	6,475	66	3,424	40	3,051
Vietnam	59	897	7	142	52	755

Sources: WRI, 1994

Box 1.5
ASEAN HERITAGE PARKS AND RESERVES: THAILAND

Khao Yai National Park

Khao Yai, 2,168 square kilometers in area, is perched on the southwest edge of the Khorat Plateau of Thailand. It is the only ASEAN heritage park situated in continental Asia. It is also the most frequented of the heritage parks due to the area's proximity to Bangkok. The park is entirely surrounded by cultivated lands and some fairly densely populated areas.

Much of the area in the west is forested mountains while undulating plains are found in the east and southeast parts. The highest mountain the park is the Khao Laem which rises to about 1,400 meters altitude. The dominant vegetation in the park is rainforest.

The 125 groups of plant species in the park are of different origins --- 16 were found to be endemic, 17 of Himalaya origin, 14 from the Annam highlands, and 12 were found to have affinities with species in Malaysia. Thus, the park represents a melting pot of botanical elements from Southeast Asia.

The park has a rich wildlife. Among the large mammals, the most important are the tiger, leopard, elephant, Gaur (an enormous wild cattle), bear, wild dog, barking deer, samber deer, mouse deer and the civet cat. In addition to the macaque monkeys, there are two species of gibbons in the park --- the only place in Thailand where these species are found to co-exist. More than 200 species of birds have also been recorded from Khao Yai. In addition to wildlife, the park has a number of beautiful waterfalls.

Kor Tarutao National Park

Kor Tarutao is the only ASEAN heritage park that has a major marine component. The park consists of some 51 islands, covering an aggregate land-sea area of 1,500 square kilometers. It lies 26 kilometers from the southwest portion of Peninsular Thailand in the Andaman Sea. The largest island in the group is Tarutao itself which is about 150 square kilometers in size. Within this relatively small area are a wide range of ecosystems --- coral reefs, sandy beaches, mangroves, marshes, semi-evergreen forest and limestone forests.

Although the park is small, it is suprisingly rich in animal life. The main mammals include the wild pig, the feral water buffalo, mouse deer, macaque, monkeys, white-face Langurs, the civet cat and tree shrews. Mouse deers are especially common. The park is also rich in birds. The most common are doves, pigeons and three species of Hornbills.

Kor Tarutao has one of the best coral reef areas in the Andaman Sea. Though many areas have been disturbed by dynamite fishing, vast stretches of pristine corals have been preserved. As a result of protection given the area, fish and other marine life abound in the park.

Source: ASEAN Secretariat



A natural park in ASEAN

which satisfy the requirements of both people and nature.

In addition to existing national protection systems, ASEAN countries have also been active participants (as signatories or contracting parties) in various international conventions and programmes aimed at conserving natural areas of worldwide signifi cance. These include the 1972 World Cultural and Natural Heritage Convention that established a system of collective protection of natural and cultural heritage sites; the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora which protects against overexploitation of endangered species by controlling trade in wild fauna and flora through a system of permits; and the 1992 Convention on Biological Diversity which covers regulation of biotechnology development, access to and ownership of genetic material, and compensation to developing countries for extraction of their genetic resources. Although not legally binding compared with conventions, the UNESCO Man and Biosphere Programme has also promoted the protection of representative natural ecosystems in ASEAN, including restoring degraded areas to more natural conditions. Seven such biosphere reserves have been established in the region.

References

ADB. 1994. *Forestry Sector Study of the Philippines.*

AEGE. 1982. *United Nations Environment Programme, ASEAN Heritage Parks and Reserves.* Bangkok.

ASEAN Secretariat. 1997. *ASEAN Statistical Indicators,* ISEAS.

ESCAP. 1992. *State of the Environment in Asia and the Pacific, 1990.* Bangkok.

ESCAP. 1995. *State of the Environment in Asia and the Pacific: 1995.* Bangkok.

FAO. 1993. *Forest Resources Assessment, 1990 : Tropical Countries, FAO Forestry Paper 112,* Rome.

IIED. 1988. *Natural Forest Management for Sustainable Timber Production, 2 volumes,* London.

IUCN. 1991. *The Conservation Atlas of Tropical Forest : Asia and the Pacific.*

Mackinnon, J and Mackinnon, K. 1986. *Review of the Protected Areas System in the Indo-Malayan Realm,* Gland.

WRI. 1994. *World Resources : 1994-1995: A Guide to the Global Environment.* Oxford University Press.



Chapter 2
Water

This Chapter describes water resources in ASEAN in terms of quantity, quality, availability and distribution. It describes the patterns of utilization and assesses the problems associated with threats to sustainability of water supply resources.

Various programmes and related ASEAN initiatives aimed at addressing these threats are also described. The presentation has two main sections: i) inland waters, and ii) coastal and marine waters. Inland waters comprise surface water in rivers, lakes and man-made reservoirs; wetlands (i.e., swamps, mangroves), and groundwater. Discussion of coastal and marine waters covers mangroves, coral reefs, sea grasses, including the marine life contained in them. A section on the high seas is included, focusing on offshore fisheries and oil spill concerns.

ASEAN Facts and Figures

Annual internal renewable water resources (1994)	3,800 cubic kilometers
Annual withdrawals by sector (1994)	
agriculture	75%
domestic use	13%
industry	12%
Domestic per capita water withdrawal (1992)	170 liters / day
Wetlands of international significance (1993)	283 sites
Coastline (1992)	89,000 kilometers
Mangrove areas (1992)	3.3 million hectares
Annual fisheries production (1991)	12 million tonnes
Annual offshore oil production (1990)	108 million metric tons
Marine and coastal protected areas (1989)	9.6 million hectares

I. INLAND WATERS

A. Water Resources Profile

The climate of ASEAN, which is predominantly wet equatorial, is characterized by a substantial rainfall supply of about 3,800 cubic kilometers annually, about two-thirds of which is accounted for by Indonesia (Figure 2.1). ASEAN's water resources are generally self-contained, meaning they are not dependent on river flows from neighboring countries. The exceptions are Thailand and Vietnam, where 70 and 568 cubic meters, respectively, of annual water flows come from neighboring countries. (ESCAP, 1987)

The volume of available water resources is not uniform across time and space. Considerable seasonal variations occur particularly in river flows, with the distribution strongly affected by the northeast and southwest monsoon periods, as well as the occurrence of typhoons. For instance, typhoons bring 25% to 35% of annual rainfall in the Philippines. There is also considerable spatial variation within a country. In the dry parts of central Sabah, Malaysia, annual rainfall is about 1,730 millimeters, whereas in the mountain areas of Sarawak, rainfall could exceed 5,000 millimeters per year.

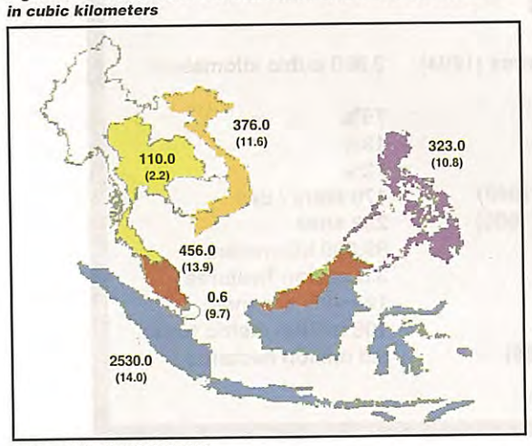
The term "annual internal renewable water resources" refers to the average annual freshwater flow of rivers and groundwater produced from rainfall that falls directly within a country's land territory. Annual internal renewable water resources per unit land area range from about 2,200 to 14,000 cubic meters per hectares (WRI, 1994; ESCAP, 1995) throughout most of ASEAN. On a per capita basis, there is greater variation throughout the region mainly due to differences in population density. Annual internal renewable water resources per capita range from about 220 cu m per year in Singapore to 2,000 in Thailand 24,000 in Malaysia (Table 2.1). Large per capita amounts however, do not necessarily mean that large quantities of water are readily available. Areas with abundant rainfall supply are often in remote mountainous areas, and in most parts of ASEAN, rainfall concentrates in only a few months of the year.

Table 2.1: Freshwater Resources Availability and Withdrawals in ASEAN

Country	Annual Internal Renewable Water Resources		Annual Withdrawals	
	total (cu km)	1992 per capita (000 cu m)	total (cu km)	1992 per capita (000 cu m)
Indonesia	2,530	13.23	16.59	95
Malaysia	456	24.27	9.42	768
Philippines	323	4.96	29.50	686
Singapore	0.6	0.22	0.19	84
Thailand	110	1.96	31.90	606
Vietnam	376	5.41	28.90	416

Source: WRI, 1994
Includes available river inflows from neighbouring countries

Figure 2.1: Total Annual Internal Renewable Water Resources in cubic kilometers



Sources: WRI, 1994; ESCAP, 1995
Note: ( ) indicates quantity available per unit land area in 000 cu m/ha

B. Surface Water Resources

Surface water resources comprise rivers, lakes and man-made reservoirs. ASEAN countries have numerous rivers and lakes that provide for domestic and agricultural water supply, navigation, recreation and fisheries. Indonesia alone has 200 major rivers; Malaysia, 110; and Thailand, 20. The region has two major lakes --- Lake Toba in Indonesia and Laguna Lake in the Philippines --- with a combined surface area of 204,000 hectares and a combined volume of 252 cubic kilometers. There are also numerous smaller lakes found throughout the region, the more significant of which are Lake Songkla in Thailand, Lake Taal in the Philippines, and Tasek Bera and Tasek Cini in Malaysia. A number of man-made reservoirs have also been created. These reservoirs play an important role in meeting the region's water supply requirements, primarily by regulating the effects of high seasonal variability in natural river flows.

C. Groundwater Resources

Substantial quantities of groundwater resources can be found in ASEAN because of favorable geology and large rainfall supplies for recharging underground reservoirs. Indonesia has an estimated exploitable groundwater potential of about 450 cubic kilometers per year, nearly 18% of its annual internal renewable water resources. Malaysia's exploitable potential is about 30 cubic kilometers, while the Philippines' is about 40 cubic kilometers, representing 7% and 12% of these countries' renewable internal water resources, respectively (ESCAP, 1992).

Because a major part of ASEAN is made up of islands, managing groundwater to maintain safe extraction levels is crucial because of its vulnerability to saline intrusion. In islands, and for small ones in particular, groundwater occurs as freshwater lenses that float on and hold back surrounding saline water. If groundwater is overdrawn, the holding effect of the freshwater lens is reduced and salinity advances inland, contaminating wells. In coastal urban areas, the overdraft of groundwater --- particularly from underground water bearing formations that are under pressure --- results in irreversible land subsidence. In Bangkok, the high level of groundwater pumping has created an extensive subsidence bowl that has impeded drainage of floodwaters, particularly during heavy rains.

D. Inland Water Resources Utilization

There are two types of surface water use: consumptive (those that involve withdrawal of water) and non-consumptive (those that involve uses of water without taking it out of its source). Consumptive uses, which include irrigation, domestic and industrial water supply, are sourced from both surface and groundwater. Non-consumptive uses, which include hydropower generation, fisheries, navigation and recreation, are sourced exclusively from surface water.

Surface water provides the bulk of the water supply in ASEAN. In Singapore and the coastal urban areas of Brunei Darussalam , there is almost total reliance on surface water. In Malaysia and Thailand, groundwater contribution to total water supply is 25% and 50%, respectively. In the Philippines, groundwater accounts for about 5% of water supply (ESCAP, 1992).

1. Consumptive Uses

Water withdrawal in ASEAN countries is about 120 cubic kilometers annually, or less than 10% of the usable internal renewable water resource supply. This withdrawal rate is considerably lower than the average for Asia, which is about 40%. With ASEAN's rapid pace of development over the last decade, water withdrawals have risen substantially to about 15% of available internal water supply. This level of water withdrawal is still safely below the accepted threshold value of 33% of

available water (ESCAP, 1992), except for two countries. Singapore's water withdrawal has reached 32% of its usable internal water resource supply while Thailand's withdrawal rate is about 29% of its combined usable internal water supply and river flows from neighboring countries (Table 2.1).

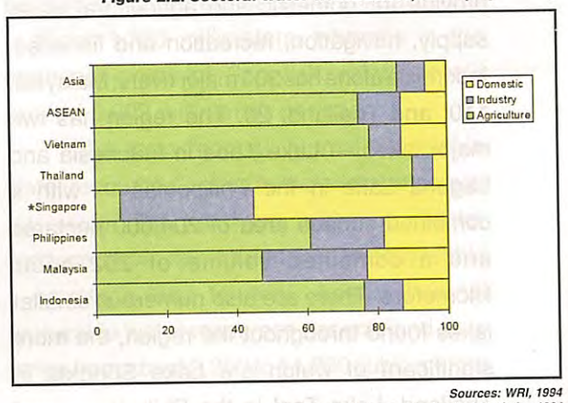
Rapid urbanization will significantly increase household and industrial demand for water. The costs of developing new supplies are high, inasmuch as the more accessible sources have already been tapped. The alternative to developing new supplies is to manage demand and improve the delivery system to minimize waste. Substantial reallocation of water resources to meet urban and industry needs will likely come from water currently allocated for agriculture which accounts for much of water consumed in ASEAN at present.

The UN predicts that water will be the most critical natural resource issue by the turn of the century. In particular, water supply to megacities is likely to be a priority issue (ADB, 1994). Over the next 10 to 15 years, the water requirements of ASEAN megacities will increase substantially. Bangkok's water supply, which comes mostly from the Chao Phraya River, is projected to increase annually by almost 4% from 40.5 cubic meters per second (CMS) in 1993 to 70 CMS by 2007. By the first decade of the 21st century, water requirements of Jakarta and Manila are forecasted to grow annually at an average rate of 10.6% and 2.8%, respectively.

Agriculture

Agriculture is the biggest consumer of water in ASEAN, accounting for 75% of water withdrawal in the region. Domestic and industrial uses account for 13% and 12%, respectively. In comparison, Asia's consumption of water is 86% for agriculture, 8% for industry, and 6% for domestic uses (Figure 2.2). However, ASEAN countries

Figure 2.2: Sectoral Water Withdrawals, 1991 (in percent)



Sources: WRI, 1994
** Data from Singapore Yearbook of Statistics 1994*

exhibit significant differences in levels of utilization for agriculture, ranging from almost none in Singapore because of very low level of agricultural activity to 90% in Thailand. The situation in Singapore is self-evident. In Thailand, substantial water demand from agriculture has resulted from a 25% expansion in cropland areas and a 20% increase in permanent pasture areas over a 10-year period from 1981. In 2000, agricultural water use in Thailand is estimated to grow to nearly twice its 1980 level (ESCAP, 1992).

Water used for agriculture in ASEAN comes mainly from surface water (rivers, natural and man-made reservoirs), except in Thailand where groundwater contributes 15% of the agricultural water supply (ESCAP, 1992). In Malaysia, the corresponding figure is 2%.

Industry

The proportion of water supply used for industrial purposes ranges from 6% in Thailand to substantial levels of 30% and 38% in Malaysia and Singapore, respectively. Industrial uses of water in the Philippines account for 21% of water supply, and in Indonesia, 11%. Surface water, obtained largely from natural and man-made reservoirs, is the major source for industrial use. In Malaysia, surface water supplies most of industrial demand; groundwater supplies only 3%. In Thailand and the Philippines, however,

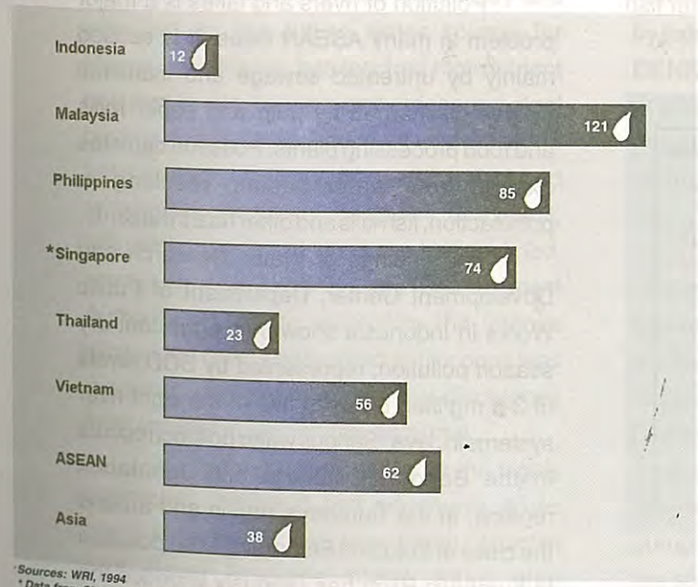
groundwater supplies a larger proportion of industrial demand --- estimated at 20% and 50%, respectively (ESCAP, 1992). Water used for industrial purposes is used mainly for cooling and cleaning, and up to 80% of this water may be returned to the source or discharged to waterways. These return flows however, are often contaminated with pollutants or released at high temperatures.

Domestic

ASEAN's average daily domestic consumption of water is about 170 liters per capita or about 62 cubic meters per year per capita (Figure 2.3). Most of the water used for domestic consumption comes from groundwater which is usually of high quality compared with surface water. Because it is free of pathogens, turbidity and color, groundwater is preferred for drinking and other domestic uses. It is the principal source of drinking water in the Philippines (60%) and Thailand (50%). In Malaysia, groundwater supplies 25% of the requirements for drinking, including for municipal use (ESCAP, 1992). The exception to this trend is Singapore where all the domestic water comes from treated surface water.

At present, 100% of the population of Singapore have access to safe drinking water compared to about 70% to 80% of the total population in Malaysia, the Philippines and Thailand. In Indonesia and Vietnam, the percentage is 40% to 50%. The world average for low income countries is about 65%.

Figure 2.3: Per Capita Domestic Water Use (cu m per year)



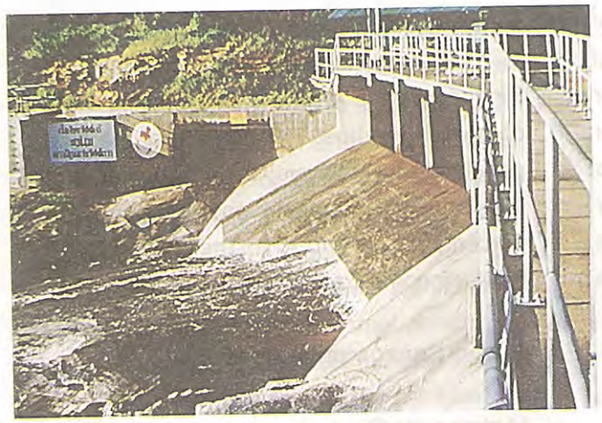
Sources: WRI, 1994
** Data from Singapore Yearbook of Statistics, 1994*

2. Non-Consumptive Uses

Hydropower Generation

Hydropower generation and inland fisheries represent the principal non-consumptive uses of freshwater in ASEAN. The estimated annual exploitable hydropower potential within ASEAN is about 835,000 gigawatt-hours. In 1992, actual hydropower generation was about 28,400 gigawatt-hours or about 15.7% of total electrical energy generation during the year. (See Chapter 7 on Energy).

Dams contribute substantially to power generation, flood control, irrigation and domestic water supply. Despite concerns about their impact on human populations and natural ecosystems, the future pace of dam construction will increase in the face of growing water and power supply needs. ASEAN governments have become more sensitive to environmental and social issues accompanying dam projects. These issues are now addressed in the planning and decision-making processes such as the integration of social concerns into environmental impact assessment. Environmental groups will continue to play an important role in advocating the need to preservation of natural areas, as well as in considering the interests of indigenous communities in the



Multipurpose Dam in Thailand

construction of dam projects.

Inland Fisheries

Freshwater catch is about one-fifth the size of marine catch in ASEAN, indicating its importance to the fish supply of the region. From 1989 to 1991, the average annual freshwater catch (which includes fish and other aquatic animals) in ASEAN was about 1.87 million metric tonnes (Table 2.2), nearly 17% of Asia's total. Most of these came from Indonesia, the Philippines, Thailand and Vietnam.

Fish production from aquaculture is equivalent to one-fourth of the freshwater catch in ASEAN. The seed supply of freshwater fish species has been increasing, along with cultured freshwater prawn species. Besides large scale hatcheries, supply from medium- and small-scale hatcheries has significantly increased the availability of fish, shrimp and prawn seeds, particularly in Indonesia, the Philippines and Thailand. However, the spread of fish and shrimp diseases has become an increasing threat to the freshwater aquaculture industry.

Table 2.2: Average Annual Freshwater Catch, 1979-1991

Country	Average Annual Fresh Water Catch (000 metric tonnes) 1989-91	Percent change since 1979-1981
Indonesia	779.8	70
Malaysia	14.9	161
Philippines	579.0	40
Singapore*	0.1	(89)
Thailand	236.6	60
Vietnam	257.0	47
Total	1,867.4	58

Sources: WRI, 1994
** Data from The Coastal Enviroement Profile of Singapore*
Note: Brunei not included
Number in parenthesis represent reduction

E. Inland Water Pollution

Pollution is increasingly degrading the quality of water resources in many parts of ASEAN. A survey of water quality issues in Southeast Asia indicates that among the major concerns are the eutrophication of surface water bodies, and the pollution caused by pathogenic agents (indicating contact with raw sewage), organic matter and heavy metals. Of relatively less importance, but nonetheless causing increasing concern, are salinization, nitrate pollution, acidification and pesticide pollution (ESCAP, 1995).

River Pollution

Pollution of rivers and lakes is a major problem in many ASEAN cities. It is caused mainly by untreated sewage and industrial wastes discharged by pulp and paper mills and food processing plants. Pollution depletes oxygen from water bodies, resulting in putrefaction, fish kills and other health hazards.

The findings of Water Research and Development Center, Department of Public Works in Indonesia show that significant dry season pollution, represented by BOD levels of 3-6 mg/liter, exists in five of the eight river systems in Java. Serious water pollution occurs in the Bandung, Jakarta and Jabotabek regions; in the Surabaya region and around the cities of Solo and Semarang. The pollution in Surabaya River has seriously impeded the proper functioning of the Surabaya water treatment plant and in pollution in the Banjar canal has similarly affected Jakarta's water treatment plant at Pejompongan. The contamination of the raw water supply together with inadequate operation of the treatment plant have made the water delivered to Jakarta unsafe and should be boiled before use as drinking water.

In Malaysia, water quality monitoring of 116 major rivers in 1993 showed that 11 rivers were seriously polluted, two more than the previous year. In the 1970s and early 1980s, numerous rivers suffered pollution from palm oil and rubber effluents as well as industrial wastes and sewage. However, pollution from palm oil and rubber production has now been contained as a result of an effective pollution charge system that has motivated industries to reduce or treat their wastes. Meanwhile, the number of slightly polluted rivers has increased from 55 in 1992 to 73 in 1993 due to silt and organic loadings particularly from sewage and animal wastes (Malaysia MOSTE, 1994).

In the Philippines, organic pollution of water bodies, in particular, the major river systems of Metropolitan Manila, is very severe. Relief comes mainly from the flushing of the rivers during the rainy season. Laguna Lake, the country's largest surface water body and intended as the future water source for Metropolitan Manila, has reached high nutrient pollution levels, consequently triggering algal blooms and fish kills. Sediment inflow into the Lake is high, making the water turbid and reducing its biological productivity. As a result, fish catch from pens in the Lake has declined, prompting the Laguna Lake Development Authority (LLDA) to rationalize the various uses of the lake. The number of fish pens was regulated and the management of discharges from industries was strictly enforced.

In Thailand, water quality in the highly congested, industrial and communal areas along the Chao Praya, Mae Klong, Thachin and Bang Prakong rivers have also deteriorated. The most critically affected is the Chao Praya River, in particular, the stretch between Praputhayodpha Bridge and the mouth of the Prakanong canal in Metropolitan Bangkok. In 1995, the dissolved oxygen in this portion of the river was at near zero level and coliform count was 999,000 MPN/100 ml (Pollution Control Department, personal communication, 1995). Similar to other ASEAN countries, Thailand has initiated a major programme to clean their rivers especially the Chao Praya. Notable improvements in the quality of Chao Praya have been realized in recent years.

Groundwater Salinization

In major cities of the Philippines, Thailand and Indonesia, groundwater salinization, caused by the overpumping of groundwater, is increasingly becoming a problem. In Bangkok, overpumping has resulted in both land subsidence and the intrusion of sea water into underground reserves. In the Philippines, reports from water authorities indicate that saltwater intrusion outside Metropolitan Manila has already affected 480,000 ha, mostly in coastal urban areas (particularly Cebu). In Metropolitan Manila, groundwater levels have gone down by more than 100 m due to overdraft (Philippine DENR, 1995). Uncontrolled pumping from artesian aquifers in the northern part of Jakarta has also led to the intrusion of sea water into underground reserves.

Salinity build-up in soils covering an area of approximately 2.5 million ha is now a problem in Northeast Thailand (Office of Environmental Policy and Planning, personal communication, 1995). The substrata of the region (particularly the Korat and Sakol Nakorn Basins) are impregnated with rock salt deposits such that wells drilled below 20 meters are likely to come across saline water. Groundwater pumping, or upward capillary action through the soil column, transports the dissolved salt

to the soil surface because of high moisture evaporation in intensively cultivated agricultural areas.

Groundwater pollution caused by the leaching of nitrogen fertilizer residues has been reported in Malaysia and Indonesia (ESCAP, 1992). In Jakarta, deep wells indicate contamination by nitrates and detergent residues, while shallow wells show significant levels of organic and coliform contamination. A significant level of water contamination has also been found in some areas of Thailand where shallow aquifiers are directly reached by irrigation water (ESCAP, 1995).

Hazardous and Toxic Wastes

Pollution from hazardous and toxic wastes is also becoming a serious problem in ASEAN. A 1983 study of the Tanggerang industrial zone in Indonesia found serious pollution at 10 monitoring locations. The most alarming finding was the high concentration of heavy metals and other toxic materials in a number of sampling stations along the river. In Malaysia, concentrations of mercury, lead and zinc, mostly discharged from industrial plants, were found to exceed standards in nine out of 50 rivers monitored during 1992. Lead concentrations exceeded standards in 12 rivers. (Malaysia MOSTE, 1993). In Metropolitan Manila, approximately 22,000 tonnes of heavy metals, biological sludges, lubricants, infectious wastes and intractable wastes are discarded annually on land and in water bodies (World Bank, 1993). A large volume of acid and alkali waste, likely coming from the electronics industry, has also been found in rivers. In Singapore, 36 industries were prosecuted in 1993 for discharging acidic effluent into the sewers, and for causing corrosion and damage to the system. (Singapore Ministry of Environment, 1994b).

F. Freshwater Wetlands

Wetlands as a whole comprises all inland and coastal areas covered with water, whether permanent or temporary, flowing or static, and fresh or brackish/saltwater in nature. They include freshwater swamp forests, peat swamp forests, mangroves, estuaries, and nearshore coral reefs and sea grass within a 6-meter depth zone (as defined by the Ramsar Convention on Wetlands of International Importance). This report presents wetlands as part of the water environment because of the critical importance of maintaininng water supply and quality.

Wetlands of all types cover nearly 120 million ha in the Asia-Pacific region. However, the area distribution is highly skewed; only seven countries account for over 80% of the total area, one of which is Indonesia. For the number of internationally important sites, Southeast Asia has the most (373) compared with other Asia-Pacific subregions. Seventy-five percent (283 sites) of Southeast Asia's wetlands are within ASEAN (Table 2.3).

Wetlands are vital ecosystems as irreplaceable habitats for many important species of plants and animals. They also perform an important role in flood retention

Table 2.3: Severity of Threat to Wetlands of International Importance

Country	Number of sites known	Degree of Threat				Sites with Moderate to High Threat (%)
		None	Low	Moderate	High	
Brunei	3	0	2	1	0	33
Indonesia	129	1	54	66	8	57
Malaysia	37	0	5	22	10	86
Philippines	49	2	13	24	10	69
Singapore	6	0	2	3	1	67
Thailand	36	1	18	14	3	47
Vietnam	23	3	14	4	2	26
ASEAN	283	7	108	134	34	59

Sources: Scott and Poole, 1989; ESCAP, 1995

and mitigation, sediment collection, nutrient recycling, recharge for groundwater, and shoreline protection. For biological productivity and diversity, they are among the most prolific of ecosystems, serving as important sources of fish and raw materials for energy and housing. They are increasingly gaining recognition as potential areas for recreation and tourism.

ASEAN's freshwater wetlands consists mainly of swamp forests of which there are two types: freshwater swamp forests and peat swamp forests. Freshwater swamp forests occur in permanently or seasonally flooded areas (usually mineral soils), particularly along rivers and as inland extensions of mangrove areas. The trees are buttressed with aerial roots that enable them to survive in flooded conditions. Freshwater swamps are very rich in biodiversity and are home to many more species than are found in mangroves tree (ADB, 1991).

Peat swamps are evolutionary successors to freshwater swamps. Worldwide, Southeast Asia has the largest extent of peat swamp forests --- progenitors of oil and gas deposits --- found mainly in Indonesia and Malaysia. In these areas, leaf litter has accumulated to form a layer of peat up to 20 meters deep. Although peat soils are acidic, they support a rich variety of plants and other organisms, including large animals such as reptiles and birds. Both freshwater and peat swamps prevent flood by detaining runoff and regulating its release. Without them, floodwaters would concentrate quickly on agricultural floodplains and populated low-lying areas. The reclamation of large areas of swamps for farming and aquaculture, combined with deforestation, has increased susceptibility of many low-lying areas to severe flooding.

The causes of wetland loss or degradation in Southeast Asia generally include excessive exploitation of wood products, disturbance from human settlements, reclamation of land for agriculture, fishpond conversion, and pollution of various kinds. Specific threats to wetlands in Southeast Asia include mining activities and oil exploration, conversion to aquaculture ponds, commercial logging and woodcutting, use of poisons and explosives for hunting and fishing, and harvesting of eggs and hatchlings of reptiles (e.g., crocodiles) and waterbirds. Logging and woodcutting, in particular, affects about 30% of all sites in Southeast Asia (Scott and Poole, 1989; ESCAP, 1995).

G. Inland Water Protection Programmes

In the 1960s and early 1970s, water development programmes in Southeast Asia were directed mainly at generating adequate supplies of water to serve the needs of agriculture, hydropower generation, domestic requirements of growing populations, and expanding industries. These efforts were characterized by massive investments in the construction of large water impounding and delivery systems that involved the clearing of vast areas of forest and watershed.

By the mid-1970s and throughout most of the 1980s, concerns over sustainability of water supplies (e.g., lifespan of reservoirs) and protection of water quality had become increasingly important. The impact of watershed degradation, wetland conversion, and urban pollution was beginning to manifest themselves in the form of more frequent and severe floods, silted waterways, and polluted rivers and lakes. Economic returns from water infrastructure investments have been decreasing. Meanwhile, remedial investments (e.g., drainage) to control or mitigate flooding and to reforest denuded water catchments are increasing. Negative impacts across interdependent resource systems were becoming inimical to the productive potential of coastal resources due to siltation and pollution, as well as to groundwater due to

Box 2.1
CLEAN RIVER PROGRAMS IN SELECTED ASEAN COUNTRIES

Rivers have always played an important role in the history of many ASEAN countries. They serve many human needs --- as sources of water for domestic, irrigation and industrial uses; for fishing, transportation and reacreation activities; and as a convenient sink for domestic and industrial wastes. The river banks were the hub of activity for commercial trade in the early days. As a result, many people migrated around the major rivers to live and find sources of livelihood. Soon, these rivers succumbed to environmental pressures brought about by high population growth, rapid urbanization and expansion of trade and commerce. Some of the urban waterways have degenerated into open sewers and rubbish dumps. The worsening conditions of the major rivers in the region has prompted ASEAN countries to initiate their respective river clean river programmes.

The 1993 Annual River Quality Monitoring Programme of Malaysia monitored 116 major rivers using a Water Quality Index (WQI) based on five water quality parameters --- BOD, COD, ammoniacal nitrogen (NH_3N), suspended solids (SS) and pH. The report showed that between 1987-1993, the quality of the water continued to deteriorate at an annual rate of 1.19%.

The Klang River is perhaps one example of a polluted river whose conditions continue to deteriorate. The reported magnesium content of the river water increased from almost zero level (0.0001 mg/l) in 1987, to an average value of 68.8 mg/l in 1993, compared to the national standard at 0.004 mg/l. The SS also increased significantly from 165 mg/l in 1987 to 180 mg/l in 1993. Similar deterioration on the other water quality parameters were also noted.

Because of heavy pollution in the Klang River, the Government decided to start a 10-year clean up programme in 1992. The programme involved nine major activities or projects, namely:

- River alignment and installation of debris traps along the embankment;
- Cleaning and debris collection along the river;
- Desilting of the river bottom;
- Beautification of the river banks
- Resettlement of the squatters along the river;
- Pig waste treatment;
- Rehabilitation of fish life;
- Public education and awareness; and
- Water pollution control.

Several ministries and government agencies are cooperating to implement the programme.

Another interesting initiative in Malaysia was the "River Watch" project. This was actually a component of the "Love Our River" programme started in February 1993 through the joint efforts of various government agencies. The "River Watch" sub-programme consisted of various activities coordinated by the Department of Environment such as monitoring and assessment. The secondary students of 29 schools throughout the country were involved in these activities and were asked to present their findings in a nation-wide symposium.

The pollution of river systems in the Philippines, especially those in Metro Manila and other urban centers, has been a major environmental concern for the past several decades. The Pasig River, which is the major river that cuts across Metro Manila, is perhaps the most polluted. The daily BOD loading is estimated at around 327 tons from domestic and industrial sources. During the summer months, the DO level is almost zero and the river emits the characteristic odour of Hydrogen Sulfide. Although the river was classified as Class "C" or water good for fishing, non-contact recreation and industrial use, the actual condition of the river has been fit only for navigation use.

In 1987, the Philippine Government started the Rivers Revival Programme aimed to reverse the deteriorating quality of the different river systems. The first project was the "Ilog Ko, Irog Ko" which was a multi-agency undertaking aimed to reduce the pollution load of the Navotas-Malabon-Tenejeros-Tullahan River, a tributary of Pasig River. The project involved a basin-wide septic tank cleaning and squatter relocation to lower BOD loading to less than 10,000 kg per day. Other projects under the programme were also started subsequently. In 1995, a major programme to clean up the Pasig River was launched. This involved the participation of the general public through financial contribution and other forms of support as well as direct involvement of different government agencies and private organizations. After just over a year, some improvements in the quality of Pasig River can be noted in terms of increased DO levels and presence of higher forms of aquatic life.

Perhaps, the most succesful Clean River Programme in ASEAN is the 10-year programme of Singapore started in 1977. The programme covered the Singapore River and the Kallang basin whose catchments comprised about one-fifth of Singapore's total land area and contained half of Singapore's built-up area. The main sources of pollution then were pig and duck farms, squatters, backyard trades, cottage industries, street hawkers, boat repairing and other riverine activities.

The action plan of the programme included urban redevelopment; relocation of riverine activities that included re-siting of street hawkers to designated special-purpose sewered premises, resettlement of squatters and transfer of pollutive backyard trades and cottage industries; phasing out of pig and duck farms; and the extension of sewers to unsewered premises.

The rernoval of these sources of pollution was complemented by the dredging and removal of accumulated flotsam and rubbish on the river beds and along the banks. After this, turfing, landscaping and the laying of sandy beaches were carried out to beautify the waterways for recreational activities. Today, aquatic life has returned to the Singapore River and Kallang basin, and they have become venues for various recreational, social and cultural activities.

Another river project implemented in 1993 was the reconstruction of the Geylang River at a cost of S$25.3 million. The river was widened and deepened and provided with mechanical removal of debris.

Sources: Malaysia MOSTE, 1994; Philippine DENR, 1992; Singapore Ministry of Environment, 1994 a

reduced recharge rates and contamination. Consequently, greater attention was directed to water resources management, particularly for multiple sustainable usage and maintenance of water quality.

Recent years have witnessed an increasing understanding of, and appreciation for, the role that water resources and water habitats play in preserving irreplaceable natural heritage. At present, most water resources management schemes address not only the need to sustain water availability and to protect its quality for human use. They also provide for maintenance needs of other living things and of nature as a whole. In addition, there has been increasing efforts to restore degraded ecosystems. ASEAN's rapid pace of industrialization in the 1990s has made the effective management of industrial toxic and hazardous wastes more compelling.

Throughout ASEAN, there has been a spate of efforts to clean up major urban rivers (Box 2.1). Singapore, for one, has been successful in rehabilitating the Singapore River and Kallang Basin through a 10-year river clean-up campaign costing S$200 million. Singapore's rivers today already support aquatic life with dissolved oxygen levels ranging from 2 to 4 mg/ltr. The government's objective is to further reduce pollution and to raise dissolved oxygen level in all streams to 4 mg/l by the year 2000 (Singapore Ministry of Environment, 1992). Clean up of rivers is made possible through a series of measures such as removing sources of pollution, providing sewerage systems and sewering of premises, and the enforcement of stringent standards.

The Clean Rivers Program (PROKASIH) in Indonesia was initiated in response to growing pollution loads in critical watersheds, and was designed to overcome the previously fragmented and uncoordinated efforts to control such pollution, especially from rapidly expanding industries. It was inaugurated in 1989 by the State Ministry for Environment with the Ministry of Home Affairs and officials from the eight most industrialized provinces: East Java, Central Java, West Java, DKI Jakarta, North Sumatera, South Sumatera, Lampung and East Kalimantan. The initial focus was on the worst industrial polluters in the 20 most highly polluted rivers, with a stated goal of reducing their pollution loads by 50%

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within two years. In 1994 the number of rivers covered by the PROKASIH program increased to 27 rivers in 13 provinces.

In 1992, Malaysia embarked on a 10-year programme to clean up the Klang River and its main tributaries. A "Love Our Rivers" campaign was also launched in 1993. The Philippines has also launched a strategic programme to rehabilitate the Pasig River, Manila's main water course. The programme consists of 21 projects aimed at significantly improving the river's water quality by 2005.

To address the worsening pollution problem in the Chao Praya River in Metropolitan Bangkok, Thailand has revised all existing policies and management strategies concerning wastewater treatment in the lower Chao Praya basin. Among others, the government has agreed in principle to establish a central Wastewater Management Authority that would be mainly responsible for providing centralized wastewater treatment services.

ASEAN countries are currently identifying the types and sources of toxic and hazardous wastes to prepare plans for their control. Treatment of toxic and hazardous wastes generally includes destroying toxic components, or converting toxic substances into an insoluble state for storage in secure landfills. In the Philippines, treatment of hazardous wastes has been initiated in the Cebu area.

Steps are presently being taken to protect wetlands, particularly those that have international significance in terms of uniqueness and biodiversity. Areas proposed for protection are being identified, provided with back-up legislation, and equipped with effective on-the-ground management systems. The status of wetland protection in various countries of ASEAN is shown in Table 2.4. Several ASEAN Member Countries, have not formally acceded to the Convention on Wetlands of International Importance (known also as the Ramsar Convention), although there has been considerable interest to support

Table 2.4: Status of Wetland Protection in ASEAN 1991

Country	Remaining Extent of Wetlands and Marsh (000 ha)	% Lost	% Area Under Some Form of Protection	% Area Totally Protected
Brunei D.	85	27	10	10
Indonesia	11872	39	35	33
Malaysia	2214	35	55	3
Philippines	1322	na	8	6
Thailand	83	96	9	4
Vietnam	26	100	na	na

Sources:
Scott and Poole, 1989; WRI, 1994
na - data not available

the Convention (ESCAP, 1995).

II. COASTAL AND MARINE ENVIRONMENT

A. Importance to the Region

The marine environment consists of coastal waters (and the ecosystems found here, particularly estuaries, mangroves, seagrass and coral reefs) and the high seas. A coastal area is a zone within 60 km inland (WRI, 1994). The coastal zone and the marine environment are closely linked in both ecological and economic aspects. The marine environment plays an important role in recycling major life support constituents (such as water, carbon, and oxygen, as well as wastes coming from land based sources) on which land inhabitants depend. Coastal and marine resources also provide shelter, food, building materials, and energy sources from offshore oil and gas deposits.

Most of the major cities evolved from coastal settlements several thousand years ago, and even now, coastal populations continue to exert pressures on the coastlines. Population growth and uneven economic development patterns create two kinds of environmental problems. The first is associated with a lack of development that drives impoverished coastal inhabitants to exploit

coastal resources without much regard for sustainability (e.g., overfishing). The other is the lack of development controls to prevent the adverse impact of pollution and loss of critical ecosystems (e.g., conversion of mangroves, mining of corals). Because the coastal environment is a common resource that could be exploited for private benefit, individual users compete among themselves to get most out of the resource in the shortest time possible.

ASEAN's coastline spans 89,000 km, longer than the entire coastline of Europe. The 65 million people living in ASEAN's coastal urban areas in 1980 is expected to double by 2000. Under currently recognized international principles, each country may establish an exclusive economic zone (EEZ) 200 nautical miles from shore and claim all the resources within that zone (fish, minerals, oil and gas). ASEAN covers an EEZ of about 8,500 sq km that are rich in biological and mineral resources (Table 2.5)

Table 2.5: Coastal Areas and Population in ASEAN

Country	Length of Coastline (km)	Maritime Area Within Exclusive Economic Zone (sq.km.)	Population in Coastal Urban Areas (Thousands)	
			1980	2000
Brunei Darussalam	130	38.6	na	na
Indonesia	54,716	5,408.6	29,166	58,303
Malaysia	4,675	475,6	3,997	9,158
Philippines	22,540	1,786.0	17,736	37,181
Singapore	150	na	2,414	3,235
Thailand	3,219	85.8	5,698	13,541
Vietnam	3,444	722.0	5,585	14,317
ASEAN	88,874	8,516.6	64,597	135,735

Source: WRI, 1992; Singapore Facts and Pictures, 1996
Data for Brunei supplied by the Ministry of Development
na - data not available

B. Mangrove Resources

Mangroves are salt-tolerant plants that generally occur in the intertidal areas of the shoreline. Mangroves support a wide variety of mammals, birds, amphibians, reptiles and crustaceans. They serve as nursing and feeding grounds for various sea animals, and protect the coastline from erosion, storms and tidal surges. The well-known major uses of mangrove ecosystems include: raw materials for firewood, charcoal, construction, paper, tannins, food and medicine. They also serve as spawning grounds for marine life, shoreline protection, flood buffer zone, and recreation, among others.

Threats to mangrove ecosystems are many and varied. They include conversion to aquaculture ponds; exploitation for fuelwood, poles and woodchips; siltation from upstream degraded lands; and pollution from urban and industrial sources. The sedetrimental effects far outweigh the value of wood and other resources that can be derived from the mangroves themselves (ADB, 1991). The mangrove areas of ASEAN have suffered considerable loss and degradation over the last fifty years. Current rates of loss due to conversion and degradation are still quite high.

The status of, and degree of threat to, mangrove areas in ASEAN countries differ, as indicated by the most recent inventories prepared by the International Union for the Conservation of Nature (IUCN, 1991).

Brunei Bay contains an extensive and well-preserved mangrove systems covering an area of 184 sq km (Box 2.2). However, these areas are increasingly being threatened by pollution from silt and debris generated by logging operations as well as illegal cutting in Sarawak (Scott, 1989). Proposals to convert mangrove areas to fish and prawn ponds, and to a limited extent, cuttings of fuelwood and poles, continue to put the mangrove areas at risk. By far, however, urbanization is the most serious threat to mangrove areas in Brunei Darussalam, where most urban development occurs in the coastal fringes. Effluents from urban and industrial

Box 2.2
COASTAL MANAGEMENT PLAN FOR BRUNEI DARUSSALAM

Brunei Darussalam has a population of 256,500 which is projected to grow at 2.6% per annum up to the year 2005. With eighty five percent (85%) of the population residing within or immediately adjacent to the coastal zones, almost all social, cultural and economic activities are carried out within this area. Such high concentration in population and human activities is expected to persist up to the year 2005.

Brunei Darussalam assigns a high priority to the sustainable development of its coastal zone because of its importance to the country's economy and social life. The trend towards coastal degradation in the region and elsewhere is a major cause of concern.

The country is in a favorable position to promote the protection of its coastal zone. Coastal resources are generally well preserved with very little developmental pressure. Nevertheless, an integrated coastal zone management (ICZM) plan for Brunei Darussalam was formulated to ensure that the foundation and essential elements of a sustainable programme are put in place.

The plan was developed after a thorough assessment of resources and consideration of different current and potential environmental issues and concerns of the different sectors in the country. It was an issue-based action plan containing long-term strategic thrusts (e.g. goals and objectives) and medium-term programs of sufficient detail for adoption and operationalization by implementing agencies.

A total of 68 projects grouped into 17 programmes were outlined in the plan in respone to existing and potential CZM issues. The plan provided the framework for sustainable development of the coastal resources of the country.

One important component of coastal zone resources included in the ICZM Plan is the mangrove forests. The Plan called for conservation and sustainable utilization of the mangrove forests --- a very important resource of the coastal zone. This resource in Brunei Darussalam was of particular interest to ASEAN, since it consisted of one of the few remaining intact mangrove forests in the region. The total areal extent of the forests was around 18,418 ha, representing 3.2% of the country's total land area. The main bulk was found in Temburong District (12,164 ha) while other sizeable areas were at Muara and Sg. Brunei (3,937 ha), Sg. Tutong (1,784 ha) and Sg. Belait (533 ha).

The mangroves of the Brunei River estuary and associated rivers were particularly important in maintaining the high fisheries potential in the area and adjacent coastal waters. The country's mangroves were home to several unique and endangered wildlife including the proboscis monkey (Nasalis larvafus), crabeating macaque (Macac fascicularis) silver leaf monkey (Presbyfis cristata) and large fruit bat (Pteropus vampyrus). The mangroves and associated mudflats were also used by migratory birds as wintering habitats.

Source: Brunei Darussalam Ministry of Industry and Primary Resources, 1992

areas are polluting the mangrove areas, thus reducing their productivity.

Within the Asia-Pacific region, Indonesia has the largest total area of mangroves, estimated at 2.1 million ha in 1990 (Table 2.6). The largest mangrove forest (300,000 ha) is found in Bintuni Bay along the southwestern coast of Irian Jaya. The shoreline of the Bay is approximately 170 km in length and the Bay contains 300,000 ha of mangrove forest. The Bintuni Bay Nature Reserve that covers 267,000 ha, is now being proposed to be established to protect this very valuable ecosystem.

The mangroves of Indonesia were relatively untouched as late as the mid-1970s. However, extensive mangrove forest exploitation for woodchips has put tremendous pressure on Indonesia's mangroves, which are probably the most threatened forests in the country. Conversions of mangrove areas to agriculture, fishponds, salt ponds, and human settlements compound the situation. Fishponds are particularly extensive in

Sulawesi, Java and Sumatra. Over 500,000 ha of mangroves have been lost in Indonesia due to combined pressures from wood production and fish-pond development (ESCAP, 1992).

Peninsular Malaysia's mangroves are found mainly along the sheltered west coast fronting the Strait of Malacca where they form an almost continuous belt and, at its widest, are about 20 km deep. Mangroves are also found along estuaries at the mouth of large rivers. In Sarawak, there are about 174,000 ha of mangrove forests. Exploitation of mangroves for woodchip and cordwood that started in Sarawak since 1969, now uses 2,000 ha of mangrove forest annually. Nearly 50,000 ha of Sabah's mangrove forests (40% of total) is under woodchipping concessions, and concerns have been raised that regeneration efforts have not kept up with such utilization rates.

The mangrove forests of the Philippines have been reduced from about half a million hectare in the 1920s to nearly 140,000 ha by the mid-1980s (Table 2.6). A more recent estimate puts the area at about 123,400 ha (Philippine DENR, 1994). Mangrove areas were shrinking at a rate of 5,000 ha per year during the 1980s (Howes, 1987) although the rate of loss has been reduced recently to about 3,000 ha per year as a result of efforts to protect the remaining areas.

In Thailand, the remaining mangrove area is about 168,000 ha (Table 2.6), It is estimated that mangrove areas are being lost at a rate of 2,700 ha annually. Only a small fraction, 34,200 ha or 20% of the remaining mangrove areas are inside protected areas.

About half of Vietnam's mangrove forests were severely damaged by the areal spraying of herbicide during the war. After the war, the Vietnam government launched a massive mangrove replanting programme, yielding several thousand hectares of thriving mangroves that currently supply fuelwood, fish and prawn products. Extensive mangrove forests are found mostly in the Mekong delta, and some in the Red River delta and along the northern coast. Vietnam's remaining mangroves cover some 147,000 ha.

Singapore has lost much of all its original 10,000 ha of mangroves; only about 2,000 ha of it remain.

Table 2.6: Current Status of Mangroves in ASEAN

Country	Remaining Extent (000 ha)	% Lost Since 1980
Brunei Darussalam	45	17
Indonesia	2101	45
Malaysia	731	32
Philippines	140	na
Singapore	2	76
Thailand	168	46
Vietnam	147	62
ASEAN	3,334	

Sources: WRI, 1994

Mangroves Protection Programmes

ASEAN countries are implementing various programmes to curb the continuing loss of mangrove forests. Most forest protection systems (discussed in Chapter 1) include mangrove areas. Creation of mangrove reserves is also being initiated, to give more adequate representation for mangroves and their unique wildlife in protected area systems. In Malaysia, a mangrove biosphere reserve has been established in Sarawak while a bird sanctuary has been created in a mangrove habitat at Kuala Gula, Perak (ESCAP, 1992). Brunei Darussalam has made plans to create mangrove conservation areas and to prohibit timber exploitation in mangrove forests. A centralized sewage collection and treatment system for Kampung Air, the old part of Bandar Seri Begawan built over the water, has begun operations. Malaysia and Vietnam have carried out extensive replanting of mangroves. In all ASEAN countries, mangrove regeneration is becoming an increasingly important component of reforestation activities.

C. Coral Reefs and Seagrasses

Coral Reefs

Corals are slow-growing colonies of animals, found mainly in the tropics. Coral reefs are formed from the accumulation of calcium carbonite remains of coral polyps that are the basis of the coral reef system. They remove calcium ions and carbon dioxide from seawater and deposit them as a limestone skeleton.

Coral reefs are rich in diversity and can support about 500 to 1,500 kg/ha of living matter (ADB, 1991). One third of all fish species live on coral reefs, making them rich fishing grounds with yields of up to five tonnes per sq km. Even when they are not fished directly, coral reef systems are critical to food webs in the life cycle of marine fishes. Apart from providing food source and habitat for fish, coral reefs help mitigate the effects of storm and tidal surges.

Over two-thirds of the world's coral reefs is found in the Asia-Pacific region, and more than half of these is found in ASEAN's marine environment. The combined area of coral reefs in Southeast Asia (including northern Australia) is about 182,000 sq km (ESCAP, 1992), accounting for about 30% of the world total. Fringing reefs near the shore are the most common in Southeast Asia, making them very susceptible to the adverse effects of coastal zone development.

Coral reef damage or destruction occurs mainly as a result of improper fishing methods. These methods include the use of dynamites, chemicals (e.g., the use of cyanide to stun and capture fish), and the pounding of coral reefs by stones to drive fish into nets. The removal of corals for ornaments, and to some extent the mining of coral deposits for building materials, compounded by siltation from inland degraded lands, contribute substantially to coral reef damage.

Seagrass

Seagrass are seed bearing marine plants (halophytes) that occur in shallow nearshore waters of sheltered coves, and in estuaries and lagoons. They occur extensively in the ASEAN region. Indonesia, for one, has 13 species of seagrass. Like coral reef systems, seagrass have high rates of biological production and play an important role in maintaining coastal marine ecosystems. They are often found intermingled with mangroves and, in the deeper waters, with coral reef systems. Together, these systems provide a highly productive habitat that supports a large quantity of marine life including commercial fish (ESCAP, 1995).

Seagrass functions as regulators of the flow of organic nutrients washed down from the land. They provide important feeding and breeding areas for fish. For instance, the endangered green turtle and Dugong from the Philippines feed on seagrass. Although seagrass have no direct commercial use, they provide shelter and food for many economically important fish and other marine products. An acre of seagrass bed can bring in up to US$86,000 from such products (ADB, 1991).

At the Seagrass Workshop held in Bangkok in December 1993, seagrass scientists of the ASEAN-Australia Living Coastal Resources (LCR) Project have indicated that seagrass habitats in East Asia are rapidly being destroyed. In Indonesia about 30% to 40% of the seagrass beds have been lost in the last 50 years, with as much as 60% being destroyed around Java. In Singapore, land reclamation had covered the patchy seagrass habitats near the coastal areas. In Thailand, about 20% to 30% of seagrass beds has been lost. Very little information on seagrass loss is available in Malaysia. In the Philippines, seagrass loss amounts to about 30% to 50%.

Ecological and physical disturbances in mangroves and coral reef systems can affect

seagrass. For instance, seagrass beds could be smothered by silt caused by excessive water turbidity resulting from the loss or destruction of mangroves. They could also be damaged directly by fishing trawlers.

D. Fisheries and Marine Life

Marine Catch

ASEAN seas are very rich in marine life, with an estimated 2,500 species of fish, as well as many kinds of invertebrates (cephalopods and crustaceans). Under FAO's marine statistical areas system, ASEAN falls within the Western Central Pacific region where one-half of the world's skipjack and one-third of the world's yellowfin catches are taken. From 1979 to 1981, marine fish catch from this region averaged 4.24 million metric tonnes per year. This increased to an average of 6.38 million metric tonnes from 1989 to 1991, an increase of 50% over a 10- year period. The quantity of non-fish animals caught (cephalopods and crustaceans) is equivalent to only 10% to 13% of the fish catch.

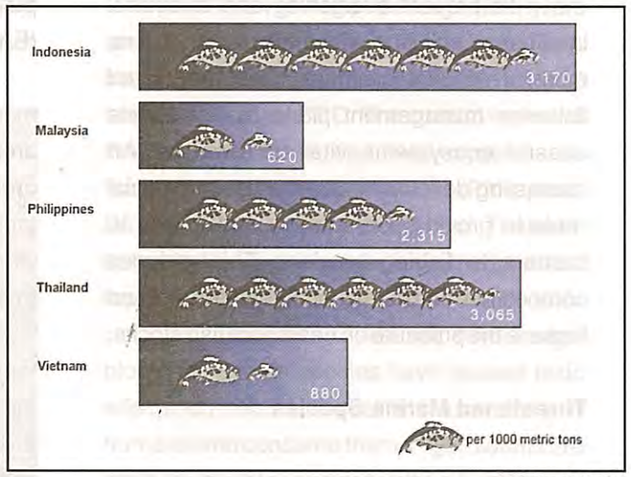
The marine fish catch from West Central Pacific region accounted for about 14% of the world total in 1990 (WRI, 1994). Most of the catch is sourced from countries along the continental shelf, formed by Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. Except for Malaysia, the fish catch of each of these countries has increased over the past decade. Fisheries in the region depend mostly on demersal and small pelagic fish resources, that are exploited mostly by small-scale artisan fishermen.

The total demersal fish catch of the Western Central Pacific region has leveled off at 600,000 to 800,000 tonnes during the 1980s. Most of the stocks in nearshore waters are heavily exploited. Heaviest fishing occurs in the inner part of the Gulf of Thailand, the Strait of Malacca, the shallow part of the Southern Java Sea, and the waters of the Philippines. Increased landings are doubtful in these areas unless adequate management schemes are employed. These would include reducing the fishing effort, regulating mesh size, and seasonal closure of important spawning and nursery areas. Demersal fish stocks in the deeper offshore waters may not yet be fully exploited, except in the Gulf of Thailand and the central and southern parts of the Strait of Malacca. Controlled expansion of fishing efforts in the offshore waters of ASEAN is important to prevent overfishing.

A number of local stocks of small coastal pelagic fish are nearing full exploitation. These include the mackerels and round scads in the Strait of Malacca and the Gulf of Thailand, round scads in the Philippines, and sardines in the Strait of Bali. Larger coastal pelagic fish have probably been slightly to moderately exploited in recent years. Cephalopods (e.g., squids and cuttlefishes) are probably the only major marine resource in the Western Central Pacific area that has not yet been overdrawn. There is still ample room for increased catch, although annual catch had stabilized at around 180,000 tonnes by the late 1980s (FAO, 1990; FAO, 1993).

The volume of fish catch during the early 1990s (Figure 2.4) was already within

Figure 2.4: Marine Fisheries Production in 1991



Source: FAO, 1993
Note: Figures include marine aquaculture production

the range of what FAO considers the marine fisheries' biologically realizable potential for the region. This means that the maximum harvest, excluding that from aquaculture, can be sustained by a fishery year after year, given average environmental conditions (WRI, 1994). This potential ranges from 5.8 to 7.8 million tonnes per year. The average annual catch from 1989 to 1991 was 1.42 million tonnes short of the upper range. In a few more years, sustainable fish stocks in the region could reach full exploitation.

Marine aquaculture serves as an additional source of fish, although its contribution is relatively insignificant at only 1% of marine catch for Asia as well as for ASEAN. Production from freshwater aquaculture, which is one-fifth of marine catch, provides a more substantial contribution to fish supply. Ensuring adequate supply of fish will depend largely on the proper management of marine resources.

Though comparatively small in production volume compared with the capture fishery sector, marine aquaculture has been expanding considerably throughout ASEAN. This is a trend expected to continue for the foreseeable future. However, recent developments in the establishment and operations of aquaculture ponds have begun to exert a considerable toll on the coastal environment.

To prevent overfishing and to control land based pollution affecting coastal waters, most of ASEAN countries have formulated fisheries management plans to rehabilitate coastal ecosystems vital to fisheries. An interesting development is the use of artificial reefs to provide fish shelters and to act as barriers to fishing trawlers. This reduces competition from small scale fishermen and lessens the pressure on nearshore fish stocks.

Threatened Marine Species

The world's oceans contain more than 90% of the world's living biomass, and a considerable portion of that is found in tropical waters. The marine environment has many unique species in terms of form and survival strategies. However, the full extent of the ocean's biodiversity is not known, and new marine species are being discovered even up to the present. Recent discoveries have raised the estimate of marine species to at least 10 million, nearly 60 times the number known in 1971 (WRI, 1994).

ASEAN seas and coastal waters are home to numerous marine mammals, sea turtles, birds, invertebrates, and a wide variety of species of fish and shellfish. The precise number of threatened marine species in the region is not known. However, there are a number of well-known examples. For instance, the single remaining species of the dugong (*Dugong dugon*) is now found only in scattered populations in the waters of the Indo-Pacific area. Sea turtles are threatened by hunting, collection of their eggs, and accidental capture in fishing nets.

Depletion of economically important fish stocks in ASEAN seas is approaching critical levels for some species. The harvesting of skipjack tuna, for instance, is approaching maximum level and most stocks of penaeid shrimps are fully or heavily exploited. Inshore stocks of demersal fish are heavily exploited and pressure from continued fishing may have pushed the catch beyond sustainable levels (FAO, 1993).

Besides overfishing, the main threats to marine life include pollution, siltation of coastal areas, and chemical runoff from land. Marine organisms are particularly vulnerable to pollutants because water easily spreads toxic substances, and because many organisms are free-floating and unable to escape from toxins.

Coastal areas are the most threatened marine habitats, mainly because of their proximity to land-based disturbances and population pressure. The impact of threats to coastal habitats is not only confined to areas directly disturbed but is also propagated throughout the marine environment. For instance, ninety percent of marine fish species exploited for human consumption depend on coastal habitats for at least part of their life cycles. The loss of such habitats is therefore bound to reduce marine populations. The same applies regarding the impact of coral reef destruction. Even the deeper ocean waters, which have been found to contain rich biodiversity, have become vulnerable to pollution caused by the disposal of toxic wastes (WRI, 1994).

E. The Coastal Waters and High Seas

Coastal Waters

Sediments carried by flood runoff from degraded upland watersheds is responsible for the silting of mangroves and nearshore coral reefs. In Malaysia, the damage to fisheries from siltation of coastal waters exceeds the damage caused by bacterial contamination from sewage (FAO, 1993). Measurements of total suspended solids (TSS) in Malaysia's coastal areas during 1993 showed that more than half of the samples exceeded the interim standard of 50 mg/l of TSS (Malaysia MOSTE, 1993). In Indonesia, siltation problems are occurring near the mouths of major river systems (ESCAP, 1992). In Segara Anakan, on the south coast of Java, siltation is filling up mangrove areas, reducing the volume of water and seriously affecting the vegetation. In the Philippines, siltation of coastal areas due to mine tailings wastes, particularly along Lingayen Gulf, is a major concern. In addition, enormous silt loads are transported by floodwaters generated by typhoons that regularly cross the country.



Sunset at Beach in ASEAN

In its 1990 report, the Group of Experts on the Scientific Aspects of Marine Pollution (GESMAP) concluded that the world's open seas are still relatively clean. However, nutrient pollution from land-based sources poses the gravest and most prevalent threat to the marine environment (UNEP, 1990). Toxic wastes from heavy metals, untreated sewage from major urban centers, coastal settlements, and industrial areas have seriously degraded the quality of coastal waters and have spoiled the beaches.

Industrial wastes, including mine tailings, often carry with them toxic wastes. The coastal waters of Johor and Pulau Pinang in Malaysia, for example, have recorded high levels of toxic waste on account of heavy metals. Significant levels of lead have also been found along the coastlines of Perak and Sabah, including high arsenic levels for the latter. Untreated sewage is generated by almost 7 million inhabitants of coastal villages in Indonesia, which end up in coastal waters and on beaches. Large quantities of sewage have also been discharged into Jakarta Bay. In Manila, unsewered, raw sewage discharged into rivers and canals find their way into Manila Bay, causing organic pollution estimated at 256 tonnes per day of BOD. The coastal waters of the Bay have shown dissolved oxygen levels that are below the ambient criteria (Philippines DENR, 1995). Around the Gulf of Thailand, untreated sewage and waste discharges from tapioca mills have badly polluted the coasts.

In some parts of ASEAN, severe algal blooms in certain species have caused toxic effects on fish and shellfish, as well as in humans who consume them. Algal blooms are caused by the proliferation of nuisance

organisms, particularly phytoplankton species (e.g., dinoflagelates and diatoms) and several other groups of photosynthetic microorganisms. These microorganisms are stimulated by organic pollution from untreated domestic and industrial wastes as well as fertilizer residues from agricultural runoff. They are commonly referred to as "red tide" since they cause visible coloration of water (although the coloration itself may be red, green, yellow, or brown). Human intoxication caused by the consumption of fish and shellfish with algal blooms have proven fatal in a number of cases.

In the Philippines, for example, paralytic shell fish poisoning from consuming shell fish caught in areas affected by red tides around Manila Bay and in Samar have resulted in serious illnesses and sometimes death. The occurrence of red tide in Manila Bay (1987 and 1989) was attributed to organic pollution. In Samar (1983), the occurrence was attributed to the euthropication of the sea area caused by wastewater from a nearby large fertilizer plant (OECC, 1992).

Table 2.7: Volume of Oil Traffic, 1988-90

Country	Average Annual Volume of Petroleum Imported and Exported (000 metric tonnes)	
	Crude Oil	Petroleum Products
Brunei Darussalam	8,579	5,174
Indonesia	46,975	26,235
Malaysia	22,229	14,164
Philippines	9,690	1,222
Singapore*	42,680	66,128
Thailand	7,211	2,317
Vietnam	na	347
Total	137,364	115,587

Source: WRI, 1994
*Note: * Data for Singapore from Singapore Trade Statistic, 1991*
na - Data not available

The High Seas

The seas of ASEAN are among the world's busiest in terms of oil and cargo traffic, as well as offshore oil and gas. From 1988 to 1990, the average annual volume of crude oil and petroleum products (imported and exported) was about 250 million metric tonnes (excluding Vietnam for which data is unavailable). Indonesia and Singapore accounted for more than seventy percent of this volume (Table 2.7). Annual offshore oil production in ASEAN was 108 million metric tonnes in 1992, more than double the 1982 level. Proven oil reserves are estimated at 1.6 billion metric tonnes (Table 2.8).

Table 2.8: Offshore Oil and Gas

Country	Annual Production				Proven Reserves	
	Oil (thousand metric tonnes)		Gas (million cu m)		Oil (million metric tonnes)	Gas (billion cu m)
	1982	1992	1982	1992	1992	1992
Brunei Darussalam	6,026	7,470	8,786	7,442	137	212
Indonesia	26,677	57,270	5,685	7,236	286	1,447
Malaysia	15,050	35,308	0	18,606	530	1,529
Philippines	822	1,245	0	0	39	57
Thailand	0	1,992	0	7,029	65	357
Vietnam	0	4,980	0	8,269	544	283
ASEAN	48,575	108,265	14,471	48,582	1,601	3,885

Sources: WRI, 1994
Note : Singapore not included

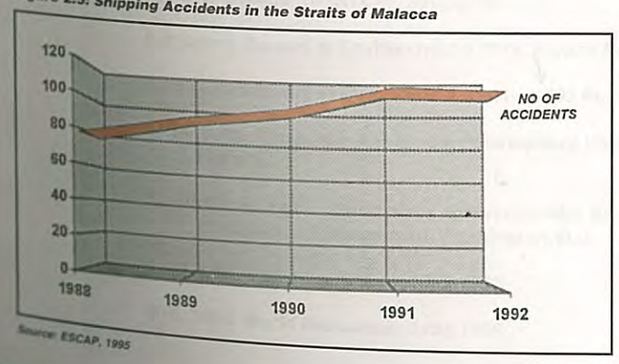
The environmental hazards associated with oil and gas production have been a major concern in ASEAN. Oil slicks and tar balls are periodically recorded, particularly along the major oil transport routes, namely: the Straits of Malacca, the Straits of Johor, and the South China Sea. In Malaysia, some beaches in Johor and Pahang have been seriously affected by tarballs. About 80% of oil and grease measurements at various sampling stations show that levels have exceeded interim standards (Malaysia MOSTE, 1993).

The hazards of oil spills along the major oil transport routes in the region is becoming a major concern. Although there has been no recorded catastropic oil spill incidence, the number of shipping accidents during the period 1988-1992 shows an increasing trend especially in the Strait of Malacca (Figure 2.5). A major incident in 1992 involving a collision between an oil tanker and a container vessel in the Straits of Malacca spilled 13,000 tonnes of crude oil. In 1993, the biggest incident involved a collision between two oil tankers that sent 27,000 tonnes of oil into the sea. In both cases, the timely response by the Malaysian and Indonesian authorities prevented considerable damage to the West Coast of Peninsular Malaysia and Northern Sumatra.

F. Coastal and Marine Protection Programmes

Programmes to protect coastal and marine environments are inherently difficult to implement because they tend to be comprehensive in scope and multisectoral in character. Because of the multiple uses of coastal and marine resources, policies must ensure a balance among various sectoral objectives. For instance, the urbanization of coastal fringes should take into account the need to address the attendant effects of increased waste generation that could bring damage to fisheries and coastal ecosystems. The provision of credit to small-scale fishermen as part of a poverty alleviation programme should anticipate the possible increase in fishing effort that could exacerbate the overfishing problem.

Figure 2.5: Shipping Accidents in the Straits of Malacca



Source: ESCAP, 1995

Current approaches to coastal and marine resource management in ASEAN countries reflect efforts to address cross-sectoral concerns affecting the environment and to integrate them in planning and project development. Indonesia, for example, is in the process of implementing two large-scale projects whose objectives are to facilitate management of the marine and coastal environments. These are the Marine Resources Evaluation and Planning Project (MREP) and the Coral Reefs Rehabilitation and Management Project (COREMAP). In addition, a number of smaller-scale projects have been undertaken to improve the management of coastal and marine environments.

Integrated coastal management plans now exist for key areas in ASEAN --- for Lingayen Gulf in the Philippines, Segara Anakan in Indonesia, Ban Don Bay and Phagnga Bay in Thailand, South Johore in Malaysia, as well as for the coastal areas of Singapore and Brunei Darussalam. Many of these plans, prepared under the ASEAN/USAID Coastal Resources Management Programme, focused primarily on integrated management approaches.

There has also been an increasing trend towards regional cooperation schemes. ASEAN countries have adopted the East Asian Seas Action Plan initiated by UNEP for coastal and marine resources management in the region. In addition, the ASEAN/Australia project on Living Coastal Resources Management has provided valuable scientific data for assessing marine pollution from heavy metals and sewage, including "red tide" occurrences. The ASEAN Council of Petroleum has prepared a plan for controlling and mitigating marine pollution

hazards from oil spills (ESCAP, 1995). A regional project on Oil Spill Preparedness and Response (OSPAR) is being undertaken with assistance from Japan. UNDP and the International Marine Organization (IMO), with funding from the Global Environment Facility (GEF), are currently implementing a project on marine pollution prevention and marine resource management, covering key areas in ASEAN countries. ASOEN has established a working group on ASEAN Seas and Marine Environment (see Chapter 9 on Legislation and Institutions).

About 10 million ha of coastal and marine areas located in over 90 sites are under formal protection status in ASEAN (Table 2.9). Most of the protected areas are in Indonesia. In addition, there are some additional 80 sites proposed as marine reserves scattered throughout the various ASEAN countries.

Table 2.9: Marine and Coastal Protected Areas, 1989

Country	Number	Areas (000 has)
Indonesia	68	8,941
Malaysia	9	52
Philippines	5	31
Thailand	10	625
Vietnam	2	34
ASEAN	94	9,683

Source: WRI, 1992
Note: Brunei and Singapore not included

References

ADB. 1991. *Environmental Evaluation of Coastal Zone Projects: Methods and Approaches.* ADB Environment Paper No. 8. Manila.

ADB. 1994. *Managing Water Resources to Meet Megacity Needs.* Proceedings of Regional Consultation, 24-27 August, 1993. Manila.

Brunei Darussalam Ministry of Industry and Primary Resources. 1992. *The Integrated Management Plan for the Coastel Zone of Brunei Darussalam.* Bandar Seri Begawan.

ESCAP. 1987. *Water Resources Development in Asia and the Pacific : Some Issue and Concerns.* Water Resources Research No. 62. Bangkok.

ESCAP. 1992. *State of the Environment in Asia and the Pacific.* Bangkok.

ESCAP. 1995. *State of the Environment in Asia and the Pacific.* Bangkok.

FAO. 1990. *Review of the State of World Fishery Resources.* Rome.

FAO. 1993. *Indo-Pacific Fisheries Commission : Papers Presented at the Seventh Session of the Standing Committee on Resources Research and Development.* Bangkok.

Howes J. 1987. *Rapid Assessment of Coastel Wetlands in the Philippines.* IPT-Asian Wetland Bureau. Kuala Lumpur.

IUCN. 1991. *The Conservation Atlas of Tropical Forests : Asia and the Pacific.*

Malaysia MOSTE. 1993. *Environmental Quality Report : 1992.* Kuala Lumpur.

Malaysia MOSTE. 1994. *Environmental Quality Report : 1993.* Kuala Lumpur.

OECC. 1992. *The Study of the State of the Environment of the Philippines and the Formulation of Recommendations for International Cooperation for Environmental Management.* Interim Report. Manila.

Philippine DENR. 1992. *The Philippine Natural Resources Accounting Project (Phase I).* Manila.

Philippine DENR. 1994. *1993 Philippine Forestry Statistic.* Manila.

Philippine DENR. 1995. *Assorted Handouts on Environmental Quality in the Philippines.* Manila.

Scott, D.A. (ed). 1989. *A Directory of Asian Wetlands.* IUCN. Gland.

Scott, D.A. and Poole, C.M. 1989. *A Status Overview of Asian Wetlands.* Kuala Lumpur.

Singapore. 1994. *Yearbook of Statistics.* Singapore.

Singapore. 1996. *Facts and Pictures.* Singapore.

Singapore Ministry of the Environment. 1992. *The Singapore Green Plan: Towards a Model Green City.* Singapore.

Singapore Ministry of Environment. 1994a. *Annual Report:1993.* Singapore.

Singapore Ministry of Environment. 1994b. *1993 Pollution Control Report.* Singapore.

UNEP. 1990. *The State of the Marine Environment.* UNEP Regional Seas Reports and Studies No. 115. Nairobi.

World Bank. 1993. *Philippines Environmental Sector Study Toward Improved Environmental Policies and Management.* Washington, D.C.

WRI. 1992. *World Resources: 1992-1993.*

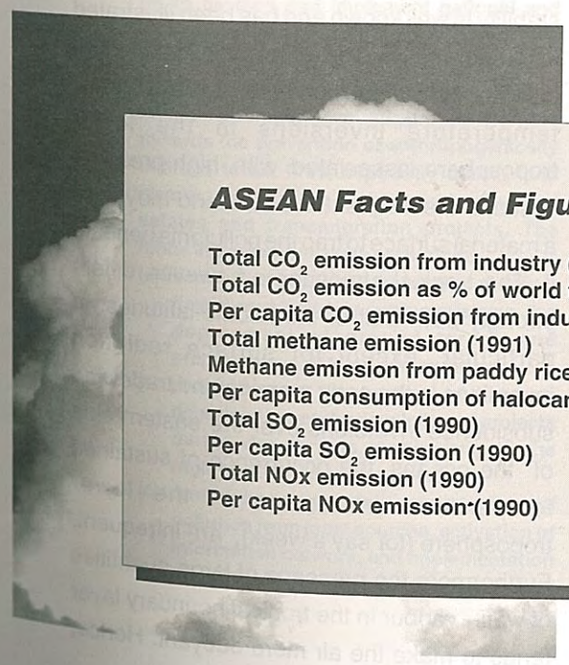
WRI. 1994. *World Resources: 1994-1995.*

Chapter 3
Air

This Chapter discusses the major types of air pollutants, their sources, and impacts on the environment. Although the present level of air quality in ASEAN countries is within acceptable norms, rapid urbanization has begun to take its toll on the environment, prompting ASEAN governments to take the required preventive measures to mitigate air pollution in urban areas. The transport sector, in particular, has been the focus of recent regulatory measures in order to safeguard public health and welfare that are being threatened by various air pollutants. Urban pollution trends in major ASEAN cities and the attendant health hazards are described in this Chapter.

The Chapter also describes climatic conditions and wind flow patterns in the region in relation to the potential for the occurrence of transboundary pollution. In recent years, dense haze episodes have been observed that are different from the transient slight hazy conditions that are usually localised in urban areas. ASEAN has initiated cooperative efforts to combat transboundary pollution in order to prevent an irreversible situation in the future.

The apparent lack of comparable regional data on air quality suggests the need for ASEAN to establish a harmonized monitoring and information system in the region. This will enable timely and accurate decisions to be made both at the national and the regional levels to arrest further deterioration in air quality.



ASEAN Facts and Figures

Total CO_2 emission from industry (1990)	107 million tonnes/year
Total CO_2 emission as % of world total (1990)	2%
Per capita CO_2 emission from industry (1990)	0.33 tonnes/year
Total methane emission (1991)	19.6 million tonnes/year
Methane emission from paddy rice (1991)	21% of world emission
Per capita consumption of halocarbon (1990)	0.06 kg/year
Total SO_2 emission (1990)	1.9 million tonnes/year
Per capita SO_2 emission (1990)	5.0 kg/year
Total NOx emission (1990)	1.6 million tonnes/year
Per capita NOx emission (1990)	4.1 kg/year

I. AIR CIRCULATION PATTERNS

The ASEAN region has a complex land-sea configuration which comprises the southeast portion of the Asian mainland, a peninsula and thousands of islands of varying shapes and sizes separated by seas and straits of different dimensions. The various scales of atmospheric motions that ensue from this land-sea distribution, as well as its interactions with the monsoon and global scale motions, give rise to diverse localised climatic regimes in the region.

ASEAN countries lie within the tropics and enjoy warm weather and sunshine throughout the year. The relative humidity in the region is high, ranging from 70% to 90%. The average temperature for most locations range from 25°C to 30°C. Tropical temperature inversions are common in the region. On days when the air is stable and sources of air pollutants are present, the concentrataions of these pollutants may increase as a result of poor dispersion. This brings about hazy mornings which normally clear by mid-afternoon.

Strong winds blow during the monsoon and typhoon periods. The Northeast Monsoon begins from mid-November to mid-February, with steady northeasterly winds blowing from the interior of Asia. It is cold and dry in the northern parts of Thailand, but as the winds blow over the South China Sea, they pick up moisture and deposit it as rain on the east coast of Peninsular Malaysia, bringing about the wettest season for this area. The Northeast Monsoon also affect most parts of Java, Kalimantan, Sabah, Sarawak, Brunei Darussalam, and the Philippines, bringing more rain over the areas, especially during the early phase of the season. The Southwest Monsoon begins in May and ends in mid-October. In contrast, during this period, most rain falls over Thailand and parts of the western coastal districts of Sumatra and Peninsular Malaysia. It is also the rainy season in the Philippines during this period.

During the monsoons, strong winds and rain help to dilute and remove air pollutants in the atmosphere. However, winds also carry air pollutants and deposit them either as "acid rain" or as particulate materials in the soil and water bodies even at some distance away from sources of emission.

A. Transboundary Pollution Potential

Outside of the monsoon seasons, light winds with relatively weak circulation and the occurrence of stable conditions reduce dilution and rain scavenging capabilities.

Air pollution can therefore reach critical levels in highly urbanised or industrialised areas located in the valleys where air pollutants are trapped and not easily dispersed. Most ASEAN capital cities, however, are located on low-lying coastal areas (except for Kuala Lumpur which is within a valley) and the air pollutants can be dispersed more easily by the land and sea breezes.

The capping influence of atmospheric stability is well known and has been illustrated in numerous studies or places in the mid-latitudes (temperate countries). In these areas, temperature inversions in the lower troposphere associated with high-pressure systems are frequent in winter and they form a material surface to trap the pollutants beneath it. The tropical atmosphere however, differs strongly from that of the middle-latitudes. In particular, except for surface radiation inversions in the early morning and tradewind subsidence inversions over the eastern side of the oceans, the occurrence of sustained temperature inversions in the lower troposphere (for say a week), are infrequent. Furthermore the presence of large quantities of water vapour in the tropical boundary layer tends to make the air more buoyant. Hence,

Box 3.1:
ASEAN CO-OPERATION PLAN ON TRANSBOUNDARY POLLUTION

ASEAN countries have agreed to collaborate actively to minimize the effects of transboundary pollution which include atmospheric pollution, movement of hazardous wastes and shipborne pollution. At a meeting held in June 1995, an ASEAN Co-operation Plan on Transboundary Pollution was formulated. In adopting the Plan, the ASEAN Ministers for the Environment recognised that public commitment and support was necessary for its effective implementation. Towards this end, ASEAN countries agreed on measures to promote public awareness and education leading to capacity-building in dealing with pollution problems at source. ASEAN countries also agreed to establish co-operative links with multilateral agencies and third countries to strengthen national and international capabilities in addressing transboundary pollution problems.

The Transboundary Atmospheric Pollution Programme has the following objectives:

(a) to assess the origin and cause, nature and extent of local and regional haze incidents;
(b) to prevent and control the sources of haze at both national and regional levels by applying environmentally sound technologies and by strengthening both national and regional capabilities in the assessment, mitigation and management of haze; and
(c) to develop and implement national and regional emergency response plans.

In order to achieve these objectives, ASEAN adopted the short-term strategy of working towards the prevention of anthropogenically induced forest fires, especially during land clearing activities in timber and agricultural estates and transmigration projects. The following measures were prescribed:

(a) timely detection and prevention of forest fires through early warming systems, the deployment of ground forces and preparedness of local communities;
(b) prohibition on the burning of biomass generated largely by development projects during dry periods, particularly in the regions affected by dry weather;
(c) during haze episodes, minimisation of pollution from local sources, activation of information network, and implementation of relevant joint activities; and
(d) promotion of investments on alternative uses of biomass.

As a long term strategy, zero-burning practices and technologies which would result in pollution reduction should be promoted in all economic sectors through attractive financing by lending agencies. The longer term measures also comprise awareness building efforts to eliminate the use of fire in land clearing activities, as well as introducing improvement of land clearing activities through economically sound and environmentally friendly methods in agriculture. Areas susceptible to spontaneous outbreaks of fire, such as coal beds and peat fields, should be developed to enable investments in appropriate activities.

The implementation of the programmes required that the following activities be undertaken:

(a) designation of National Focal Points in each country with the following functions: making an inventory of existing resources; establishing a regional information dissemination mechanism; and identifying types of information to be shared or disseminated.
(b) establishing procedures for reporting or alerting on fires by concerned agencies;
(c) developing a common air quality index and harmonised air quality sampling techniques;
(d) developing a regional fire danger rating system;
(e) sharing knowledge and technology in the prevention and mitigation of forest fire and other emission sources;
(f) establishing a mechanism for cooperation in combating forest fires and other emission sources at their points of activation;
(g) enhancing national and regional capabilities to deal with forest fires and other emission sources;
(h) expanding the role of the ASEAN Specialised Meteorological Centre (ASMC) to develop an atmospheric transport model to predict the tracts and spread of smoke haze; and
(i) expansion of the role of the ASEAN Institute of Forest Management (AIFM) to strengthen national capacity through training in forest fire management.

Source: ASEAN Secretariat, 1995

the tropical atmosphere for most of the time is conditionally unstable. If some mechanism exists to lift the tropical air high enough, convection would occur, and there would be some mixing of air upwards to this level. This helps to disperse and dilute the concentration of the pollutants efficiently either through convective mixing or by forming widespread heavy rain to wash out the trapped pollutants.

Generally hazy conditions over the equatorial belt of the ASEAN region usually occur during the months of July to September of the Southwest Monsoon season. Depending on whether it was drier or wetter than normal Southwest Monsoon season, the severity of haze fluctuates. When it becomes very dry (eg in 1972 and 1994) and large scale sources of haze are present, the situation can be quite bad. On the other hand there could also be occasions when frequent thunderstorms are observed. When such weather is present, conditional instability and the convergence of air and moisture over the region increases the dispersal capability of the atmosphere.

B. Haze Episodes

The ASEAN region has experienced hazy conditions since the early 1980s. In recent years, however, dense haze episodes have occured that are different from the localised transient and slight hazy conditions usually observed in urbanised areas. The observed dense haze episodes result from either the injection of suspended ash particulates from volcanic eruption, or from large-scale forest fires and open burning.

One of the worst haze episodes in the region occurred from August to October 1994. Haze particles from forest fires in parts of Indonesia were blown in by prevailing south-easterly to south westerly winds which affected large parts of Peninsular Malaysia, Singapore, Indonesia and Brunei Darussalam. Stable atmospheric conditions also contributed to the trapping of the haze particles within the boundary layer. The prevaling winds also caused haze particles to be blown from extended emission sources in Kalimantan.

The number of sunshine hours were reduced together with the average global irradiation. Poor visibility affected aviation as flights had to be rescheduled, cancelled or redirected to airports with radar facilities. Many people showed up at hospitals and clinics for treatment of asthma and bronchial related ailments.

While the intense haze episode over parts of Malaysia, Singapore and Brunei Darussalam were caused by the advection of smoke particulate from forest and plantation fires in the region, local emissions of suspended particulate also contributed to the problem. Since the capacity of the atmosphere to disperse the pollutants has a threshold limit, the additional load aggravated further the haze condition. Control of all kinds of emissions from all sources was therefore very important during such episodes.

Local authorities of the countries affected by the haze urged the public to cooperate to mitigate the adverse impact of the haze. People were encouraged to stop open burning and to refrain from using vehicles unnecessarily to reduce traffic congestion and excessive emissions. Industries were encouraged to voluntarily cut-back or reduce fuel combustion and consumption of energy. The general public was advised to drink plenty of water and stay indoors and to consult their physician as and when they begin to experience respiratory and health problems.

II. AIR POLLUTION EMISSIONS

Gases and particulates are emitted to the atmosphere from both natural and man-made sources. Oxides of carbon, sulphur and nitrogen and trace metals occur naturally. On the other hand, human activities such as industrial, agricultural and anthropogenic combustion have modified the global biogeochemical cycles that could intensify their discharge into the atmosphere. Moreover, many chemicals found in the environment today --- like halocarbons and chlorofluoro-carbons (CFCs) --- are man-made and have no natural sources. The continuing expansion and diversification of ASEAN economic activities have made the region increasingly concerned with these emissions and their effects on air quality.

Table 3.1: Characteristics of Different Greenhouse Gases

Greenhouse Gas	CO2	CH4	CFC11	CFC14	NO2
Global Warming Potential* (GWP)	1	21	3500	7300	290
Present Concentration (ppm)	353	1.72	0.00028	0.00048	0.31
Annual Growth Rate (%)	0.5	0.9	4	4	2.25
Atmospheric Lifetime (yr)	50-200	10	65	130	150
Relative Contribution over 100 yrs (%)	61	15	11.50	11.50	4

Source: IEA, 1991
*Note: *Warming effect of 1 kg of each gas relative to CO_2*

A. Greenhouse Gases

Components in the earth's atmosphere such as carbon dioxide, water vapor, methane and nitrous oxide produce the "greenhouse effect". This phenomenon occurs when greenhouse gases rise into the atmosphere and trap infrared radiation or heat coming from the sunlight. This heat is reflected back towards earth, warming it. Without those gases, the heat would radiate out into space. A certain concentration of greenhouse gases is necessary to keep the earth warm and habitable. However, the increasing intensity of human activities, especially during the last several decades, has made the concentrations of these gases too high and has caused other greenhouse gases (e.g., CFCs) to be introduced as well. This trend has resulted in the present phenomenon of global warming.

A huge amount of carbon dioxide is added to the atmosphere every year and is the main contributor to the greenhouse effect. Different gases have different warming effects and these are measured relative to carbon dioxide (Table 3.1). CFCs have the highest potential contribution to global warming, although they are normally present in very small amounts.

Climate change due to greenhouse gases has elicited worldwide cooperation and support. Different international fora have addressed various aspects of the problem with particular attention to monitoring and assessment. Recently, the World Meteorological Organization (WMO) has established the Global Atmosphere Watch (GAW) to integrate and coordinate monitoring and research activities on greenhouse gases (UNEP, 1993). The GAW programme maintains a network of approximately 30 global stations and about 200 to 300 regional stations. These stations aim to improve inventories of anthropogenic greenhouse gas emissions at the national, regional and global levels. From these data bases, assessment and modelling of climatic phenomena could be fully understood and more effective policies implemented.

Global efforts have produced visible results. A number of countries have independently set-up national inventories and many have attempted to harmonize their systems with international standards. Recent reports show that global emissions of major greenhouse gases have started to decline. This observation is generally true in ASEAN on a per capita basis. Drastic reduction and accelerated phase-out of CFC use are

Table 3.2: Trends in Carbon Dioxide Emission from Industrial Sources in Selected Countries (1000 tons Carbon per year)

Country	Year			
	1960	1970	1980	1990
Brunei D.	91	2,238	1,871	1,421
Indonesia	5,844	9,050	25,825	38,506
Malaysia	1,112	4,092	7,764	16,216
Philippines	2,303	6,733	9,971	11,752
Singapore	380	4,964	8,217	10,279
Thailand	1,012	4,190	10,921	25,535
Vietnam	2,061*	7,696*	4,633	6,337
ASEAN	12,803	38,963	69,202	107,046
USA	799,544	1,165,477	1,259,281	1,310,341
Japan	63,997	202,973	254,881	289,288
World	na	na	5,066,855	5,824,051

Source: UNEP, 1993
*Note: na - data not available; *estimated by combining North and South Viet Nam data*

guaranteed by policy actions from national governments.

Despite these encouraging results, the problem of greehouse gases remains serious. Even with the decline in emissions, greenhouse gases in the atmosphere continue to accumulate. It is estimated that it will take a 60% immediate reduction in greenhouse gases with long life cycles to stabilize atmospheic concentrations (WRI,1994)

1. Carbon Dioxide

Carbon dioxide (CO_2) is responsible for more than 60% of global warming. The man-made sources of carbon dioxide are fossil fuel combustion in industrial processes, gas flaring, and the production of cement. Deforestation is a contributory factor since it reduces the plant population that removes CO_2 or act as a carbon sink.

ASEAN emissions of carbon dioxide at 107 million tons per year is still very small --- constituting less than 2 % of total global emissions (Table 3.2). The tropical forest in the region could adequately serve as carbon sink for this annual emission level. The per capita generation is also small compared to other more developed countries (Table 3.3).

However, there are some disturbing trends. Carbon dioxide emissions in ASEAN is growing very fast. In just three decades, total emission increased almost 10 times on account of increasing population and the intensity of per capita generation. Per capita generation of CO_2 increased by more than 30% from 0.25 to 0.33 tons carbon per year from 1980 to 1990 (Table 3.3). The figure for 1991 was lower at 0.28 tons of carbon per year with the inclusion of data for Vietnam (Table 3.4).

It is estimated that every year, about 674 million tons of carbon remain in the atmosphere because the forest in ASEAN that should have absorbed the gas was destroyed (Table 3.4). Since land use change is irreversible, the capacity of forest to decrease carbon is permanently removed. ASEAN countries are currently addressing the problem of forest depletion as a means to reduce carbon dioxide emissions.

Carbon dioxide generation in ASEAN countries increases by 0.32 kg of carbon per year on the average for every one US dollar increase in GDP --- a rate significantly higher than that in developed countries. Despite this, however, the four largest ASEAN countries ranked relatively low among the 50 major contributors to carbon dioxide emissions (WRI 1994). Since ASEAN economies are growing very fast, the rate of carbon dioxide emission is expected to increase very rapidly unless intensity is reduced by promoting industrial efficiency and by making life styles less energy intensive.

Table 3.3: Estimates of Per Capita CO2 Emission (tons per year) from Man-made sources, 1980-1990

Year	ASEAN*	USA	Japan	World
1980	0.25	5.35	2.20	1.14
1990	0.33	5.24	2.35	1.10

Source: UNEP, 1993
*Note: *Viet Nam not included*

Table 3.4: Other Statistics on Carbon Dioxide Emission

Country	Per Capita Emission from Industrial Sources (tons Carbon per Year) 1991	Emission from Industrial Sources per unit GDP (Kg. Carbon per Year) 1990	Emission from Land-use Changes (1000 tons per year) 1991
Brunei D.	5.34*	na	na
Indonesia	0.92	0.36	330,000
Malaysia	3.33	0.38	110,000
Philippines	0.7	0.27	110,000
Singapore	8.87	0.21	na
Thailand	1.83	0.32	91,000
Viet Nam	0.29	na	33,000
ASEAN	0.28	0.32	674,000***
USA	19.53	0.24	22,000
Japan	8.79	0.1	4391**
World	4.21	na	3,400,000

Sources: UNEP 1993, WRI 1994
*Note: na -- data not available; *1990 data; **1985 data;*
*** Brunei Darussalam and Singapore are not included*

2. Methane

Atmospheric methane (CH_4) comes primarily from the anaerobic decay of organic matter in natural wetlands, rice paddies, enteric fermentation in ruminants, landfills, biomass burning, natural gas production and transmission, and coal mining. The difficulty in quantifying emissions from these sources has been a major source of dispute between the industrialised nations and the developing, agricultural based communities like ASEAN.

ASEAN's share in total methane emissions is larger compared to carbon dioxide (Table 3.5). Every year, ASEAN adds 19.6 million tonnes of methane to the atmosphere, largely from agricultural activities, in particular, paddy rice growing. ASEAN contributes an estimated 21% of the world's methane emissions that arise from wet paddy fields. Although this is a cause for concern, methane emissions from wet paddy fields are considered "survival emissions" from food production that cannot be compared with emissions from non-critical activities like air-conditioning. If emissions from agricultural sources are netted out, ASEAN's contribution to world methane emissions is around 2% --- a level comparable with ASEAN's share to carbon dioxide emissions. ASEAN countries with a large agricultural base like Indonesia, the Philippines, Thailand and Vietnam contribute more to methane emissions.

Table 3.5: Emissions of Methane (1000 tons per year) from Man-made Sources, 1991

Country	Solid Waste	Coal Mining	Oil and Gas Production	Wet Rice Agriculture	Livestock	Total
Indonesia	480	82	720	5,100	650	7,100
Malaysia	65	0	250	290	39	640
Philippines	220	na	na	1,500	220	1,900
Singapore	61	na	na	na	0	60
Thailand	110	9	83	5,300	440	6,000
Vietnam	120	75	0	3,400	270	3,900
ASEAN*	1,056	166	1,053	15,590	1,620	19,600
USA	8400	9,100	5,300	750	6,000	29,000
Japan	1,900	97	35	1,400	280	3,600
World	40,000	40,000	26,000	72,000	76,000	250,000

*Note: na -- data not available; *data not available assumed negligible in obtaining ASEAN aggregate figure*
Source: WRI, 1994

3. Halocarbons

Halocarbons are man-made and have no natural sources. The fully halogenated compounds are stable and resistant to physical and chemical removal process and thus have long atmospheric lifetimes. These compounds, aside from their greenhouse effects, are also known to have ozone depleting potential. However, recent studies suggest that the heat-trapping properties of CFCs may be offset by stratospheric cooling resulting from the depletion of the ozone gas that also functions as a natural greenhouse gas (WRI, 1994). Nevertheless, the adverse effects of CFCs on weather patterns and other climatic phenomena remain.

ASEAN countries

Table 3.6: Consumption of CFCs and Halons (tons/year)

Total CFCs & Halons	ASEAN*		USA		Japan		World		
	Total	per capita	Total	per capita	Total	per capita	Total	per capita	ASEAN % of World
1986	19,549	0.07	363,767	1.53	135,089	1.12	1,549,933		1.3
1990	18,638	0.06	145,593	0.88	120,074	0.97	1,027,748	0.72	1.8

Source: UNEP, 1993
*Note: *Brunei Darussalam and Vietnam are not included.*
Per capita consumption in kg per year

consumed less than 2% of the world's total consumption of holocarbons, the per capita consumption of halocarbons in ASEAN is only 0.06 kg in 1990 --- a level that is approximately 15 times less than the developed countries (Table 3.6). Moreover, ASEAN countries, as signatories to the Montreal Protocol on Substances that Deplete the Ozone Layer are commited to phase out the use of these ozone depleting substances. As prescribed by the Montreal Protocol, many companies in the region are now shifting to CFCs with lower warming potential (e.g. from CFC 11 and 12 to CFC 22 and soon to non-CFC alternatives).

4. The Greenhouse Index

The Greenhouse Index gives a measure of the country's contribution to global warming. Ideally, there should be national inventories to enable the calculation of national contributions to global warming. However, in the absence of such inventories, each country's greenhouse gas emissions are estimated based on:anthropogenic sources of CO_2 (calculated from data on fossil fuel combustion, cement manufacture, and deforestation); methane emission (from landfills, coal extraction, oil and gas production, wet rice agriculture, and livestock); and production of two main chlorofluorocarbons (CFCs) from data on the use of CFC-11 and CFC -12.

Using the method proposed by the Inter-governmental Panel on Climate Change (IPCC), emission estimates for each gas are combined with the global warming potential and these are added to give an overall index of each country's contribution to the increase in the warming potential of the atmosphere in a given year. Using the Greenhouse Index Ranking Scale, Indonesia, Thailand, Malaysia and the Philippines were listed among the top 50 contributors. These ASEAN countries obtained high rankings primarily because of their contribution to methane emissions from agricultural activities. Based on per capita green-house emissions, however, only Singapore (rank 15 with per capita measure of 6.33) and Malaysia (rank 33 with per capita measure of 3.93) were included among the top 50 countries (WRI, 1994).

B. Other Gaseous Pollutants

In addition to greenhouse gases, ASEAN countries emit other pollutants that contaminate the air and have the potential to cause damage to property, human welfare and other life forms as well. These pollutants include sulphur dioxide, and nitrogen oxides.

1. Sulphur Dioxide

Natural emissions of sulphur dioxide (SO_2) from volcanic activity, sea-salt sprays and microbial activities account for about half of all atmospheric sulphur dioxide. These sources are not of major concern in as much as natural sulphur does not increase but is only recycled. However, man-made emissions are reasons for concern since these sources increase the volume of sulphur that return to the soil as dust or form droplets of acid rain.

Sulphur dioxide is emitted when fossil fuels that contain sulphur, such as coal, oil and natural gas, are burned for power generation or for industrial processes. Smelting of metal and sulphuric acid production also generate

Table 3.7: Emissions of SO_2 from Man-made Sources (1000 tons per year)

Emissions of SO_2	ASEAN		USA		Japan	
	Total	per capita	Total	per capita	Total	per capita
1975	1,550	5.6	25,900	111	2,570	23
1980	2,218	7.1	23,400	99	1,600	14
1985	1,909	5.5	21,100	89	1,180	10
1990	1,925	5.0	21,100	85	1,140	9
% change 1975-90	24		(19)		(56)	

Note: per capita emissions in kg per year
Enclosed in ( ) means decrease
Source: UNEP, 1993

sulphur dioxide emission.

Exposure to sulphur dioxide can damage the respiratory system. It irritates the lung and causes chronic disorder and other complications. Environmental effects of sulphur dioxide include: acidification of soils, lakes and rivers; damages to plants; corrosion of buildings; and reactions with limestone deposits. On the whole, the acid deposition affects human health, plant growth, and aquatic life.

In 1990, per capita emissions of sulphur dioxide from man-made sources in the ASEAN region was only 5 kg compared to a range of 9 kg to 85 kg in developed countries (Table 3.7). Total emission in ASEAN still shows an increasing trend, in contrast to developed countries (USA and Japan) that are able to reduce their total emissions. Per capita emission in ASEAN, like in other countries, is decreasing.

To reduce sulphur dioxide emissions, ASEAN countries are shifting to the use of low-sulphur fuel (preferably less than 1%) particularly for industries near urban centers. This practice is being forced by stricter national emission standards. Meanhwile, the use of sulphur dioxide removal technologies such as scrubbers that desulphurise flue gas are still limited because of the prohibitive cost. ASEAN countries are also adopting various measures to conserve energy and improve energy generation efficiency.

2. Nitrogen Oxides

Nitrogen oxides in the atmosphere are from both natural and man-made sources. Natural sources include lightning, forest fires, volcanic activity and microbial activities in soil. The ASEAN region experiences frequent tropical thunderstorms and is expected to have a higher background level of nitrogen oxides. Some nitrogen oxides come from the microbial action of nitrogen-fixing bacteria.

Man-made emissions come mostly from combustion of fossil fuels in power stations and from vehicular emissions. Combustion produces several oxides of nitrogen. Those known to have adverse environmental or biological effects are nitrogen oxide (NO) and nitrogen dioxide (NO_2).

Total nitrogen oxide emissions in ASEAN increased during the period 1980 to 1990 in contrast to decreasing levels in

Table 3.8: Emissions of NO_x from Man-made Sources (1000 tons per year)

Emissions of NO_x	ASEAN		USA		Japan	
	Total	per capita	Total	per capita	Total	per capita
1975	940	3.4	19,200	82	2,330	21
1980	1,189	3.8	20,400	87	2,130	18
1985	1,412	4.0	19,800	83	1,950	16
1990	1,582	4.1	19,800	79	1,940	16
% change 1980-90	33		(3)		(9)	

Note: Viet Nam not included; per capita emission in kg per year
Enclosed in ( ) means decrease
Source: UNEP, 1993

developed countries like the US and Japan (Table 3.8). Per capita emission in ASEAN however, was much lower than these two countries and was maintained at less than 5 kg per person per year.

III. URBAN AIR QUALITY

The absence of comparable data makes it difficult to assess air quality in ASEAN. National monitoring programmes have been designed individually and different types of monitoring equipment are used by ASEAN countries. Without comparable data from stations (which have to be suitably selected), only broad generalisations for the city or country are possible. Because of this limitation, this section describes air quality in selected ASEAN cities instead of for individual ASEAN countries.

Some ASEAN cities have participated and submitted data on urban pollution to the World Health Organization (WHO) under the GEMS Urban Air Quality Monitoring Project better known as GEMS/Air. Participation in the project has allowed for better harmonization and assessment of air quality data. GEMS/Air has expanded to 80 cities in over 50 countries at present.

A. Factors Affecting Urban Air Quality

The deterioration of air quality in ASEAN urban areas is mainly due to industrial expansion and rapid population growth, and the increase in the number of vehicles. High rates of economic growth enjoyed by ASEAN countries in the past few years have put heavy pressure on the environment, particularly in urban areas. The transport sector in particular, has been responsible for emissions of substantial quantities of lead, particulates, carbon monoxide, halocarbons and nitrogen dioxide.

The ASEAN population has increased rapidly over the past 40 years. This, combined with increasing level of urbanization, has caused the urban population in ASEAN to expand very rapidly (see Chapter 4 on People). Today, three of the ASEAN capital cities rank among the world's 30 largest urban agglomerations in terms of population size (Table 3.9). By the year 2000 the population of Bangkok, Jakarta, and Manila will reach at least 10 million, qualifying them to be among the 20 megacities in the world.

Rapid population growth has increased the demand for transportation. The number of passenger vehicles on the road has grown over the years, and so has the demand for public transportation. However, the inability of some countries to cope with the transport requirements of rapid urbanization exacerbated the problem of urban congestion. Inadequate public transport systems made people want to own their own vehicles, thus aggravating traffic and adversely affecting the quality of the roads. The resulting traffic congestion increases fuel consumption and the levels of pollutants emitted into the air.

Table 3.9: Urban Agglomerations

Rank	Agglomeration	Country	Population (millions)
1	Tokyo	Japan	25
16	Jakarta	Indonesia	9
18	Metro Manila	Philippines	9
24	Bangkok	Thailand	7
30	Essen	Germany	6

Source: UNEP, 1993

Traffic congestion forces people to spend more time on the road and be exposed longer to higher levels of polluted air. Emissions can adversely affect health, especially of the very young and the very old members of the population . School children aged 14 years and below, that comprise about 30% of the population, are most affected. This group of children are most susceptible to deteriorating air quality because they spend more time on the road travelling to and from school and playing out in the open field.

Table 3.10: Number of Motor Vehicles in Selected ASEAN Capital Cities, 1993

ASEAN Capital Cities	Population	Motor vehicle Population	Unit per'000 population
Bandar Seri Begawan	276,300	153,351	555
Jakarta	9,200,000	1,072,500	117
Kuala Lumpur	2,000,000	733,083	370
Metro Manila	8,900,000	675,000	75
Singapore	2,873,800	584,000	203
Bangkok	7,100,000	2,500,000	350

Source: ESCAP, 1994
Note: na -- data not available

As ASEAN becomes more affluent, the volume of motor vehicles will grow more rapidly. At present, vehicle population is incresing at an average annual rate of almost 8%. In 1990, more than 8 percent of the total vehicles in the ESCAP region can be found in ASEAN (ESCAP, 1990 and 1994). This does not include several millions more motorcycles and others vehicles with less than four-wheels. Thailand, Indonesia and Malaysia account for more than 80 percent of the motor vehicles in the region.

The concentration of motor vehicles in cities makes their impact on the urban environment more pronounced. The ratio of cars per thousand population in ASEAN capitals ranges from 75 to 555 (Table 3.10). It is highest in Bandar Seri Begawan and lowest in Metro Manila. The differences in vehicle per capita ratios in ASEAN countries are accounted for by several factors, among others: the relative affluence of the people; the adequacy and efficiency of public transport systems; the pace and extent of the development of suburban settlements; and specific government policies.

B. Sources and Relative Importance of Environmental Pollutants

The control of air pollution from mobile sources would require comprehensive policies affecting millions of polluters. Measures would include the use of cleaner fuels, catalytic converters, improved public transportation, the use of mass transit system, car-pooling, and other fiscal controls to discourage the ownership or use of private vehicles. In this regard, Singapore is perhaps the only ASEAN Member Country that was able to control vehicle growth and usage as a means to bring down urban pollution from motor vehicles (see Chapter 4 on People).

Air pollution from stationary sources are considered of low to moderate environmental significance. The primary sources in ASEAN cities are power generation plants, cement factories, oil refineries, agro-based industries such as palm oil and rubber processing, chemical plants and wood-based industries. These are mostly confined to certain areas (industrial estates) such that control of emissions could be handled through the enforcement of emission control legislations, the mandatory use of pollution control equipment, or through the proper siting and zoning of industrial sites.

C. Urban Air Pollutants

Public health and welfare are continuously threatened by exposure to polluted air. Evidences show that air contaminants have been a major cause of increased morbidity and even mortality , especially in urban areas (UNEP, 1993). This situation has increasingly alarmed ASEAN governments.

The three ASEAN megacities are currently experiencing serious problems with respect to suspended particulate matter. These cities suffer low pollution caused by sulphur dioxide, and moderate to heavy pollution

Table 3.11: Status of Pollutants in Selected Megacities, 1992

City	SO_2	SPM	Pb	CO	NO_2	O_3
Bangkok	L	S	L	L	L	L
Jakarta	L	S	M	M	L	M
Manila	L	S	M	N	N	N
Beijing	S	S	L	N	L	M
Delhi	L	S	L	L	L	N
New York	L	L	L	M	L	M
Seoul	S	S	L	L	L	L
Tokyo	L	L	N	L	L	M

Source: WRI, 1994
Note:
S -- serious pollution: WHO guidelines exceeded by more than a factor of two
M -- moderate to heavy pollution: WHO guidelines exceeded by up to a factor of two
L -- low pollution: WHO guidelines normally met (short-term guidelines exceeded occassionally)
N -- no data or insufficient data to make an assessment.

caused by lead. Bangkok is generally safe in terms of pollution levels for carbon monoxide, nitrogen dioxide and ozone. Jakarta has higher levels of pollution for carbon monoxide and ozone (Table 3.11).

The ASEAN megacities compare favorably with the other cities of the world in terms of air pollutants, except for lead. New York and Tokyo have lesser problems with air pollution than other megacities.

In Manila, the transport sector is the major contributor of lead, carbon monoxide, halocarbons, nitrogen oxides and particulates (Table 3.11). Vehicles using gasoline emit lead and carbon monoxide while diesel-run engines (usually in commercial vehicles) generate particulates and sulphur dioxides. Both gasoline and diesel engines emit nitrogen dioxide. The major sources of lead are additives from gasoline while combustion of sulphur-containing fuels, especially diesel oil, is the main source of sulphur dioxides. Although data is only available for Manila, the concentration of pollutants is likely the same in other large cities of ASEAN such as Bangkok and Jakarta, and to a certain extent, also Kuala Lumpur and Ho Chi Minh. The Asian Development Bank predicts that the concentration of these major pollutants are likely to exceed WHO limits by 2005 if appropriate measures are not taken.

ASEAN countries are taking measures to control air pollutants in order to protect the health and welfare of urban dwellers. Some of their initiatives for major pollutants are discussed below.

1. Carbon Monoxide

Carbon monoxide is normally generated from the incomplete combustion of carbon-containing fuels. Almost all of carbon monoxide emissions come from motor vehicle exhaust. Emission levels for carbon monoxide exceed the levels for all other urban air pollutants in ASEAN cities. Among the air pollutants, it is suspected to be a major cause of cardio-vascular ailments.

Some ASEAN countries are now experimenting on the use of liquified natural gas (LNG) as fuel to improve combustion efficiency and reduce carbon monoxide and carbon dioxide emissions. Another option would be to clean exhausts from motor vehicles by using catalytic converters, although this device has not yet been widely adapted in the region. The initiatives of ASEAN countries to relieve traffic congestion and restrict the use of motor vehicles will also result in lowering carbon monoxide emissions.

Table 3.12: Reduction of Lead Content in Gasoline

Country	First Reduction	Second Reduction	Unleaded Patrol Introduced
Brunei D.	0.8 to 0.4 g/l	0.4 to 0.15 g/l	January 1994
Indonesia	NA	NA	NA
Malaysia	0.84 to 0.4 g/l (1986)	0.4 to 0.15 g/l (1990)	
Philippines	0.6 g/l	0.15 g/l	
Singapore	0.6 to 0.4 g/l (1983)	0.4 to 0.15g/l (1987)	January 1991
Thailand	0.84 to 0.45 g/l (1989)	0.45 to 0.15 g/l (1992)	January 1991

Source: Official Reports from ASEAN Governments

Table 3.13: Average Concentration of Lead (Pb) in ug/m³ in selected ASEAN Cities

City	1989	1990	1991	1992	1993	Standard
Jakarta	NA	NA	NA	NA	1.26	60 ug/m³
Kuala Lumpur	1.27	0.61	0.44	0.35	0.25	1.5 ug/m³
Singapore	0.3	0.3	0.2	0.2	0.1-0.2	1.5 ug/m³
Bangkok	0.4	0.44	0.3	0.2	0.21	10 ug/m³

Sources: National Government Data
Note: NA - data not available

2. Lead

Tetra-ethyl lead and tetra-methyl lead are added to petrol as anti-knock agents. In turn, these are emitted into the atmosphere by vehicular exhausts. Long-term exposure to lead can cause irreversible damage to the brain and other organs. Fetuses and children are particularly sensitive to the deleterious effects of lead while their nervous systems are in the process of development.

Increasing concern for the public health risks associated with exposure to lead has prompted the gradual reduction of maximum permissible levels of lead in petrol. Singapore was the first country in the ASEAN to reduce its level of permissible lead from 0.6 g/l to 0.4 g/l in 1983. This was further reduced to 0.15 g/l in 1987 until unleaded petrol was finally introduced in 1991 (Table 3.12).

The reduction of lead content in petrol has resulted in a corresponding decrease in

Table 3.14: Concentration of Suspended Particulate Matter at Selected GEMS/Air Sites (Mean annual values in microgram per cubic meter)

Country/City	Site	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Indonesia: Jakarta	CCR	274	273	215	271	201	204	na	na	na	na	na
	SI	167	172	18	na	na	na	204	183	188	na	na
	CCI	na	na	359	262	180	175	na	na	na	na	na
	NA	na	na	na	na	na	na	212	156	188	237	na
Malaysia: Kuala Lumpur	SI	182	159	120	104	188	na	124	138	136	na	na
	SR	na	247	96	na	104	139	162	120	121	na	na
Thailand: Bangkok	SI	174	244	265	247	218	204	320	241	292	198	na
	SR1	115	118	151	163	205	156	127	92	107	115	na
	SR2	232	na	169	188	237	236	261	242	204	194	na
China: Beijing	SI	na	479	454	421	512	na	385	400	414	418	430
	CCC	na	422	527	504	595	na	402	417	415	407	418
	SR	na	252	277	220	308	na	234	250	268	247	271
	CCR	na	415	409	384	400	na	356	367	375	369	371
Japan: Tokyo	CCC	59	63	57	54	64	56	58	60	55	47	56
	SR	52	53	53	51	56	51	47	55	48	46	49
	CCI	na	na	na	na	52	51	61	62	55	58	63
USA: New York	SR	51	52	45	43	50	48	44	50	na	na	na
	CCR	62	65	58	54	62	68	59	60	61	65	56
	CCI	63	68	60	63	67	74	64	73	68	69	67

Note: na -- data not available. CCC -- City Centre Commercial; CCI -- City Centre Industrial; CCR -- City Centre Residential; CCM -- City Centre Mobile; SI -- Suburban Industrial; SR -- Suburban Residential; NA -- Site not assigned Gems/Air site code.

Source: Environmental Data Report, UNEP 1993-1994

ambient kerbside concentration levels for lead. Ambient lead levels in selected ASEAN cities are within national guidelines and concentration levels are decreasing (Table 3.13). Recent readings however, show much lower values compared to national standards, suggesting a possible lowering of standards possibly to the WHO-recommended level of 0.5 ug/m³ (WRI, 1994).

3. Total Suspended Particulates

The level of total suspended particulates (TSP) in some GEMS/Air sites indicate that air pollution in Bangkok, Jakarta and Kuala Lumpur are much higher than WHO guidelines and actual reported values for other cities in developed countries (Table 3.14). The major sources of TSP are poorly-maintained diesel-run commercial vehicles.

4. Sulphur Dioxide

Levels of sulphur dioxide in selected ASEAN capital cities were within the national standards and the WHO Guidelines (Table 3.15). Similar to TSP, the major sources of sulphur dioxide emissions are diesel-driven vehicles in the cities.

5. Nitrogen Dioxide

On the basis of limited data available, levels of nitrogen dioxide in selected ASEAN cities are well below national standards and WHO guidelines (Table 3.16).

Table 3.15: Average Concentration of SO_2 in ug/m³ in selected ASEAN Cities

Capital City	1989	1990	1991	1992	1993	1994
Jakarta	NA	13	5	16	18	23
Metro Manila	31	NA	NA	NA	NA	NA
Singapore	19	20	18	19	18	19

Note: NA = Not available
Sources: National Government Data

Table 3.16: Average Concentration of NO_2 in ug/m³ in selected ASEAN Cities

Capital City	1989	1990	1991	1992	1993	1994
Jakarta	NA	9	6	6	11	30
Metro Manila	NA	NA	39	NA	NA	NA
Singapore	17	16	21	22	15	29
Bangkok	20	NA	NA	NA	NA	NA

Source: National Government Data
Note: NA - data not available

IV. AIR QUALITY MONITORING

On the whole, air quality in ASEAN is within national air quality standards except in capital cities that are heavily congested with traffic. The present level of air quality in ASEAN may not be particularly worrisome on account of the favourable meteorological conditions that help to disperse gaseous pollutants. However, the rapid development of the region is likely to increase pollution levels that may soon exceed recommended levels unless adequate control measures are applied.

Individual ASEAN countries have adopted their own guidelines for ambient air quality (Table 3.17). Many have adopted the WHO Guidelines with some adaptations to existing local conditions, available pollution control technology, and monitoring equipment. ASEAN countries have also established air quality monitoring sites mostly located in urban centres, although some are located in industrial estates (Table 3.18). The monitoring equipment used differ from country to country and range from the semi-automatic to fully automatic telemetry network system.

A harmonised monitoring system for ASEAN is necessary for generating comparable results and for predicting and preventing transboundary movement of air pollutants. Efforts are underway to establish an ASEAN Network of Environmental Monitoring (ASNEM) to ensure that comprehensive and comparable data are generated for environmental planning at the national and regional levels. The ASEAN State of the Environment Report should also be able to provide an impetus for ASEAN cooperation in harmonizing air quality monitoring system in the region.

Table 3.17: ASEAN: Air Quality Standards and Guidelines

Pollutants	Time Average	WHO Guidelines	Brunei Darussalam	Indonesia	Malaysia	Philippines	Singapore	Thailand
		ug/m³	ug/m³	ppm	ug/m³	ug/m³	ug/m³	ug/m³
SO_2	1 hr	300	350	0.1	350	340		780
	24 hr	125	125	-	105	180	-	300
	annual	50	50	-	-	80	80	100
CO	1 hr	30,000	30	-	35	35,000		34,200
	8 hr	10,000	10	200	10	10,000	10,000	10,260
	annual	-	-	-		6,000		
NO_2	30 min	-	-	-	-	-	-	-
	1 hr	400	300	-	320	190	-	320
	24 hr	150	100	0.05	-	-	-	-
	annual	-	-		-	-	100	-
O_3	30 min	-	-	-	-	-		-
	1 hr		120	0.8	200	140	235	200
	8 hr		60	-	120	10		-
SPM	24 hr	120	150	260	260	230	-	330
	annual	-	90	ug/m³	90	90	75	100
PM10	24 hr	-	100	-	150	150	150	120
	1 year	-	60	-	50	60	50	50
Pb	24 hr	-	-	60	-	-		
	3 month	-	1.0	ug/m³	1.5	1.5	1.5	
	annual	0.5	-	-	-	-		1.5
				-				
H_2S	30 min				0.03		-	
	1 hr				-			
NH_3	24 hr				2		-	
HC	3 hr				0.24		-	

Source: ERTC, 1991
Note: Indonesia - Guidelines are only for Jakarta; Malaysia - Proposed guidelines; Singapore - USEPA/WHO standards used as guidelines
Conversion Factor (30° C)
SO_2: 1 ppm = 2.57 mg/m³; CO: 1 ppm = 1.13 mg/m³; NO_2: 1 ppm = 1.85 mg/m³; O_3: 1 ppm = 1.93 mg/m³; H_2S: 1 ppm = 1.37 mg/m³; NH_3: 1 ppm = 0.68 mg/m³

Table 3.18: Air Quality Monitoring Sites and Parameters Measured in ASEAN Capital Cities

Capital City	Monitoring Stations	Parameters									
		SO_2	CO	NO_2	O_3	SPM	PM10	Pb	NH_3	HS	HC
Bandar S. Begawan	1	v		v	v	v	v	v	-	-	-
Jakarta	33	v	v	v	v	v	-	-	v	v	-
Kuala Lumpur	3	v	v	v	v	v	v	v	-	-	v
Metro Manila	12	v	v	v		v	v	-	-	-	-
Singapore	15	v	v	v	v	v	v	v	-	-	v
Bangkok	17	v	v	v	v	v	v	v	-	-	v

References

ASEAN Secretariat. 1995. *ASEAN Cooperation Plan on Transboundary Pollution.*

ESCAP. 1990. *State of the Environment in Asia and the Pacific.*

ESCAP. 1994. *Statistical Yearbook for Asia and the Pacific.*

ERTC. 1991. *Proceedings on ASEAN Workshop on ASEAN Network on Environmental Air Quality Monitoring (ASNEM).* Thailand.

Indonesia. 1994. *Statistik Lingkungan Hidup Indonesia.*

IEA. 1991. *Greenhouse Gas Emissions-The Energy Dimension.*

OECC. 1992. *The Study of the State of the Environment of the Philippines and the Formulation of Recommendations for International Cooperation for Environmental Management.* Philippines.

UNEP. 1993. *Environmental Data Report, 1993-1994.*

WRI. 1994. *World Resources 1994-1995 : A Guide to the Global Environment.* Oxford University Press.

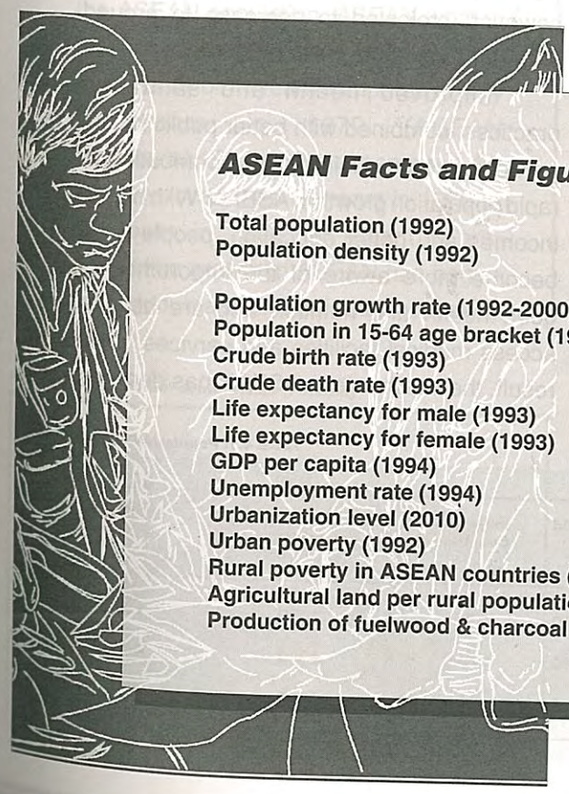


Chapter 4
People

This Chapter presents key demographic and socio-economic data that reflect patterns of human and economic development in ASEAN. It analyzes the urbanization patterns in ASEAN countries, in particular, the growth of the capital cities, which are also the primate cities in the region. The growth of cities can be traced to in-migration from the rural communities brought about by disparities in living conditions and opportunities. This urban agglomeration has affected the environment and consequently, urban living conditions.

The Chapter describes the important features of rural living environment in ASEAN.

This Chapter also discusses the effects of natural disasters in two ASEAN Member Countries. Finally, the status of efforts to improve environmental education and awareness in the region is presented.



ASEAN Facts and Figures

Total population (1992)	401 million
Population density (1992)	122 persons per square kilometers
Population growth rate (1992-2000)	1.7%
Population in 15-64 age bracket (1994)	61.4%
Crude birth rate (1993)	25 per 1000 population
Crude death rate (1993)	7 per 1000 population
Life expectancy for male (1993)	67 years
Life expectancy for female (1993)	71 years
GDP per capita (1994)	US$ 1,255
Unemployment rate (1994)	2.9%
Urbanization level (2010)	43%
Urban poverty (1992)	7.8%
Rural poverty in ASEAN countries (1993)	0% to 36%
Agricultural land per rural population (1992)	0.23 hectare per person
Production of fuelwood & charcoal (1992)	251 million cubic meters

I. DEMOGRAPHIC, ECONOMIC, SOCIAL AND CULTURAL PROFILE

The population in ASEAN Member Countries varies in size, from 250,000 people in a very small country, Brunei Darussalam, to more than 188 million people in one of the most populous countries in the world, Indonesia. The culture of ASEAN peoples is rich and varied— spanning many generations of traditions and practices enriched by influences of foreign culture. Demographic, social, and economic diversity has played an important factor in shaping development patterns that differ widely among Member Countries.

The ASEAN economies are in different stages of development. Singapore is fast approaching developed country status, while Indonesia and the Philippines are classified as developing economies. Brunei Darussalam and Vietnam are now pursuing industrial diversification while Malaysia and Thailand are widely recognized as newly industrializing economies. Per capita income levels in ASEAN countries also show wide disparities. GDP per capita in 1993 (adjusted for purchasing power parity or PPP) ranges from $1,010 in Vietnam to $5,344 and $5,361 in Singapore and Brunei, respectively (UNDP, 1995). Amidst these differences, ASEAN countries share a common vision to improve the quality of life of its people. They also find common cause in the protection and proper management of the environment.

A. Population

The environmental consequences of rapid population growth have become a major global concern in the last several decades. In less than half a century, the world's population increased by 130% from 2.52 billion in 1950 to 5.76 billion in 1995. Various projections indicate that world population would reach more than 8 billion in 2025, and expand further to 10 billion in 2050. Governments are becoming increasingly concerned about the interaction of population growth, economic progress and sustainable use of natural resources.

Population pressure on natural resources is more pronounced in ASEAN countries whose population and economies have been expanding very rapidly in recent years. The ASEAN population more than doubled in 32 years, from 195 million in 1960 to 401 million in 1992 (Table 4.1). ASEAN's share to total world population increased from 6.5% in 1960 to 7.4% in 1992. During the same period, the average annual population growth rate for ASEAN of about 2.3% was higher than that for industrial countries and all developing countries at 0.4% and 1.8% respectively, and the whole world at 1.5% (UNDP, 1995). The high population growth rate for ASEAN is however, projected to decrease to around 1.7% for the period 1992 to 2000.

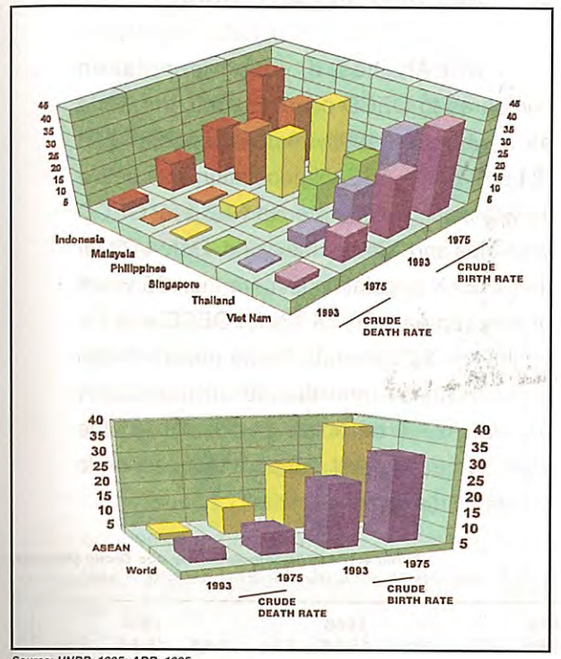
Improved health and sanitation practices, combined with better public health services, are the main factors contributing to rapid population growth in ASEAN. With higher incomes and better education, people have become more aware of the importance of good health and nutrition and are able to access medical facilities and services. As a result, the death rate in ASEAN has declined

Table 4.1: Population Trends (million)

Year	World	Industrial Countries	%	Total for developing countries	%	ASEAN	%
1960	3000	930	31.0	2070	69	193	6.5
1992	5420	1200	22.1	4220	77.9	401	7.4
2000	6120	1240	20.3	4880	79.7	457	7.5

Source: UNDP, 1995

Figure 4.1: Birth and Death Rate (Number per 1000 population)

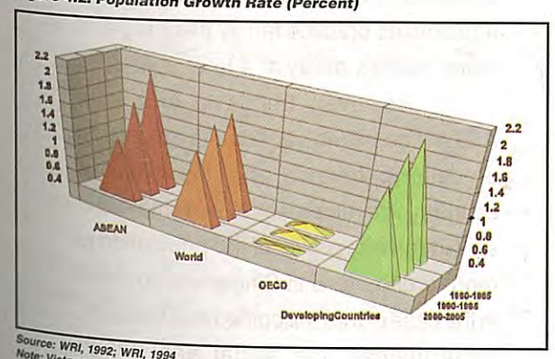


Source: UNDP, 1995; ADB, 1995
*Note: *1970 data; Brunei Darussalam not included.*

dramatically from 14 per thousand population in 1975 to only 7 per thousand in 1993 (Figure 4.1). This also led to a significant increase in life expectancy of the ASEAN population. ASEAN women can now expect an average life expectancy of 71 years compared to only 59 years in 1970 (ASEAN Secretariat,1997). Life expentancy for men improved from 56 years in 1970 to 67 years in 1993. In recent years, population growth in ASEAN has begun to slow down as a result of better education and increasing prosperity leading to a way of life that is slowly approximating those in industrial countries. From an average of 2.05% during the period 1980 to 1985, population growth dropped to an average of 1.7% during the period 1990 to 1995. It is expected to decrease further to an average of 1.26% by 2000 to 2005 (Figure 4.2). As a result, ASEAN population growth rates have become lower than the average for all developing countries (1990-1995) although they are still significantly higher than that of OECD countries. The birth rate in ASEAN has declined from 38 per thousand population in 1975 to 25 per thousand population in 1993.

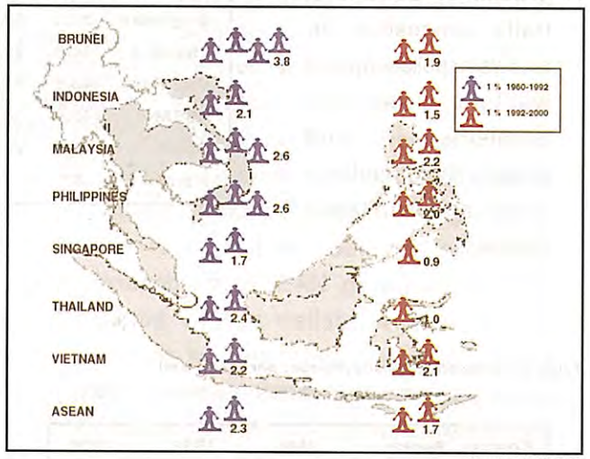
The experiences of industrialized countries have shown that population growth tends to slow down as the country improves its level of economic development. This trend is evident in ASEAN although at varying degrees

Figure 4.2: Population Growth Rate (Percent)



Source: WRI, 1992; WRI, 1994
Note: Vietnam not included

Figure 4.3: Annual Population Growth Rate in ASEAN Countries (Percent)



Source: UNDP, 1995

among individual Member Countries. As society modernizes, as in the case of Singapore, full employment is attained. With both spouses gainfully employed under conditions of high wages, the tendency has been to prefer smaller sized families. Singapore has the lowest population growth rate in ASEAN estimated at 0.9% for the period 1992 to 2000 (Figure 4.3).

B. Population Density

Population density in ASEAN is one of the highest in the world. In 1992, the aggregate population density of ASEAN countries was 122 persons per square km — three (3) times higher than the world average (Table 4.2). On an individual country basis, Singapore has the highest population density at 4,397 persons per sq km in 1992, followed by Vietnam and the Philippines with 214 and 212, respectively, for the same year. Population density in ASEAN has increased more than two-fold over the period 1960 to 1992, higher than the average increases for the industrialized countries (30%) and the world (82%). High population densities in ASEAN have brought about associated problems of urban congestion, growth of squatters, traffic congestion, air and water pollution, solid waste disposal problems, and availability of potable water and sanitation facilities.

Table 4.2: Population Density (Persons per square km)

Country / Region	1960	1992	2000
Brunei Darussalam	20	60	60
Indonesia	53	104	117
Malaysia	25	57	68
Philippines	92	212	249
Singapore	1600	4397	3000
Thailand	52	112	121
Viet Nam	107	214	254
ASEAN	59	122	139
Developing Countries	27	55	64
Industrial Countries	17	22	23
World	23	42	47

Source: UNDP, 1995

C. Age Distribution Profile

ASEAN has a young population compared to OECD countries and the world as a whole. In 1994, more than one-third (34.5%) of the ASEAN population was below 15 years of age compared to 19.2% for OECD countries and 32% for the world. Only 4.2% of the ASEAN population is more than 65 years of age, compared to 14.1% for OECD and 7% for the world (Table 4.3). These indicate that in the years ahead, more than 60% of the ASEAN population will be active participants in the work force and will support the economic growth in the region.

Table 4.3: ASEAN Population by Age Group (Percent)

Country	1975			1985			1994		
	0-14	15-64	65+	0-14	15-64	65+	0-14	15-64	65+
Indonesia	42.0	54.8	3.2	38.7	57.7	3.6	33.0	63.0	4.0
Malaysia	42.1	54.2	3.7	38.7	57.6	3.7	38.0	58.0	4.0
Philippines	43.6	53.7	2.7	41.0	56.0	2.9	39.0	58.0	3.0
Singapore	32.8	63.0	4.1	24.4	70.4	5.2	23.0	70.0	7.0
Thailand	44.9	52.1	3.0	36.0	60.3	3.7	29.0	66.0	5.0
Viet Nam	43.7	52.3	4.0	40.5	55.0	4.5	38.0	57.0	5.0
ASEAN^	42.9	53.8	3.3	38.9	57.5	3.7	34.5	61.4	4.2
OECD	25.1	63.4	11.5	na	na	na	19.2*	66.7*	14.1*
World	37	57	6	na	na	na	32*	62*	7*

Source: ADB, 1995; WRI, 1994
*Note: na — data not available; ^Brunei not included; *1995 projected data*

In the years to come, the size of ASEAN's aging population will increase. More people will live longer because of better health care. At the same time, slower rates of population growth are expected to continue in ASEAN as more households practice family planning and more couples marry at a later age.

However, trends in individual ASEAN countries vary due to influences of culture, religion and the pace of economic development. For example, the shift in the age profile of the population is more pronounced in Singapore and less in the case of the Philippines and Vietnam. Nevertheless, the social and health problems related to an ageing population is a challenge that all ASEAN countries will have to face eventually.

D. Economic Profile

Despite high population growth rates, ASEAN has enjoyed moderate to high GDP per capita increases over the years. ASEAN economies were able to expand fast enough to more than offset the effects of population increases. From 1982 to 1994, aggregate ASEAN GDP grew at 150% — much faster than the growth in population of 30% over the same period (Table 4.4). The rapid rate of economic expansion allowed the aggregate GDP per capita to double over the same period.

Table 4.4: ASEAN Economic Indicators

	1982	1984	1986	1988	1990	1992	1994
GDP (US$ billions)	211	220	223	257	337	425	521
GDP / capita (US$)	645	643	625	691	878	1063	1255

Source: ADB, 1995; UN, 1994 (data for Brunei)

E. Employment

Except for the Philippines, the rates of unemployment in ASEAN countries have been maintained at around two percent during the past decade (Table 4.5). Most ASEAN countries have traditionally been suppliers of excess labor to the more developed economies. In recent years, however, they have expanded domestic employment opportunities through the expansion of the industry and service sectors. Malaysia and Thailand, which used to be labor surplus economies, have now become net importers of labor. A number of ASEAN countries however, continue to provide workers to developed countries, as well as to other countries in the region, for employment mostly in the construction and domestic services sectors. In recent years, the trend for overseas employment among ASEAN countries has included professionals in key management positions. Many Filipino professionals, for example, are employed in the finance and manufacturing sectors in Indonesia and similar exchanges of professionals are also taking place between Malaysia, Thailand and Singapore.

Overseas workers have made significant contributions to the economy through foreign exchange remittances that have helped stabilize currency exchange rates. In recognition of their role in their country's economic development, ASEAN governments have initiated various welfare programmes for overseas workers. They have also entered into bilateral agreements to set the general terms and conditions to govern the employment of their nationals abroad.

Table 4.5: Unemployment Rate (Percent)

Country	1982	1984	1986	1988	1990	1992	1994
Brunei Darussalam	ng	ng	ng	3.6	ng	ng	ng
Indonesia	3.0	2.0	2.6	2.8	2.5	2.7	1.6
Malaysia	4.6	5.8	8.3	7.2	5.1	3.7	2.9
Philippines	6.0	6.2	6.7	8.3	8.1	8.6	8.4
Singapore	2.6	2.7	5.7	2.6	1.8	2.0	2.0
Thailand	3.5	2.3	3.5	3.1	2.2	1.4	na
ASEAN	3.7	3.1	3.8	4.0	3.5	3.5	2.9

Source: UN, 1994
Note: Viet Nam not included; ng — negligible; na — data not available

F. Literacy and Education

Asian culture highly values education as a means to a better life and as a fitting gift to children to help them build their future. The large student population and the substantial allocation of public funds to education essentially reflect this orientation. Government expenditures for

Table 4.6: Public Expenditure on Education in Selected ASEAN Countries (Percent)

Country	Education (% of GNP)		Education (% of Total Government Expenditure)
	1960	1990	
Malaysia	2.9	6.9	18.8
Philippines	2.3	2.9	10.1
Singapore	2.8	3.4	na
Thailand	2.3	3.8	20.0

Source: UNDP, 1995.
Note: na — data not available

education range from 2.9% of GNP for the Philippines to 6.9% for Malaysia (Table 4.6). As a percentage of the total government budget, expenditure allocation for education ranges from 10% to 20%. Given this level of resources, ASEAN countries are able to support education for the people despite rapid population increases.

Economic development in ASEAN countries has brought about corresponding improvements in educational levels. Literacy rates have increased significantly over the last 20 years. In 1992, adult literacy rates reached almost 90% — higher than the world average of 76%, and the average for all developing countries of 68%. (Table 4.7) Almost all the ASEAN populations between 6-11 years enter primary schools during the years reported (Table 4.8). The ratio of the population between 12-17 years that are in the secondary schools has increased from 45.2% in 1970 to 51% in 1992. Similarly, ASEAN populations between 20-24 years enrolled in tertiary schools increased from 9.8% in 1980 to 13.2 in 1992. The combined gross enrollment ratios in primary, secondary and tertiary schools in ASEAN countries are higher than most developing countries and that of the whole world (UNDP, 1995). However, the number of degree-holders in ASEAN is still far below that in the industrialized countries (Figure 4.4). Adult education programs to boost knowledge and technical skills are becoming popular in many ASEAN countries as a means to substitute for higher education.

Table 4.7: Adult Literacy Rate (Percent)

Country	1970	1992
Brunei Darussalam	na	86
Indonesia	54	82
Malaysia	60	82
Philippines	83	94
Singapore	na	90
Thailand	79	94
Vietnam	na	92
ASEAN	69	89

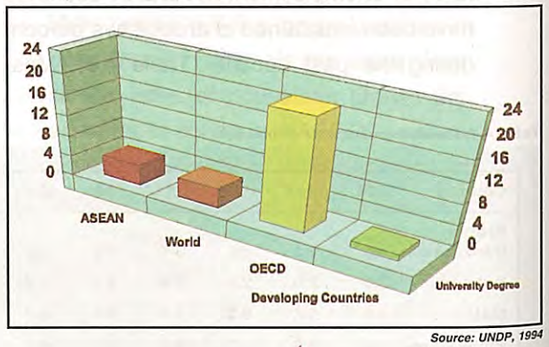
Source: UNDP, 1995.
Note: na — data not available

Table 4.8: School Enrollment in ASEAN Countries

Country	Persentage of Age Group Enrolled in School					
	Primary		Secondary		Tertiary	
	1970	1992	1970	1992	1970	1992
Brunei Darussalam	na	na	na	na	na	na
Indonesia	107	115	29	38	4	10
Malaysia	93	93	48	58	4	7
Philippines	113	109	65	74	28	28
Singapore	108	107	58	70	8	na
Thailand	99	97	29	33	13	19
Vietnam	109	108	42	33	2	2
ASEAN	104.8	104.8	45.2	51	9.8	13.2

Source: ASEAN Secretariat, 1997
Note: na — data not available
Primary school data exceeds 100 because of students outside school age bracket that enters the school system.
Tertiary level includes vocational, adult and distance education, community colleges, etc.

Figure 4.4: Percentage of the Population with a University Degree



Source: UNDP, 1994

G. The Human Development Index

The ultimate goal of development is to improve the quality of life of the people. Longevity, education and standard of living are the key elements of this goal. The Human Development Index (HDI) has recently been devised as an overall measure to gauge the net effects of development on people based on these parameters.

The HDI is a composite of 3 indicators of human development, namely: longevity, knowledge and standard of living. Longevity is measured by life expectancy. Knowledge is measured by a combination of adult literacy (two-thirds weight) and mean years of schooling (one-third weight). Standard of living is measured by purchasing power, based on real GDP per capita (adjusted for purchasing power parity or PPP) (UNDP, 1994).

The HDI offers an alternative to GNP for measuring the relative socio-economic progress of nations. It enables people and their governments to evaluate progress over time and to determine priorities for policy intervention.

However, HDI also has the same limitations as other aggregate measures of development. For one, it does not indicate how the population shares in the benefits development. National averages can conceal much and may lead to misplaced sense of complacency and inaction. An alternative is to further desegregate the index into separate HDIs for the most significant groups, for example, by gender, income group, geographical region, race, or ethnic group.

The 1992 HDR ranked Singapore and Brunei among the top 50 countries in terms of the HDI. Thailand and Malaysia ranked 58 and 59, respectively; and the Philippines, Indonesia and Vietnam ranked 100, 104 and 120, respectively (Table 4.9). The improving ranking of Singapore and Thailand indicates faster development compared to other listed countries. Changes in the rankings of the other ASEAN countries are largely the result of an increasing number of countries included in the listing.

Table 4.9: Human Development Index

Country	1990(1)		1991(2)		1992(3)	
	Rank	Index	Rank	Index	Rank	Index
Singapore	40	0.848	43	0.849	35	0.878
Brunei Darussalam	41	0.848	44	0.847	41	0.868
Malaysia	51	0.789	57	0.79	59	0.822
Thailand	69	0.685	74	0.715	58	0.827
Philippines	80	0.6	92	0.603	100	0.677
Indonesia	98	0.491	108	0.515	104	0.637
Vietnam	na	na	na	na	120	0.539

Source: UNDP, 1994; UNDP, 1995
Note: (1) 160 countries; (2) 173 countries; (3) 174 countries

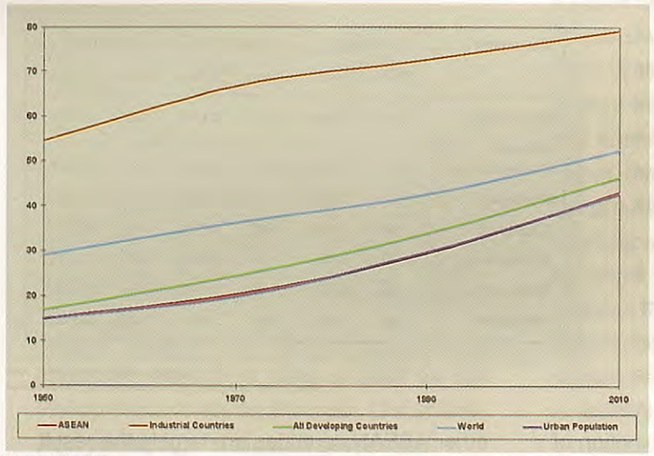
II. URBAN ENVIRONMENT

Urban areas are characterized by high concentration of the population, increased human activity, and a high level of consumption of goods and services. They are normally the centers of trade and commerce, political and administrative power, and industrial activities. High population density and the relative affluence of people living in urban areas exert pressure on the environment which in turn, affects the quality of life in the cities.

A. Urbanization Trends

The level of urbanization in ASEAN is modest compared to other countries. In 1990, 30% of the total population in ASEAN lived in urban areas — a level lower than that in industrialized countries, developing countries, and the world (Figure 4.5). Urbanization trends in ASEAN follow the normal population shift from rural to urban areas as countries develop. From about 15% in 1950, urban population is projected to increase to 43% by 2010. In-migration is a major factor contributing to the rapid growth of the urban population,

Figure 4.5: Level of Urbanization (Percent of Population)



Source: ADB, 1995
Note: Brunei Darussalam not included

particularly in Indonesia, Malaysia and the Philippines (UNDP, 1995). In-migration to the cities is expected to cause a decline in the rural population in the Philippines by 0.2 percent annually, while that of Indonesia will remain almost stagnant during the 1990s.

Urbanization in ASEAN reached its peak during the period 1970 to 1990 when population shifts to urban areas were increasing at an average rate of 4.2% per year. During the 1990s, the rate of urbanization in ASEAN is expected to taper off to around 3.5%. However, in-migration to urban centers will persist during the first half of the decade as urbanization continues to outpace the rate of population growth of 1.7% during the period 1990 to 1995. Although the rate of urbanization is increasing, wide differences in the level of urbanization prevail among ASEAN countries. For most ASEAN countries, rural population is still expected to dominate the demographic profile up to 2010, except for Singapore, Malaysia and the Philippines (ADB, 1993).

B. Rural-Urban Migration

Rural-urban migration accounts for almost half of the increase in urban population, and by the end of the next two decades, it is expected to account for almost 60%. In-migration compared to natural population increase, does not add much pressure on the urban economy because migrants are normally enterprising and generally engage in economically productive activities. This is especially true when the general economy is improving and income generating activities are available. Otherwise, they add to the burden on social services in the urban areas.

One of the factors driving rural-urban migration is the prospect of better employment and higher incomes in the cities. People from the rural areas move to urban centers in search for better jobs and other economic opportunities. The continuing transition of ASEAN countries from agricultural to industrial economies further reinforces this pattern as employment opportunities in the rural areas are reduced and shifted to urban growth centers.

Another factor contributing to urban in-migration is the availability of better services in the cities (Table 4.10). The disparity in urban-rural services is more pronounced in the area of sanitation which the relatively lower income rural communities are not able to afford

Table 4.10: Rural-Urban Disparity in Services (100 = rural-urban parity)

Country	Health (1985-1993)	Safe Water (1985-1993)	Sanitation (1985-1993)
Indonesia	na	63	56
Malaysia	na	69	na
Philippines	96	93	78
Thailand	100	83	90
Vietnam	80	54	38
All Developing Countries	na	68	26

Source: UNDP, 1995.
Note: Service in the rural areas is compared to the urban areas which is indexed at 100. Thus smaller figures indicate a bigger gap.

because of its huge investment requirements. As the economy improves however, the rural-urban disparity is minimized and better services become available and accessible even to the rural population.

C. The Growth of Cities and Urban Agglomerations

People choose to live in certain areas because of the attractions offered by favorable geographic, climatic, economic and other conditions. As the influx of people increases through time, such areas eventually acquire the characteristics of an urban area. The process of continuous agglomeration of several urban areas leads to their transformation into a mega-city. The United Nations defines a mega-city as an urban agglomeration of 8 million or more inhabitants. This pattern of growth can be observed in many cities throughout the world, including those in ASEAN.

As a city develops, infrastructure and services begin to expand to accommodate the demands of an increasing population. The quality of life in the city generally improves during this period. However, the perception of the good life induces more migrants to the city, thus accelerating population growth until the physical environment is unable to cope with population pressures. At this stage, the quality of life begins to taper off and may even decline. People may no longer want to live in the city as the urban environment begins to deteriorate.

In ASEAN countries, the agglomeration of the population and economic activities in one or a few large cities has resulted in the development of the primate city, which in most cases are the capital cities. The primacy pattern is normally measured by the degree of urban supremacy. This is expressed as an index of dominance of the biggest city in relation to the total urbanization of the country. Urban supremacy is also measured by the relative sizes of the first and second largest cities, as well as the share of the largest city's population to the total urban population of the country.

The growth of primate cities is brought about by the intensive concentration of economic activities and the attendant opportunities that attracts population to move to these areas. As economic expansion takes place, these cities begin to serve as international gateways for commerce and become the center for government agencies responsible for processing licenses and permits. The high level of centralization of services and the convergence of infrastructure development has contributed to the growth pattern of primate cities in ASEAN.

Urban primacy is evident in many ASEAN cities. The population of Bangkok accounted for 57% of the total urban population in 1990. Manila follows with 32%, Ho Chi Minh City with 22%, Kuala Lumpur also with 22%, and Jakarta with 16% (ADB, 1993). The high level of Bangkok's primacy is probably due to its geography and well-equipped harbors that are considered the best in the country. There is a deliberate policy however, to decongest Bangkok by bringing down its share to total urban population from 65.5% in 1970 to 55% by 2000. Other ASEAN cities have followed a similar trend except for Kuala Lumpur which is expected to gradually increase its share to total urban population up to 23% by the year 2000. Malaysia has effectively dispersed population and development throughout the country since the 1950's, resulting in a relatively low primacy of the capital city.

The long - term consequences of high urban primacy are not favorable to sustainable economic growth and could cause adverse impact on the environment. While higher levels of economic growth can be stimulated in the short run, there is a tendency for the occurrence of spatial polarization, social inequity and diseconomies of scale in the long term that could eventually slow down the pace of development in such urban centers.

D. Population Dispersal Initiatives

ASEAN countries have instituted specific policies and programmes to disperse population and reduce urban primacy. Indonesia is implementing a transmigration policy (Box 4.1), rural and urban development of the outer islands, disincentives to projects and programmes that will lead to further growth in Jakarta, and industry dispersal programmes. Malaysia aims to further equalize regional development and economic benefits especially to the island states, develop new townships, promote resettlement, urban development and renewal, and provide industry dispersal incentives. The Philippines is pursuing balanced regional development through integrated rural development, the agrarian reform programme, and the promotion of regional growth centers and medium-sized cities. Thailand continues to restrict the primacy of Bangkok through such efforts as land-use and zoning regulations, taxation, industry dispersal, and the promotion and development of regional growth centers especially in the eastern seaboard. In Vietnam, government plans to establish new economic zones and open up agricultural lands in the southern parts of the country are intended to slow down the further growth of big cities like Ho Chi Minh.

The implementation of dispersal policies and programmes have met with varying degrees of success. Even in cases where policies have been effective however, it would take some time for population dispersal measures to stop the growth inertia in the primate cities. Thus, it is expected that the population in ASEAN's primate cities will continue to grow. By 2010, the population in Jakarta, Manila and Bangkok will reach 13.7, 11.8 and 10.3 million, respectively (Figure 4.6) — thus qualifying them among the largest mega-cities in the world.

Box 4.1
TRANSMIGRATION PROGRAMME IN INDONESIA

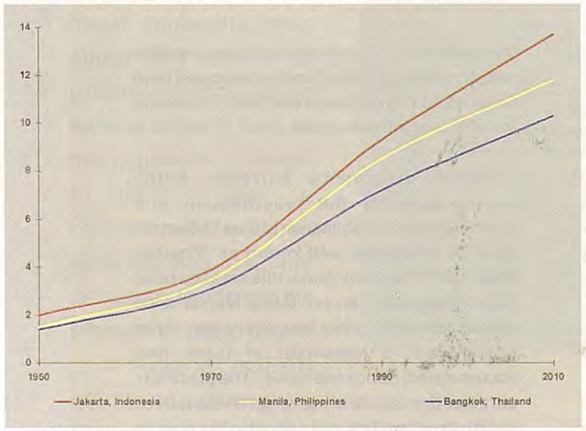
The transmigration programme in Indonesia is the largest voluntary resettlement programme in the world. Under the programme, households from the well-developed islands of Java, Bali and Lombok are moved to the less developed but bigger outer islands such as Sumatra, Irian Jaya and Kalimantan. The vast majority of these are rural households that resettle to form new rural communities. In their new locations, they are provided with basic infrastructure and services to be able to live in normal agricultural communities. Between 1969 and 1991, the programme has resettled more than 855,000 households. The government has tapped the assistance of the private sector in financing the programme.

The programme is moving rural residents from agricultural communities, where they could hardly find employment, to new agricultural areas where each family is provided with at least two hectares of land to cultivate. By providing rural residents who are potential migrants to the big cities, with the means to engage in economically productive activities, the programme hopes to reduce rural-to-urban migration. The programme is also assisting in the development and exploitation of natural resources in the outer islands. At the same time, the settlers are also able to provide security to border areas.

As a whole, the Transmigration Programme is thought to have both positive and negative impacts to the environment. The expected one million (1,000,000) families that will be relocated by the turn of the century will mean decongesting the highly populated islands of Java, Bali and Lombok thereby improving the ecological balance in these places. Remote areas will be cultivated and made productive. Living conditions of the migrant families will be enhanced. On the other hand, this will also mean massive conversion of land use to agriculture. Assuming half of the land is forested, the Programme would have destroyed two million hectares of forest by the year 2000.

Source: Government of Indonesia, 1995; ESCAP, 1995

Figure 4.6: Population Size of ASEAN Mega-cities (Millions)



Source: ADB, 1995

E. Urban Environmental Concerns

The degree of urbanization influences the pattern of economic development and the level of affluence of a country. When managed properly, urbanization could be beneficial to the economy and even to the environment. It allows excess labor in the rural areas to find productive work. However, when urbanization is not managed properly and is allowed to grow without restraint, it could threaten the sustainability of economic growth and could result in a host of environmental problems. These include problems of inadequate infrastructure and social services, urban poverty, unemployment and underemployment, pollution and environmental degradation in general.

1. Stress on Infrastructure and Basic Services

Rapid population growth, high population density, and greater per capita consumption has placed a great amount of stress on urban infrastructure and services. In most cases, the expansion of infrastructure and services is unable to cope up with the requirements of urbanization.

Housing

Housing has become a problem in most urban areas because of limited land and the prohibitive cost of construction. In contrast, people in the rural areas can satisfy their housing needs with minimum difficulty. Land on which to build shelter is readily available and housing materials are relatively affordable to almost everyone. Rural residents often provide the labor to build a house at no monetary cost.

The situation in urban areas is different. The price of land is prohibitive, ranging from US$20 to US$1,500 per square metre in most residential areas in ASEAN's capital cities. Considering the low salaries prevailing in the region, land prices as well as the cost of labor and housing materials, are not affordable to many urban dwellers. The cost of a typical house and lot in ASEAN capital cities is equivalent to several years of a professional's salary.

The construction industry and the financing institutions are unable to meet the demands for housing arising from rapid urbanization. In the meantime, the housing backlog pushes the price of housing even higher. In the Philippines, for example, the present housing backlog is estimated at more than one (1) million units. In the meantime, the construction industry, using current technology and resources, can only build a small fraction of this number every year. The housing problem worsens through the years and compounds the backlog.

The acute shortage in urban housing has led urban dwellers to resort to make-shift shelters built without permission on government land or on private property. This has led to the spread of squatter and marginal settlements where approximately 20% of the population in the capital cities of ASEAN live. Many of these squatter settlements are located

Box 4.2
NATIONAL SQUATTER PREVENTION AND RESETTLEMENT PROGRAMME IN THE PHILIPPINES

Under the 1973 Philippine Constitution, every citizen is entitled to enjoy adequate housing and a decent standard of living. Over the past decades, the shortage of adequate housing has been plaguing urban centers and major cities in the country, including Metro Manila. Some reports (1993) place the squatter population in Metro Manila at around 2.4 million.

Squatting, or the illegal settlement of families on government and private lands, is a social phenomenon commonly related to urban development. The problem can be traced to the influx of migrans, mostly from rural areas to urban centers, in search of better livelihood opportunities. Without definite places to go, the migrans settle on idle public or private lands that are close to their places of work or trade. The prohibitive cost of housing, which is beyond the means of the urban poor, compounds the problem of squatting, and inevitably, causes the expansion of squatter settlements in the metropolis.

To solve the squatter problem effectively, a long-term national squatter prevention and resettlement programme has evolved as part of the National Shelter Programme for the low and marginal income families. The programme identifies and prioritized squatter areas for clearing, determines and provides the required number of serviced homelots for the displaced indigent families, and identifies and allocates the needed resources from the various participating agencies.

Another programme is the slum improvement programme designed to upgrade existing squatter colonies on site. A related component, the sites and services development programme, is aimed at providing affordable serviced homelots to accomodate the increasing migrant population. It also provides settlement for squatter families relocated from unsafe and dangerous areas, and from lands intended for infrastructure.

A major programme currently being implemented is the resettlement and rehabilition and rehabilitation of the a 21-hectare garbage dump site, well known as "Smokey Mountain". For many years, this area has been the major dump site for Metro Manila solid wastes, receiving 1200 tons every day. After some time, a mountain of trash had accumulated, hence the name. The place has attracted thousands of scavengers who moved in with their families and settled in the area as squatters. Scavenging and waste recycling became the major source of livelihood for the residents. Civic and religious groups supported residents in small-scale activities such as the making of silk-screened shirts, greeting cards from recycled paper, etc. Eventually, a community of around 1600 families evolved at the site.

The government ordered the closure of the dump site in 1993 and developed a master plan to rehabilitate the area. These plans included permanent housing for all the 1,600 families, several port-related projects, and the reclamation of the coastal areas for conversion into a high-value residential/commercial estate. The entire project is being implemented using the build-operate and transfer scheme (BOT) with the reclaimed land providing most of the payment for the services rendered by the proponent.

The construction work is now in full swing and todate, around 71 has of off-shore land have been reclaimed. In another four years, the place will be a modern harbor center with industrial, commercial centers and residential communities.

Source: Government of the Philippines, 1993; 1995

near urban rivers that provide water for washing and serve as a site for the disposal of their sewage and solid wastes. The clogging of rivers makes them prone to natural disasters such as flooding. At the same time, pollution of urban waterways poses health hazards to residents who begin to bear the consequences of environmental degradation and its associated risks.

Most people in squatter colonies live under marginal conditions without proper housing and basic services. Meager living

conditions in these areas foster criminality, drug abuse, and other social problems that pose serious societal risks to the population at large. In most cases, a comprehensive urban renewal has become necessary to address the problem of urban blight.

Table 4.11: Access to Sanitation Services in Selected ASEAN Countries

Cities	% Urban Population with Piped Water			% Urban Population with Sewerage Facilities		
	1980	1990	Change in %	1980	1990	Change in %
Indonesia	35	35	0	29	79	50%
Malaysia	90	96	6%	100	94	(6%)
Philippines	65	93	28%	81	79	(2%)
Singapore	100	100	0	80	99	19%
Thailand	65	67	2%	64	84	20%

Source: WRI, 1994

Among ASEAN countries however, Singapore's experience is different. The relatively small size of the city and the affluence of its population has made urban development more manageable. Adequate housing and basic services are available to urban dwellers. Regulations to safeguard the environment are also well in place and are effectively enforced.

ASEAN countries have adopted various policies and programmes to address urban housing problems, including the regulation and prevention of the spread of squatter colonies. These measures include affirmative actions such as resettlement, urban slum renewal, and urban socialized housing, among others (Box 4.2). In the long-run, the solution to urban housing problems is the proper management of the growth of the urban population. A balanced development of all the regions in the country will regulate the size of cities and avoid the problems associated with rapid urbanization.

Water and Sanitation Services

Urban areas need adequate infrastructure for transport and communication systems, water supply, sanitation and solid waste collection. Infrastructure networks are vital to support areas with high population density and to sustain the economic development of the region as a whole. The quality of basic services affects both the environment and the functional efficiency of the urban areas. With a rapidly growing urban population, it has become increasingly difficult to meet the demands for such infrastructure and services.

The potential shortage of potable water supply is a problem faced by many ASEAN cities. Although water is abundant in the region, huge investments are required to collect, store, treat and distribute water to individual households. The problem of water supply is further exacerbated by the growth in urban population.

ASEAN cities have increased the water supply coverage of the urban population in a modest scale during the last decade (1980-1990). The increase was notable in the Philippines which was able to increase urban population coverage by up to 28% (Table 4.11). Malaysia and Thailand had modest increases of 6% and 2%, respectively. Indonesia reported no increase in coverage, while Singapore has already attained complete coverage. Despite these improvements, the provision of adequate water supply can hardly cope with continuing urban population growth. In some ASEAN cities, reliable and safe drinking water cannot be supplied to urban residents (Box 4.3). Indicators for sanitation coverage are much better although a decrease was reported for Malaysia and the Philippines at 6% and 2%, respectively (Table 4.11). Indonesia and Singapore achieved substantial improvements in sanitation coverage at 50%

Box 4.3
DOMESTIC WATER SUPPLY IN VIETNAM

Out of more than 430 urban centers in Vietnam, barely 100 have piped water systems. These systems serve a total of about 6.0 million people or only 47% of the total urban population of more than 15.0 million. The rest of the residents use unprotected and polluted water from shallow wells, rainwater collection tanks, streams and ponds.

The quality of urban water supply systems in Vietnam requires upgrading to acceptable standards. Many plants have been poorly designed and constructed and would need rehabilitation even if they are still relatively new. In some urban centers, untreated water is distributed directly to the different households in the absence of treatment facilities.

Only Ho Chi Minh City generally meets drinking water standards set by the World Health Organization (WHO). Still, the water supply system of Ho Chih Minh would need rehabilitation to be able to continue providing good quality water. Other urban water supply facilities are unable to supply acceptable quality of drinking water due to operation and maintenance problems. These include the lack of regular chemical supply, chemical dosing and process control equipment and spare parts, and qualified staff. In some cases, officials responsible for water supply systems are more concerned with meeting target quantities rather than meeting quality standards.

Source: World Bank, 1995

and 19% increase respectively during the period 1980-1990.

2. Urban Poverty

Although poverty may be a nation-wide occurrence, urban poverty is more visible and its effects on the environment more widely felt. These include pollution, urban blight and the accompanying social ills such as crime and drug abuse, among others. There is much apprehension that the absolute number of urban poor will continue to increase towards 2000. This will add more strain on national resources for the provision of adequate water supply, sanitation, other infrastructure systems, and social services.

The urban poor in ASEAN accounted for 7.8% of the total ASEAN population in 1992 (Table 4.12). The urban population living below poverty levels in ASEAN declined during the period 1990 to 1992 except for Thailand which recorded a slight increase. Brunei Darussalam and Singapore do not have population groups below poverty level.

Urban poverty brings into sharp focus the disparity in income distribution still prevalent in many ASEAN countries. The benefits of industrialization and economic growth have not filtered down to certain segments of the population. In Indonesia, the lowest 40% of the households accounted for only 21% of household incomes, and in Malaysia, only less than 13% (Table 4.13). Meanwhile, the ratio of the income share of the highest 20% to the lowest 20% of the population ranged from 4.9 for Indonesia to 11.7 for Malaysia. The disparity in income distribution in Indonesia is notable and to a certain degree comparable with many highly industrialized countries. Indicators for other ASEAN countries are

Table 4.12: Urban Poverty, 1992

	ASEAN*	Developing Countries	World
% Urban Poor	7.81	7.08	5.5
No in relation to total population	26.1 million out of 334.1 million	300 million out of 4,240 million	300 million out of 5,450 million

Source: UNDP, 1994.
*Note: *Vietnam not included*

Table 4.13: Income Share in Selected ASEAN Countries

Country	Lowest 40 % of Households (1981-1992)	Ratio of Highest 20% to Lowest 20% (1981-1992)
Indonesia	20.8	4.9
Malaysia	12.9	11.7
Philippines	16.6	7.4
Singapore	15.0	9.6
Thailand	15.5	8.3

Source: UNDP, 1995.

lower than the industrialized countries but higher than most other developing countries (UNDP,1995).

ASEAN countries have allocated significant amounts of resources for social services as a means to alleviate poverty. Expenditures for social services in ASEAN however, is much lower than those in more developed countries (UNDP, 1995). As ASEAN countries become more prosperous, it is expected that expenditures for social services will correspondingly increase. Singapore, which is the most affluent among the ASEAN economies, spends 7.1% (Table 4.14) of its total GDP for social security benefits, a level that is comparable with some of the developed countries.

Table 4.14: Social Investment in Selected ASEAN Countries

Country	Expenditures on Social Security Benefits (% of GDP) (1985-1990)	Public Expenditures on Education (% of GNP)	Public Expenditures on Health (% of GNP)
Indonesia	na	na	0.7
Malaysia	0.5	6.9	1.3
Philippines	0.7	2.9	1.0
Singapore	7.1	3.4	1.1
Thailand	na	3.8	1.1
Vietnam	na	na	1.1

Source: UNDP, 1995.
Note: na — data not available

3. Traffic Congestion

High population density and inadequate infrastructure have led to problems of traffic congestion in ASEAN cities. The long hours spent by commuters on the road to reach their destinations have become customary in Bangkok, Manila and Jakarta. Traffic has been a major obstacle to efficiency in business as well as in the public service.

The impact of traffic congestion to the economy and society is staggering. Work hours and resources for fuel, repair and maintenance of vehicles are wasted tremendously. Traffic is a major contributor to urban air pollution, releasing ambient air that is dangerous to health, especially during the daily peak traffic hours. In many cases, traffic has worn out the patience of drivers, triggering incidents of violent behavior that has resulted in injury and even death.

ASEAN governments have instituted various policies and programmmes to address traffic problems in urban areas. Singapore is one of the first to address the problem and probably the most successful so far. A direct approach has been the construction of more and wider roads to accommodate the increasing number of vehicles. Multi-tiered structures such as fly-overs, sky-ways, double-deck roadways, as well as pedestrian underpasses, crossways and bridges are now common in many ASEAN cities. Mass transport systems, such as the Mass Rapid Transit (MRT) in Singapore, and the Light Rail Transit (LRT) in Manila, are in operation and in many other cities, these are at various stages of planning and implementation in many other ASEAN capital cities. Rehabilitation and upgrading of rail way systems are also being undertaken to provide alternative transport systems for businesses and city dwellers.

Measures to restrict the number of vehicles in busy streets at designated peak hours are being enforced in a number of ASEAN capitals. Singapore took the lead in adopting such measures. In Manila, the use of major thoroughfares is restricted, four hours a

day, on alternating days of the week, to certain vehicles based on the last digit of their plate numbers (Odd-Even Scheme). In Jakarta, vehicles are prohibited from using major streets during peak hours unless at least three passengers are on board.

The problem of urban traffic has been recognized by ASEAN countries as a major environmental and social problem that would require innovation and political will to address. In the long run, the problem of urban traffic must be addressed in the larger context of urban congestion to achieve the ultimate objective of providing better living conditions for the population.

4. Industries in Urban Areas

ASEAN cities contribute around 35% to 40% of GDP to industrial output (Table 4.15). This reflects a high level of industrial activity in densely populated areas, exposing large portions of the population to industrial pollution and the hazards of industrial accidents. Many industries in ASEAN traditionally located themselves along the major rivers or near the coasts to have easy access to a water source and a place to discharge their residuals. Some industries were established near population centers that can provide the personnel needed for labor-intensive industries. Others that were established far from population centers consequently attracted people to settle nearby because of employment and other economic opportunities. People clustered around industrial sites until these areas eventually evolved into urban centers. Today, highly populated urban areas especially in the capital cities, are also centers of industrial activities.

To regulate industrial concentration in cities, ASEAN countries have adopted various forms of city zoning. Industrial zones are designated in certain areas in and around the urban areas, thereby still allowing the industries to tap into the available pool of human resources in the cities. In some cases, the industries allowed in these urban industrial zones are restricted to certain types. Later, as urban congestion worsened, ASEAN governments promoted the establishment of industrial estates and other development areas away from the cities. This strategy allowed better utilization of rural human and natural resources, dispersal of the city population, and the establishment of new growth centers. A number of ASEAN countries have implemented this strategy successfully.

Table 4.15: Urban Industrial Output of Selected ASEAN Countries, 1990

Countries	% of Total Industrial Output (GDP)
Indonesia	40
Philippines	35
Thailand	39

Source: UNDP, 1994.

Box 4.4
THE GREENING OF SINGAPORE

As far back as the 1980s, Singapore already had the basic infrastructure to meet its environmental needs, such as the collection, treatment and disposal of solid wastes, wastewater and storm water. However, increasing population pressures on resources and expectations of a higher standard of living required a fresh approach to environmental management in the early 1990s. The Government initiated a major policy review with the participation of all sectors that resulted in the formulation of the Green Plan of Singapore. The Green Plan was presented at the Earth Summit in Rio de Janeiro, Brazil in 1992, to demonstrate Singapore's commitment to sustainable development in support of Agenda 21. The Plan contained action programmes for improving and promoting environmental education, environmental technology, resource conservation, clean technologies, nature conservation and the reduction of environmental noise.

Environmental education. Environmental education is a lifelong process intended to encourage all sectors of society to be environmentally proactive. Some of the approaches being promoted are as follows:

- Consciously integrating environmental education into the formal education system;
- Educating students about the environment through participation and fun rather than compulsion and fines;
- Involvement of and leadership by environmentally committed organizations and business rather than just by the government; and
- Concentrating on broad-based campaign themes coherently developed over the years rather than ad-hoc themes to meet the needs of the day.

The Green Label was introduced to increase the environmental consciousness of consumers and to convince manufacturers on the value of making products that are environmentally friendly.

Environmental technology

Over the past 20 years, Singapore has accumulated considerable experience and know-how in identifying and applying appropriate environmental management and control technologies. Under the Green Plan, the government will actively promote the environmental technology industry and act as a "market maker" by spotting and taking advantage of market and technological opportunities. The Plan also aims to promote Singapore as a regional centre for environmental events and activities. Research and development in environmental technology will focus on improving established or emerging technologies and adapting these technologies to suit local conditions.

Resource Conservation.

The increasing demand for goods has caused a corresponding increase in the consumption of energy and the generation of pollutants. A number of programmes have been developed to help conserve resources. Some of these programmes are:

- In Singapore, as in many ASEAN cities, collectors go from house to house collecting old newspapers, glass bottles, old car batteries and other used items that still have an economic value. To replace this practice, Singapore has introduced a modern recycling system that would sort out wastes through bins positioned in specific locations in housing estates, schools, offices, factories and petrol stations.
- To conserve energy, Singapore has provided tax incentives to encourage the installation of energy-efficient equipment. Energy audits identify companies with poor energy management and the incentive system is used to persuade companies to remedy the situation.
- The Singapore Green Plan calls for measures to keep carbon dioxide emission levels as low as possible. It also encourages the use of cleaner and better resource utilization efficiency.
- Programmes have been introduced to reduce waste at source and introduce recycling for domestic, commercial and industrial wastes. In addition, industries are encouraged to form "waste exchange" networks.
- Industries are encouraged to adopt clean technologies and processes to improve the quality of the environment. Tax incentives are given to industries in the form of accelerated depreciation within one year. The largest polluters — the power generation plants — are encouraged to switch over to natural gas while the public is encouraged to use public transport.

Nature conservation

The Green Plan stipulates that 5% of the land should be set aside for conservation areas dedicated to the preservation of nature. The Park Connectors Network is one of the programmes that have been formulated to promote nature conservation in Singapore. The network will link major parks through an integrated series of green connectors, including jogging and bicycle tracks, to connect most of the nature areas and to provide corridors for the movement of birds.

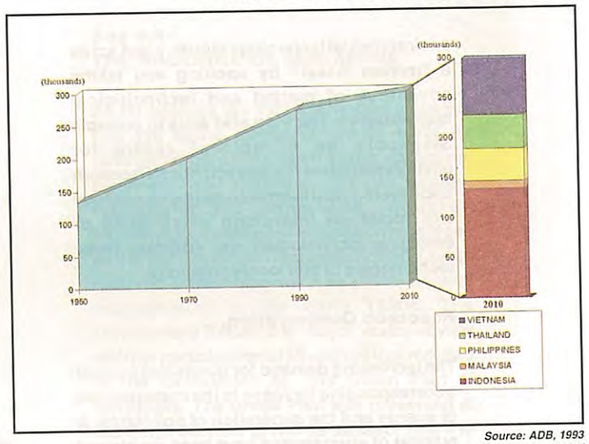
Environmental Noise

Although the noise levels in Singapore are within acceptable limits, the government has decided to develop an integrated noise management system to manage environmental noise. It will also promote "quieter" technologies and the minimization of residual noise through better building design and land-use management.

Source: Singapore Ministry of the Environment, 1993

ASEAN countries continue to pursue different strategies for coping with the inevitable increase in urban population and the need to improve the quality of urban living. One of the most comprehensive programmes now in place in ASEAN is the Green Plan of Singapore (Box 4.4). This programme has produced tangible results and can serve as a useful model for other ASEAN cities to follow.

Figure 4.7: Rural Population of ASEAN (millions)



Source: ADB, 1993
Note: Brunei not included

III. Rural Living Environment

Despite the rapid growth in urban population, majority of the ASEAN people still live in rural areas and will continue to do so beyond 2000. Conditions of depravity in the rural areas have made ASEAN countries realize that sustainable development is only possible if living conditions in the rural areas are substantially improved.

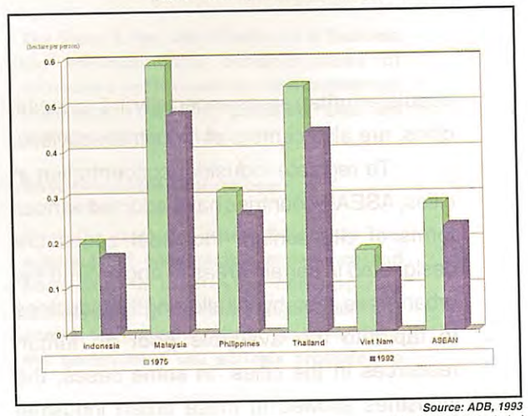
A. Population Pressure

In ASEAN countries, rural families are normally larger than urban families. Higher fertility rates of rural women have brought about higher rates of increase in the rural population. In the meantime, agricultural production has not increased fast enough to absorb new entrants into the labor force. In fact most of the expansion in agricultural production, especially in Malaysia, was due to modernization and increases in farm inputs rather than in labor inputs. Excess labor supply in the rural areas has consequently pushed migration into the cities. Despite the out-migration trends, however, the rural population in ASEAN is expected to increase, reaching almost 300 million by 2010 or an average annual rate of increase of 1.3% from 1950 levels (Figure 4.7).

The persistent increase in the rural population continues to exert pressure on land use. Because the available land in ASEAN is fixed, and croplands can only be expanded up to a certain extent, increases in the rural population may eventually compromise the ecological balance. For the period 1975 to 1992, agricultural land in ASEAN has expanded from 55 million to more than 63 million hectares (see chapter on Agriculture). This is equivalent to an average annual expansion of about 0.9% — lower than the 1.3% annual increase in the rural population. This implies a net reduction in the amount of land available for every farmer.

In 1975, the amount of agricultural land available per person in the rural areas was only 0.28 ha and this was further reduced to 0.23 ha in 1992 (Figure 4.8). The apparent

Figure 4.8: Agricultural Land per Rural Population



Source: ADB, 1993
Note: Brunei not included

shortage of available agricultural land is more acute for farmers in Indonesia and Vietnam. However, there is wide latitude in expanding agricultural land use in these two countries without disturbing the ecological balance inasmuch as the proportion of land devoted to agriculture is still small.

Apart from migration to the urban areas, the shortage of agricultural land has other serious consequences to the rural environment. Farmers without land to till often illegally encroach on forest land for slash and burn agriculture or other means of livelihood that indiscriminately exploit forest resources (see chapter on Land). The lack of available land ultimately results in the spread of poverty and the deterioration of living conditions.

B. Rural Poverty

Poverty in ASEAN and other developing countries is more widespread in the rural areas. In 1992, the aggregate poverty level in urban areas was less than 8% compared to a range of 12.2% to 35.9% in the rural areas of Indonesia, Malaysia, Philippines and Thailand (Table 4.16). Relative poverty in the rural areas is one of the factors propelling migration into the cities.

Table 4.16: Rural Poverty in Selected ASEAN Countries (Percent to total population)

Country	1990	1992
Indonesia	30.6	18.8
Malaysia	16.8	12.2
Philippines	36.7	35.9
Thailand	25.9	26.2

Source: UNDP, 1992; UNDP, 1994

Poverty eradication ranks high among the priority goals of concerned ASEAN countries. Comprehensive programmes to address the poverty problem have resulted in the reduction of poverty levels in recent years. These include land reform, industry dispersion, resettlement, rural infrastructure development especially irrigation and post harvest facilities, price support for basic agricultural products, credit extension facilities and several others. Some ASEAN countries have placed empowerment of the rural population a major developmental objective. Despite these efforts, however, wide disparities in living conditions still exist between rural and urban areas in most ASEAN countries.

C. Public Health and Environmental Sanitation

1. Health Indicators

The rural population is most vulnerable to the effects of inadequate public health services and environmental sanitation facilities. In 1981, the World Health Assembly agreed to monitor the progress of the people's health throughout the world using a health indicator system. The Assembly agreed on an initial set of 12 indicators that were subsequently revised, reformulated and finally adopted in 1990. These include infant mortality, life expectancy, incidence of diseases, access to health services and immunization status.

Infant Mortality and Life Expectancy

ASEAN countries have made significant progress in improving the health of their peoples. Through improvements in health care services, infant mortality has been significantly reduced from 124 per thousand live births in 1960 to 47 per thousand live births in 1992 (Table 4.17). Among the ASEAN countries, Singapore, Brunei Darussalam and Malaysia recorded significant reductions in their infant mortality rates. Average life expectancy in ASEAN also improved, from an average of 45.6 years in 1960, to 65.1 years in 1992.

Table 4.17: Health Indicators: Life Expectancy and Infant Mortality

Country	Life Expectancy at Birth (Years)		Infant Mortality Rate (per 1000 live birth)	
	1960	1992	1960	1992
Brunei Darussalam	62.3	74.2	63	8
Indonesia	41.2	62.7	139	58
Malaysia	53.9	70.8	73	13
Philippines	52.8	66.3	80	44
Singapore	64.5	74.8	36	6
Thailand	52.3	69.0	103	37
Vietnam	44.2	65.2	147	42
ASEAN	45.6	65.1	124	47
High Human Development Countries	56.5	69.5	83	38
All Developing Countries	46.3	63.2	149	70

Source: UNDP, 1995

Incidence of Diseases

Malaria remains to be a prevalent disease in many ASEAN countries primarily on account of large bodies of standing water used for irrigation that serve are fertile breeding grounds for vector-borne diseases (Table 4.18). The proximity of human dwellings to these bodies of water increases the likelihood of infection. The World Health Organization reported that there were 290 malaria cases per 100,000 population exposed in ASEAN compared with 240 per 100,000 exposed in other developing countries (UNDP,1994). To combat the threat of malaria, large-scale and more effective spraying actions are needed. These have to be complemented by selective indoor spraying of insecticides and insect-repelling products, personal protective measures, and better management of water resources. The malaria problem in ASEAN is aggravated by the developing resistance of parasites to drugs, resistance of vectors to insecticides, climate changes, and the inadequate basic and rudimentary health services in certain areas.

Table 4.18: Malaria Cases in Selected ASEAN Countries (Number of Cases)

	1987	1988	1989	1990
Indonesia	19,309	32,471	22,8-2	26,018
Malaysia	36,657	50,743	65,363	50,500
Philippines	154,091	154,943	115,542	86,172
Thailand	321,510	349,291	299,137	272,634

Source: UNDP, 1994

Water-borne diseases arise from the presence in water of human or animal feces, or urine carrying infectious pathogenic viruses and bacteria. These are transmitted when the contaminated water is used for drinking or food preparation. Examples of water-borne diseases common in the region are cholera and typhoid. The lack of access to safe and sufficient water supply as well as inadequate sanitation affects the number of people at risk to such diseases. Water-borne diseases still remain the largest single category of communicable diseases that have resulted in infant mortality in the developing countries.

Besides water-borne diseases, air-borne diseases are another group of prevalent diseases in ASEAN. Air-borne diseases include pneumonia, bronchitis and other respiratory diseases aggravated by air pollution. Indoor air pollution arising from the use of bio-fuels also poses health risks for rural houses. Indoor air pollution from bio-fuel combustion can be 60 times higher than fossil fuels. The risk of intensive exposure to indoor pollution can be aggravated by poor ventilation, proximity to sources of combustion such as cooking stoves, and increased exposure to suspended particulate and benzopyrene.

Health Services

As ASEAN continues to progress into the twenty first century, conscious and vigorous efforts will be made to improve health care services to enhance the people's quality of life. In 1991, at least 70% of the ASEAN population had access to health services (UNDP, 1994). Further improvements in the delivery and quality of health care services are envisaged with the rapid growth of the ASEAN economies. Comprehensive immunization programs for infants and children have been undertaken by ASEAN countries to safeguard against infectious diseases and reduce infant mortality. In recent years, the immunization rate for infants has approached levels that approximate those in the more developed economies (Table 4.19). The prevention and treatment of diseases are also part of ongoing efforts to provide health for all by the turn of the century.

Table 4.19: Immunization Among One-Year-Olds

Country/Region	Tuberculosis 1990-1993 (Percent)	Measles 1990-1993 (Percent)
Brunei Darussalam	97	92
Indonesia	94	90
Malaysia	99	80
Philippines	90	87
Singapore	99	89
Thailand	98	86
Vietnam	94	93
High Human Development Countries	96	87
All Developing Countries	85	77

Source: UNDP, 1995

The ASEAN people, as a whole, have now better access to the services of medical professionals. The number of practicing doctors in the region has increased. In 1980, there are 5,139 persons for every doctor; in 1993, this number has been reduced to only 3, 767 (Table 4.20). Similar improvements have been observed in the case of nurses and other medical workers.

Increased allocation of public funds can bring about improvements in public health services. During the period 1960 to 1990, public expenditures for health services in ASEAN have increased significantly. As a percentage of GDP however, the change was not substantial, accounting for only one percent in 1990 (Table 4.21). Public expenditures for health in ASEAN are still below those of the more developed economies.

Table 4.20: Health Professionals in ASEAN

Country	Population per Doctor		Population per Nurse	
	1980	1993	1980	1993
Brunei Darussalam	2,205	1,396	410	225
Indonesia	11,408	7,030	7,302	na
Malaysia	3,563	2,410	570	470
Philippines	6,656	8,120*	5,030	na
Singapore	1,220	693	320	258
Thailand	6,755	4,420	1,326	910
Vietnam	4,164	2,300	706	400
ASEAN	5,139	3,767	2238	453

Source: ASEAN Secretariat, 1997
Note: *refers to 1990; na — data not available

Table 4.21: Public Health Expenditures in ASEAN

Country/Region	Percent of GNP 1960	Percent of GDP 1990
Indonesia	0.3	0.7
Malaysia	1.1	1.3
Philippines	0.4	1.0
Singapore	1.0	1.1
Thailand	0.4	1.1
Vietnam	na	1.1

Source: UNDP, 1995

2. Water Supply and Sanitation

Safe water supply and good sanitation are important prerequisites in maintaining the health of the population. Unfortunately, the provision of these facilities would require substantial public investment and their availability would imply a certain level of affordability by consumers. Both factors are functions of the relative affluence of the country and the individual households concerned. Hence, the relatively affluent ASEAN countries like Brunei Darussalam and Singapore are able to provide safe water supply and good

sanitation to 100% of their population.

During the period 1988 to 1993, majority of the rural population in ASEAN, except for Vietnam and possibly Indonesia, have access to safe water supply (Table 4.22). Data on access to sanitation is more difficult to obtain because of differences in interpretation. In general, more than the majority of the rural population in Brunei Darussalam, Malaysia, Philippines, and Thailand have some form of safe sanitation facilities. In all of these countries, sanitation coverage is better compared to many developing countries although significantly lower than countries with a high development index (UNDP, 1995). As ASEAN countries continue to improve their economies, better sanitation facilities could be made available to the rural areas.

Table 4.22: Rural Drinking Water Supply and Sanitation in Selected ASEAN Countries

Country	Water Coverage (%)	Sanitation Coverage (%)
Indonesia	43	36
Malaysia	66	na
Philippines	79	62

Source: UNDP, 1995

D. Domestic Energy Supply

The rural population continues to rely heavily on the use of traditional biomass fuels (mainly, wood and crop waste, and animal dung to a lesser extent) because commercial fuel and services are not readily accessible in rural communities. Even if commercial fuels were available, people would still prefer biomass fuels because it is either free or low-priced.

As a result of increases in the rural population, fuelwood usage in ASEAN has increased from 197 million cubic meters in 1980, to more than 250 million cubic meters in 1992 (Table 4.23). Indonesia accounted for more than half of the total extraction in ASEAN, using more than 146 million cu m of fuelwood in 1992. However, because the gathering of firewood is not an organized effort, it has been difficult to control and manage. Roundwood deforestation and removal is caused mainly by the widespread use of fulewood in the rural areas. The destruction it causes may even be more than what the aggregate extraction figures indicate.

Table 4.23: Production of Fuelwood and Charcoal in ASEAN (1000 cubic meters per year)

Country	1979-1981	1992
Brunei Darussalam	80	80
Indonesia	115,530	146,278
Malaysia	6,710	9,157
Philippines	26,320	35,040
Singapore	-	-
Thailand	29,000	34,860
Vietnam	19,450	25,160
ASEAN Total	197,090	250,570

Source: UNDP, 1995

Wood extraction for fuelwood and charcoal could pose a serious threat to the forests and woodlands of ASEAN in the coming decades. This trend could taper off and eventually reverse as the rural population growth declines and other commercial energy sources become available to rural households. Through government programmes on rural electrification, rural households are given the opportunity to move away from the use of biomass fuels that has been causing severe damage to forests and contributing to indoor air pollution.

IV. NATURAL DISASTERS

The types and degree of occurrence of natural disasters vary widely among ASEAN countries. Drought, typhoons, floods and landslides are the types of natural disasters commonly experienced in the region. Two

ASEAN Member Countries namely, Indonesia and the Philippines, are particularly vulnerable to various types of natural disasters.

Earthquakes and floods are frequent occurrences in Indonesia. Between 1964 and 1986, these natural calamities occurred 66 times in the country, resulting in the loss of human lives, and damage to crops, public infrastructure, and private property. Indonesia has also been affected by landslides, storm surges, and occasional volcanic eruptions. Table 4.24 provides the most recent natural disasters that had occurred in Indonesia and the Philippines.

The Philippines is perhaps among the worst hit countries in the world in terms of the severity and frequency of natural disasters. The country's geographical location and physical environment make it vulnerable to typhoons, storm surges, floods, drought, earthquakes, tsunamis, volcanic eruptions and landslides.

In addition, there are also several major and minor earthquake generators in the Philippines that can cause an average of five earthquakes per day. Between 1589 and 1983, a total of 63 major earthquakes visited the country, causing massive destruction and irreparable loss. Measuring 7.7 on the Richter Scale, the earthquake of July 1990 that occurred in northern Philippines caused 1,666 lives, injury to 3,561 people, and property damage amounting to PHP 11.0 billion or US$ 423 million.

The eruption of Mt. Pinatubo in June 1991 was perhaps one of the worst disasters to come to the Philippines. The whole ASEAN region and to a certain degree, the entire world, experienced the effects of this eruption. During the last four years, the eruption has released billions of tons of volcanic debris that buried completely 91 barangays along eight major river basins surrounding the volcano. Today, the eruption of the volcano still poses a major threat to the hundreds of thousands of people living within a 40 km radius of Mt. Pinatubo. The Government has spent billions of pesos for continuing rehabilitation and resettlement efforts in the affected areas (Box 4.5).

Fortunately, other ASEAN countries have not experienced natural disasters of such magnitude as those occurring in Indonesia and the Philippines. The human dimension of natural disasters has become a more prominent concern and has expanded because of increasing population pressure on settlements in disaster-prone areas; increasing environmental degradation that increases disaster risks, and increasing vulnerability of poverty-stricken population.

Table 4.24: Recently Reported Natural Disasters in Indonesia and the Philippines

Country	Year	Month	Type of Disaster	No. of Persons		
				Dead	Injured	Affected
Indonesia	1992	October	Landslide	75	-	-
	1992	December	Earthquake/ Tsunami	2,500	-	-
Philippines	1990	June	Typhoon	156	14	160,000
		Juli	Earthquake	1,660	3,513	1,594,040
		August	Typhoon	285	-	-
		November	Storm	100	-	-
		November	Typhoon	1,212	1,594	8,184,612
	1991	May	Storm	3,956	3,050	-
		June	Volcano	639	-	-
		August	Floods	50	-	-
		October	Typhoon	39	38	360,000
		November	Typhoon/ Floods	8,840	6,149	996,908
	1992	September	Typhoon	50	13	942,764

Source: UNEP, 1993

ASEAN needs to formulate strategies that would direct population settlements away from disaster-prone

Box 4.5
THE MT. PINATUBO DISASTER

The Philippines experiences a number of natural disasters such as typhoons every year and ocasionally, earthquakes and volcanoes because it is situated in the so called Pacific "rim of fire". The worst incident in recent years was the eruption of Mt. Pinatubo in 1991, barely a year after a major earthquake had hit the country. Mt. Pinatubo is an active volcano located 70 km north of Metro Manila that last erupted more than 600 years ago..

When the first rumbles of the eruption began, some of the people in the area began to move out. However, most of the rural inhabitants living on the slopes and foothills of the mountain did not evacuate until the occurrence of the big explosion which spewed lava and destroyed homes and crops. It was estimated by experts that around eight-billion cubic meters of volcanic debris was released during the eruption. Much of the surrounding areas — including the neighboring towns and Metro Manila — were covered with a thick layer of volcanic dust. In some areas, it took months before the air cleared. Weeks later, fine volcanic dust was detected in the atmosphere of the neighboring countries and the effects on the atmosphere and climate were felt worldwide.

Thousands of families had lost their homes as a result of the Mt. Pinatubo eruption. The Government formed a Mt. Pinatubo Commission to provide immediate relief in terms of temporary shelter to some 200,000 victims that needed immediate relocation and other assistance such as cash, food and medicine. Most of the more than three (3) million population of the provinces around the volcano were directly affected by the eruption. The Commission initiated the construction of homes and infrastructures in suitable neighboring areas to normalize the lives of the victims. The government helped to resettle more than 30,000 families, one third of whom are from the upland areas while the remaining are from the lowland sites. Social, medical, and educational support were extended to the victims. They were also given skills training and employment opportunities to help them adjust to a different livelihood.

The surrounding environment affected by the eruption has to be rehabilitated as well. The worst affected communities and farmlands were those located along the river systems surrounding the mountain. Nine river systems were affected by the sediments — causing changes to the water flow and drainage in the river basins. Most rehabilitation activities like the construction of resettlement homes, provision of relief as well as social and medical services to the affected families, were almost completed. However, the country eventually realized that the tragic effects of Mt. Pinatubo's eruption will continue for several more years.

During strong rains, billions of tons of pyroclastic materials deposited in the slopes of Mt. Pinatubo were released at high speed by hot water in the form of lahar. This molten volcanic debris buried whole communities while destroying infrastructure and properties along its path. After several years, around 1.2 billion cubic meters of lahar still remain in the mountain slopes and are expected to be released by strong rains within the next 5 years, or more. The areas threatened by lahar flow covers a radius of 40 km. from the mountain.

According to some reports, as of 1995, government has already spent around PHP 23 billion (US$ 0.88 billion) in relief and rehabilitation efforts mostly for the construction and repair of roads and bridges, containment dikes, continuous dredging and clearing of river basins, and other infrastructure. Amidst all these efforts, the final solution to the lahar problem continues to be debated. Views have been expressed that complete rehabilitation will need a few more billion dollars before the perennial damage to life and property can be contained. Todate, a new major effort is being undertaken to save from lahar the capital city of Pampanga province and surrounding towns — construction of a "mega dyke" to contain the flow of lahar. For this purpose, another allocation of PHP1.2 billions (around US$45 millions) was released by the governmet and hopefully this will be finished before the onset of the raining season of 1996.

There are several lessons to be learned from the Mt. Pinatubo disaster. First is the need to have an effective information drive to appraise the residents of the extent and degree of the risks faced during disasters. This requires detailed hazard mapping and risk assessment. Once this has been undertaken, police power should be used to force evacuation of disaster-prone areas in order to avoid human tragedy and mitigate unnecessary loss of life and property.

Second, the consequences of major natural disasters may require a complex set of solutions that are beyond the capability of any single country to handle. Expertise from other countries should be accessed in order to determine the optimal approach to problems brought about by the disaster.

Finally, disasters must be treated with urgency, forcefully ensuring that the measures adopted are adequate to meet requirements. Measures that are inadequate or unresponsive could only exacerbate the situation.

Source: Government of the Philippines, 1993 and 1995.

areas, strive for the improvement of infrastructure to withstand natural disasters, and prepare for the handling of emergency situations. Hazard mapping and risk assessment should also be conducted in disaster-prone areas.

V. ENVIRONMENTAL EDUCATION AND PUBLIC AWARENESS

Understanding the complexities of the environment requires knowledge, values and skills. Both formal and informal education and training programmes, together with the development of effective communication pathways, need to be formulated to promote environmental awareness among all sectors of society (Box 4.6 and Box 4.7).

Television has been increasingly used by governments for the promotion of environmental awareness. Special sections on the environment in newspapers have been effective in making the general public aware of environmental issues. Interesting features on the environment are also contained in

Box 4.6
ASEAN ENVIRONMENT YEAR 1995: GREEN AND CLEAN

The Sixth ASEAN Ministerial Meeting on the Environment (AMME) held in Bandar Seri Begawan in April 1994 declared 1995 as ASEAN Environment Year (AEY) with the theme "Green and Clean". The objectives of the collaborative campaign are as follows:

- highlight ASEAN environmental issues and cooperative programmes in order to stimulate awareness of these issues among the ASEAN populace and the world at large;
- broaden the participatory process in the area of environment in ASEAN with emphasis on the private sector; and
- stimulate regional activities in the environmental area.

Apart from promoting awareness of and broadening the participatory process for environmental programmes, AEY was also a celebration of ASEAN's achievements in environmental co-operation as well as achievements of individual ASEAN Member Countries in the field of environmental protection and management.

- Each ASEAN Member Country carried out its own national activities under the AEY theme. Among the activities were:
- Organization of exhibitions on environmental-friendly products, technologies and equipment;
- Competitions in art, photography, and essays on the environment;
- Production of promotional/souvenir items e.g. stamps, coins, telephone cards, etc.
- Organization of campaigns e.g. clean water campaign, battery collection, clean up activities, tree planting, waste minimization and recycling etc. that involves the participation of both the public and private sectors; and
- Leadership training of environmental volunteers.

Source: ASEAN Secretariat

Box 4.7
ENVIRONMENTAL EDUCATION AND AWARENESS ACTIVITIES IN MALAYSIA

In the early 1990s, the Malaysian primary school curriculum introduced environmental principles through a special subject called "Alam dan Manusia" (Man and the Environment). This was phased out in 1995 with the introduction of a science-based subject called "Kajian Tempatan" (Local Studies) which integrated environmental science as well as natural environment elements into the sciences. The Malaysian secondary school curriculum will presently include environmental components. As regards the tertiary education syllabi, formal degree courses in Environmental Science, Environmental Engineering, Environmental Management, and Environmental Technology are currently offered at local universities and institutions in Malaysia.

Over the last five years, government, the private sector and the "green" NGOs have conducted training, workshops, seminars and conferences on the environment with increasing frequency. Media has also played an important role in assisting government in promoting environmental consciousness. Two English dailies in Malaysia have regular weekly columns featuring environmental articles and news. Another English daily features investigative environmental reporting.

Environmental campaigns are also popular, but they tend to be short-lived. The most popular types of campaigns are tree-planting and recycling of newspapers, aluminum cans and glass bottles. NGOs, local governments, some newspaper companies, industry groups, department stores and supermarkets are normally involved in these activities. World Environment Day, World Water Day, and National Environment Week are some occasions that provide the opportunity for special fora or features on the environment.

Among the communicator groups that have developed are the "green" and "brown" NGOs with interests in the "natural" and "industry-associated" environments, respectively. Malaysia's environmental NGOs include Sahabat Alam Malaysia (SAM), the Environmental Protection Society of Malaysia (EPSM), the Environmental Management and Research Association of Malaysia (ENSEARCH), Malaysian Nature Society (MNS), Centre for Environmental Technologies (CETEC), Centre for Environment, Technology and Development (CETDEM), and the consumer associations. In addition, there is the Environmental Committee of the Malaysia International Chamber of Commerce and Industry (MICCI) and the Business Council for Sustainable Development Malaysia (BCSDM), among others.

Source: Government of Malaysia, 1995

newsletters and magazines, mostly published by NGOs. Other communication strategies that are used for promoting environmental awareness include the use of folk media, e.g., theatre, music and dance, which appeal to the masses.

Essentially, better networking and communication, together with basic education and training are the progressive ways to promote awareness and skills needed for improving the environment and the quality of life. Recognizing this, ASEAN Member Countries formed a Working Group on Environmental Information, Public Awareness and Education in May 1991 to provide timely information about environmental conditions and trends for informed decision-making. An informed, environmentally conscious community is important for sustained economic development in the region.

References

ASEAN Secretariat. 1997. *ASEAN Statistical Indicators.* ISEAS.

ADB. 1995. *Key Indicators of Developing Asia and Pacific Countries.*

ESCAP. 1990. *State of the Environment in Asia and the Pacific.*

ESCAP. 1995. *State of the Environment in Asia and the Pacific.*

Government of Indonesia. 1995. *Official Report.*

Government of Malaysia. 1995. *Various Reports and Press Release.*

Government of the Philippines. 1993. *Official Report.*

Government of the Philippines. 1995. *Official Media Release.*

Singapore Ministry of the Environment. 1993. *The Singapore Green Plan-Action Programmes.*

UN. 1992. *Statistical Yearbook for Asia and the Pacific Region.*

UN. 1994. *Statistical Yearbook for Asia and the Pacific Region.*

UNEP. 1993. *Environmental Data Report, 1993-1994.*

UNDP. 1994. *Human Development Report.*

UNDP. 1995. *Human Development Report.*

World Bank. 1995. *Environmental Programme and Policy Priorities for a Socialist Economy in Transition.*

WRI. 1994. *World Resources 1994-1995 : A Guide to the Global Environment.* Oxford University Press.

Chapter 5
Agriculture

This chapter presents an overview of the agriculture sector in ASEAN. Agriculture remains to be an important sector in most ASEAN countries despite the industrial transformation that has been taking place in recent years. More than 50% of ASEAN people are dependent on agriculture for livehood. Agriculture-based products still comprise a significant amount of ASEAN exports and many industries depend on agriculture for their feedstocks.

Agriculture is strongly affected by environmental conditions. In turn, unsustainable agricultural practices significantly affect the environment. In this chapter, the impacts of environmental conditions on agriculture, especially water and land, are discussed. Finally, the impacts of agriculture on the environment, both local and global, are presented, together with the recent policy initiatives to address environmental concerns.

ASEAN Facts and Figures

Contribution to GDP (1993)	14%
Agriculture Production Index w/o Singapore (base year 1979/1981=100)	119-182
Employment (1992)	5-67%
Cropland (1992)	19.3% of total land
Cropland per capita (1992)	0.16 hectare/person
Rice production (1994)	18.8% of world
Palm oil production (1994)	74.4% of world
Rubber production (1994)	79% of world
Export of fishery products (1992)	12.4% of world
Fertilizer application (1984-1990)	80 kilogrammes/ hectare/year
Methane emission from rice and livestock (1991)	10% of world
Food imports (1992)	6.4% total merchandise imports
Irrigated cropland (1992)	26% of cropland

I. THE IMPORTANCE OF AGRICULTURE TO ASEAN ECONOMIES

The 1990s has been one of the most prosperous decades for ASEAN. The ASEAN economies posted an average growth rate of 9.5% for the period 1989-1992 (ESCAP, 1994). As small and open economies, all the ASEAN countries have adopted approximately the same export-led growth strategy based on industrial restructuring and diversification away from the traditional sectors. The 1980s and early 1990s saw the continuing shift away from the agriculture sector in favor of the industry and service sectors. Agriculture's contribution to GDP decreased from 18% in 1983 to 14% in 1993. Meanwhile, the industry and services sectors registered corresponding increases in their contributions to GDP (Figure 5.1).

Despite its declining share in the national domestic product (GDP), agriculture continues to play an important role in the economies of most ASEAN countries. It has been the main supporting sector in the transition to industrialization. What is more important, agriculture remains to be the major source of income for more than half of ASEAN's population. Out of ASEAN's total population of 406.5 million, 54% to 75% of those living in the rural areas are highly dependent on agriculture.

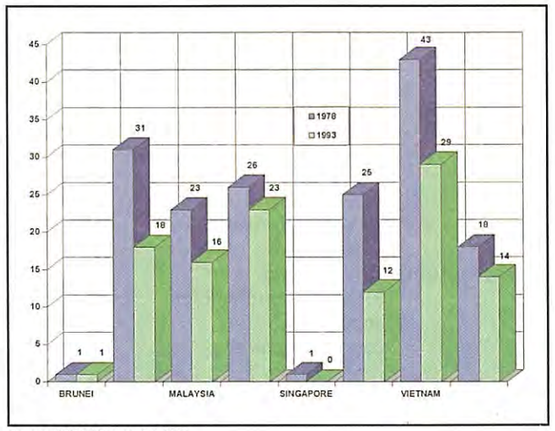
Agricultural employment has declined in recent years as a result of the shift to industrialization and the adoption of modern technology in agricultural production (Table 5.1). The contraction of agriculture's share in the ASEAN economies has limited the opportunities for rural employment and has shifted the burden to the industry and the services sectors. In the midst of rapid economic growth, ASEAN countries are facing the widening disparity in the incomes of agricultural and non-agricultural households. Proper management of natural resources is imperative to sustain the productivity of agriculture.

Table 5.1: Employment by Sector in ASEAN (percent to total)

Country	Agriculture		Industry		Services	
	1965	1990/2	1965	1990/2	1965	1990/2
Brunei D.	na	na	na	na	na	na
Indonesia	70	56	9	14	21	30
Malaysia	58	26	13	28	29	46
Philippines	58	45	16	16	26	39
Singapore	6	0	27	35	67	65
Thailand	82	67	5	11	13	22
Viet Nam	79	67	6	12	15	21

Source: UNDP, 1995
na - data are not available

Figure 5.1: Agricultural share of GDP (percent) for selected years in ASEAN



Source: ASEAN Secretariat, 1994

A. Agricultural Land Use

Over the last two decades, agricultural land use in ASEAN has expanded only slightly from 16.8% of total land area in 1975 to 19.3% in 1992 (ADB, 1995). In fact, ASEAN's total croplands remained at around 63 million ha during the period 1986-1992. The Philippines, Thailand, and Indonesia accounted for most of the earlier expansion. Malaysia was able to increase agricultural production without expanding agricultural land by concentrating on plantation type farming

Table 5.2: Distribution of land use in selected regions, 1989-91 (percent)

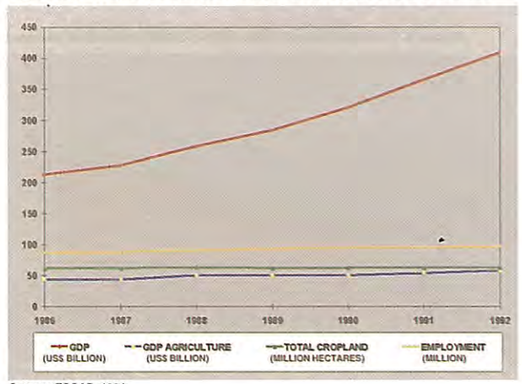
Region	Cropland	Permanent Pasture	Forest & Woodland	Other Land Use
ASEAN	19.7	4.3	49.8	26.2
Asia	17.1	28.3	19.9	34.7
Africa	6.1	30.4	23.1	40.4
North & Central America	12.7	16.9	33.2	37.2
South America	6.5	28.2	47.3	18.0
Europe	29.3	17.6	33.3	19.8
World	11.1	25.7	29.9	33.3

Source: WRI, 1994

and mechanization. Agricultural land use in Vietnam remained almost unchanged on account of the disruption caused by the war.

Despite the marginal expansion over the past twenty years, croplands as a proportion of ASEAN's total land area is still one of the highest compared to Asia, Africa and South America (Table 5.2). This shows that crop production remains important in the region especially for food production and agro-based industries. Arable land and land under permanent crops in Indonesia, Malaysia, and Vietnam constituted between 12% to 20% of total land area in 1992. For the Philippines and Thailand, cropland use is 31% and 39%, respectively (although official statistics indicate higher estimates of 43% and 50%). Notwithstanding the declining contribution of agriculture to national output, the sector has made substantial gains with productivity increases. Total agricultural output has increased from US$44 billion in 1986 to US$58 billion in 1992 (Figure 5.2).

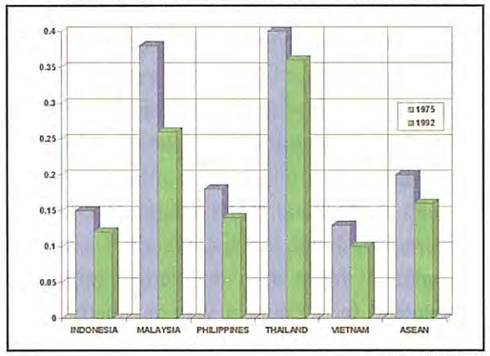
Figure 5.2: Trends in Selected Statistics on Agriculture of ASEAN



Source: ESCAP, 1994

Cropland per capita in ASEAN has declined significantly from 0.20 hectare in 1975 to 0.16 hectare in 1992 (Figure 5.3). These levels are lower than the world's average of 0.26 ha per person in 1992. Most of the ASEAN countries indicated this trend, with Malaysia recording the most significant change from 0.38 hectare in 1975 to 0.26 hectare in 1992. Increased land productivity as a result of increased agriculture inputs and improvements in management practices accounted largely for the expansion in production.

Figure 5.3: Cropland per Capita in ASEAN (hectare/person)



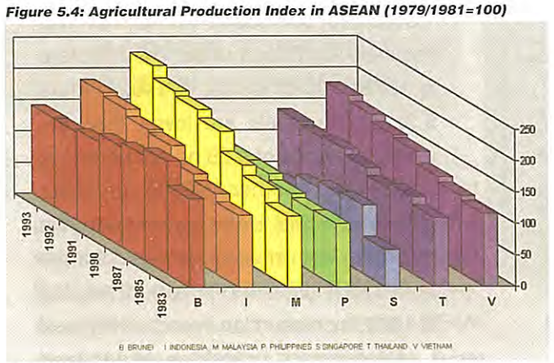
Source: ADB, 1995b

B. Agricultural Production

ASEAN produces some of the most important commodities in the world. It is a major producer of rubber , palm oil, rice and sugar. In recent years, Thailand has become the leading rubber producer, whereas Malaysia still maintains its position as the main supplier of palm oil in the world. Indonesia and the Philippines have attained self-sufficiency in rice, although setbacks suffered on account of adverse natural conditions and calamities have prompted both countries to again resort to importation in recent years.

Over the past decades agricultural production in the region has diversified to various commercial crops and fisheries development. Thailand has led the region in

Figure 5.4: Agricultural Production Index in ASEAN (1979/1981=100)



Source: ESCAP, 1994

diversifying from traditional crops to horticulture, fruit trees and orchid plantation. Fisheries and aquaculture products, especially shrimps, have become major export earners for many ASEAN countries. The Philippines has become a major exporter of processed seaweeds even as other ASEAN countries began to expand their seaweed production capacities.

Agricultural production in ASEAN has increased during the last decade. During the period, it more than doubled in Malaysia, followed by Indonesia with an increase of about 50%. Brunei Darussalam, the Philippines, Thailand and Vietnam recorded more moderate rates of expansion. (Figure 5.4)

1. Major Crops

Major crops in ASEAN include rice and other cereals, cassava, sugar, coconut, rubber and palm oil. These crops are critical for food production as well as for export earnings, either as agricultural commodities or processed agricultural products. Rice is the most important crop in ASEAN, being the staple food of the general population. It is also a major export commodity for some ASEAN countries.

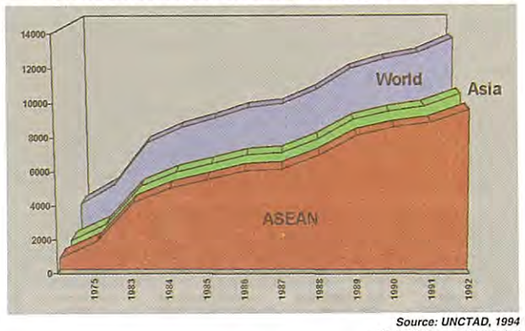
ASEAN has been recognized as an important rice producing area in the world. ASEAN produced almost 100 million tonnes of rice in 1994, equivalent to 21.6% of the total production in Asia and 18.8% of the whole world. Production is growing at an average annual rate of almost 2.9%, higher than the whole of Asia and the world (UNCTAD Commodity Yearbook, 1994).

More than 24 million ha or 40% of total cropland in ASEAN was devoted to rice in 1993 (UN Statistical Yearbook, 1994). In recent years, the expansion in the volume of rice production was achieved through increases in productivity rather than through the augmentation of land used for rice cultivation. During the last decade, productivity (kilograms per hectare yield) in rice and maize increased by 1.56% and 3.16%, respectively. Improvements in management practices and increases in agricultural inputs combined were mainly responsible for productivity increases.

The growth of palm oil production in ASEAN has been phenomenal. Over the last two decades, the palm oil industry has become a major player in the world vegetable oil market. From production levels of 651,000 tonnes in 1970, it grew by more than 14 times to over 9.5 million tonnes in 1992. Production is still growing at almost 10.3% per year, higher than the world average rate of 8.8% (Figure 5.5). At present, ASEAN accounts for 96.7% of total production in Asia and 74.4% of the world. Malaysia and Indonesia are the main producers of palm oil in the region.

Besides palm oil, rubber has also been a traditional product of ASEAN. In the mid-1970s, ASEAN became a major supplier of the

Figure 5.5: Production of Palm Oil in ASEAN (thousand tonnes)



Source: UNCTAD, 1994
Note: Vietnam not included

Table 5.3: Selected Major Crop Production in ASEAN 1994

Crop	Production 1994 (thousand tonnes)	Average Annual Growht Rate 1985-1994 (percent)	Percent of Asia 1994	Percent of World 1994
Paddy	99,860	2.9	21.6	18.8
Cereal	117,300	1.6	14.0	6.0
Sugarcane*	102,700	4.2	20.8	9.9
Maize	17,100	2.2	12.5	3.0
Coconuts	26,800	1.0	69.8	61.9
Palm oil*	9,536	10.3	96.7	74.4
Rubber*	4,000	2.1	91.5	79.0

Source: ADB, 1995; ESCAP, 1995; and UNCTAD, 1994
*Note: * 1992 Production data used; Average growth rate for period 1983-1992; and Japan included in total for Asia-Pacific*

commodity, accounting for about half of the world's output. At present, ASEAN accounts for about 91.5% of total Asian production of rubber and 79% of the world. During the period 1983 to 1992, ASEAN rubber production grew at about the same rate as that of Asia, but slower than that of the world. This was the result of conversion of some rubber plantations into palm oil (Table 5.3).

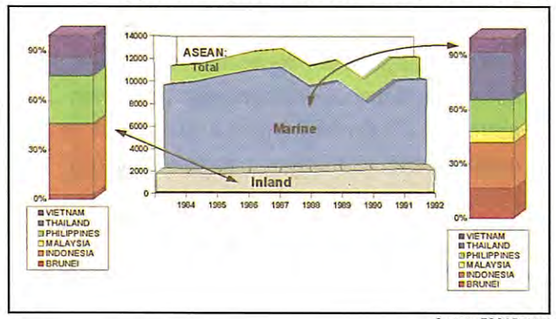
Sugar cane has long been one of the traditional crops and commodity exports of ASEAN countries. In 1992, ASEAN production of sugar cane was 20.8% of Asia's production and around 10% of the world's. Despite market reversals in the 1980s on account of competitive sweetener products, sugarcane production in ASEAN still grew at an average annual rate of more 4% during the period 1985-1992.

Similar to sugar, ASEAN has been a major supplier of coconut products in the world for many decades. Recently, however, the region has begun to face stiffer competition from other vegetable oil products such as palm oil, and its by-product, palm kernel oil. The latter is now competing directly with coconut oil in the lauric market. Thus, for the period 1985-1994, coconut production grew at an average rate of only around 1%. Nevertheless, ASEAN remains to be a dominant producer, supplying 70% and 62% of the Asian and world markets, respectively.

2. Fisheries

Fish is the primary source of protein in the diet of the ASEAN population and is an important source of income for agricultural households. Marine production, mainly from coastal and offshore fishing, constitutes more than 80% of total fisheries production, and has been increasing gradually since 1983 (Figure 5.6). Compared to maritime fishing, inland fishing and aquaculture are relatively less important, constituting less than 20% of total fishery production. However, most of the ASEAN countries are seriously developing their aquaculture production, despite the challenges of having to mitigate adverse economic and environmental consequences.

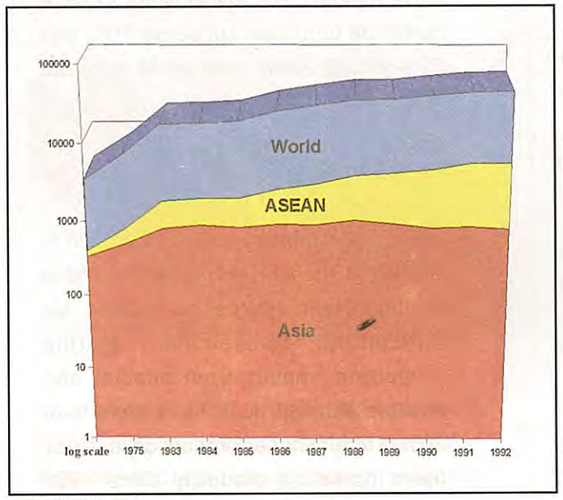
Figure 5.6: ASEAN Fisheries Production (thousand tonnes)



Source: ESCAP, 1994

ASEAN accounted for 10% of world fishery production in the 1990s compared to only 6% in the early 1980s. Over the last decade, fisheries export from ASEAN countries grew at an annual average rate of 20%. This was higher than the average growth rate of less than 1% for Asia and 11% for the world (Figure 5.7). A highly competitive fishing sector and the efficient processing of marine products

Figure 5.7: Export of Fishery Commodities (million US$)



Source: UNCTAD, 1994

were the factors that contributed mainly to ASEAN's good export performance.

With better facilities and equipment, ASEAN's extensive marine resources could be developed further to expand production, not only to meet domestic requirements for consumption but also to supply the raw material needs of industry. There are certain fishing areas, however, where sustainable limits are about to be reached. Appropriate technologies are necessary to sustain yields and to mitigate adverse consequences on the environment of further expansion in fisheries production.

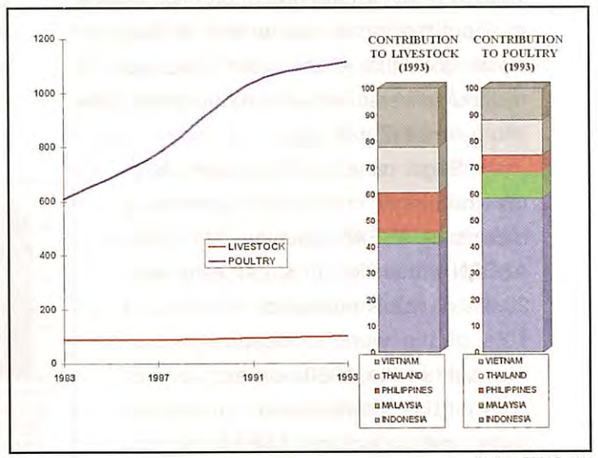
3. Livestock and Poultry

Compared to fisheries, livestock contributes very little to total agricultural production. Poultry, on the other hand is becomming quite popular in the region and has become the major source of animal protein in the ASEAN diet. In 1992, livestock per capita is one head for every person compared to poultry per capita of 2.8 heads per person. During the period 1983-1993, livestock production grew by 12.5%, while poultry production grew by 83.3% (Figure 5.8).

C. Agricultural Inputs

The growth of agriculture in ASEAN is a result of both expansion in land area and increased productivity. Expansion of land as a source of production growth has more serious environmental consequences, especially when marginal and fragile agricultural lands are used. Environmental risks include soil erosion, land degradation, environmental damages from deforestation, and lower agricultural yield. Increased agricultural productivity, on the other hand, can be attained through various combinations of inputs and cultural management practices. Increased agricultural inputs also impacts on the environment through increased residuals.

Figure 5.8: Livestock and Poultry in ASEAN (million heads)



Source: ESCAP, 1994
Note: L = livestock heads; P = poultry heads

ASEAN agricultural development followed the pattern in developed countries that emphasized short-term gains by increasing productivity through modern technology. The "Green Revolution" introduced in the early 1970s symbolized this pattern of agricultural development in the Asia Pacific region, including ASEAN. The strategy under the "Green Revolution" was to promote the use of high yielding varieties, and the increased

Box 5.1
AQUACULTURE IN VIETNAM

Aquaculture has developed rapidly in Vietnam in recent years. It now contributes around 30% of total fisheries production. In 1992, total aquaculture production amounted to 349,000 tonnes, largely from brackish water. The country is now exporting shrimps, seaweed (Gracilaria spp) and other invertebrates such as mollusks. There are 20 indigenous species of fish that are cultured for possible export.

Brackish water aquaculture is highly developed in the provinces of Kien Gang and Minh Hai. Along with this, freshwater fish aquaculture is also practiced in freshwater ponds and ditches throughout the country. Pangasius spp and tilapia spp are raised in ponds, while carps (Puntius spp, Leptobarbus spp and Cyprius spp) are raised in large ditches. Mussel culture for pearl production is also becoming popular especially in the Mekong Delta where annual average yields are around four to five tonnes per hectare. Floating cage culture is practiced in the larger rivers such as the Mekong and the Bassac in the province of An Giang. The main types of fish raised are carps, catfish and pangasus spp. Yields are high (about 80 kilograms per cubic meter per year) and profitable for the farmer.

Shrimp aquaculture is practiced in the estuarine or coastal areas of the country. In inland waters, the naturally present shrimps are simply gathered instead of raised through the more expensive freshwater aquaculture. The use of natural seeding stock instead of fingerlings is more widely practiced as this is more economical. However, proper water management is not usually practiced and ponds are normally abandoned after every four years due to increasing acidity. This practice, which is commonly referred to as "shifting aquaculture", eventually leads to unsustainable yields.

Minh Hai province, located in the Mekong Delta, is now facing serious socio-economic and environmental problems due to unsustainable agricultural practices. During the period 1985 to 1991, the opportunities for "shrimp aquaculture attracted farmers to migrate to the area at a rate of 3.7% per year. The area under shrimp farming increased by 15,000 hectares per year such that in 1992, about 132,000 hectares, mostly converted from mangroves, have been cultivated. During the initial years, the natural environment was able to sustain the shrimp farming methods employed. After a few years, however, the acidity of the ponds caused decreasing shrimp yields, prompting the cultivators to abandon their ponds.

Source: World Bank, 1995

application of chemicals and fertilizers in several ASEAN countries. The International Rice Research Institute (IRRI) located in the Philippines has made significant contributions in the effort to promote the adoption of modern technologies in agriculture.

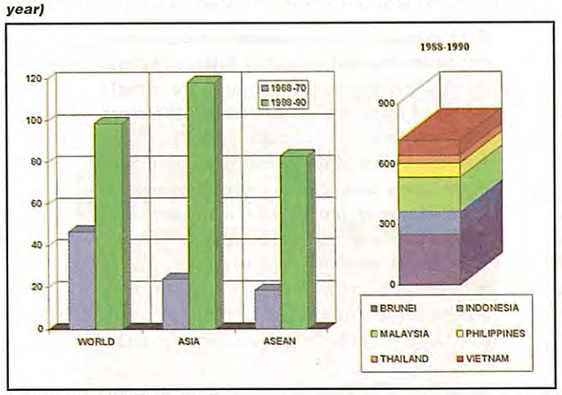
The use of agro-chemicals in ASEAN farms contributed significantly to increases in agricultural yields. For example, average yield of rice and maize in ASEAN increased by more than 1.5 and 3.1 % per year, respectively, during the period 1983-1992. ASEAN however, is also concerned about the environmental consequences of using agro-chemicals.

1. Fertilizer

ASEAN fertilizer consumption is small when compared to average world consumption. In 1991, it was only less than 4% of the world's total (Figure 5.9). Over the last decade, however, ASEAN fertilizer consumption has been increasing by an average of 7% annually, from 3.2 million tonnes in 1983 to 5.5 million tonnes in 1991. This rate of increase is higher than the average rate of 5.7% in the ESCAP region, and 1.4% for the world (ESCAP, 1994).

The rapid growth in ASEAN fertilizer consumption resulted from substantial increases in application rates. From an average of about 20 kilograms per hectare per year during the period 1968 to 1970, fertilizer application increased to more than 80 kilograms per hectare average between 1988 to 1990 (Figure 5.9). This level of intensity in fertilizer use is still significantly lower than the

Figure 5.9: Rate of Fertilizer Consumption in ASEAN (kilogram/hectare/ year)



Sources: WRI, 1994; World Bank, 1995
Note: Vietnam not included in ASEAN aggregates

average of 118 kilograms per hectare per year in Asia. But because of higher growth rates of adoption, the fertilizer application rate in ASEAN has already approximated the world average of 98.6 kilograms per hectare per year.

The trend in ASEAN fertilizer consumption follows closely the expansion in agricultural production (ESCAP, 1994). This indicates a direct correlation between fertilizer use and increased agricultural productivity. Increases in farmers' income resulting from increased productivity further encourage the use of fertilizers among ASEAN farmers.

2. Pesticides

Besides fertilizers, pesticides, herbicides, and other agricultural chemicals to control pests were also used extensively under the Green Revolution. Pesticides were promoted either directly through business schemes, or indirectly through various incentive systems that encourage the use of pesticides, especially in developing countries. Through pesticide promotion, the Asia-Pacific region, including ASEAN, has become one of the highest pesticide markets in the world (UNEP, 1993; WRI, 1994).

Regarding agricultural chemicals, the consumption in Indonesia alone increased by 70% from 1983 to 1992, while that in Malaysia and Thailand more than doubled during the same period. The rates of consumption in these three countries were higher than the average of 60% and 20% for Asia and the rest of the world, respectively (United Nations Statistical Yearbook, 1994).

Box 5.2
ENVIRONMENTAL-FRIENDLY PESTICIDES IN THAILAND

Increasing public awareness of the harmful effects of chemical residuals on agricultural products have begun to alter consumer preferences in favor of those products that are free from the toxic effects of chemicals. As a result, many farmers in Thailand have recently shifted to least toxic or toxic-free vegetable plantations. Some farmers adopt biological control of pests, while others use herbal insecticides or mosquito nets to reduce the unnecessary use oil pesticides.

One of the most effective nontoxic ingredients available locally in Thailand at very minimal cost is the extract from the neam tree-a multipurpose tree widely known in the country. The leaves of the neam tree are edible, and can also be used to cure several types of skin diseases. Studies have shown that the residuals of neam fruits, leaves or seeds are also full of soil nutrients.

A recent study comparing the economics of neam extract and insecticide applications in Chinese kale production found that farmers using neam extract earned a net income of 520 US dollar per hectare more than those using chemical pesticides. This is possible on account of the low price of neam extract - 17 US cents per kilogram - which more than offset lower yields of 3,000 kg per ha and the high cost of chemical fertilizers. Apart from income benefits, health benefits have accrued to the fammers as weil. The study shows that adequate price margins are possible even with the use of environmental-friendly practices that benefit both producers and consumers.

Source: Napaporn Phromchana and Somkiat Harnnarong, 1995

Box 5.3
INTEGRATED PEST MANAGEMENT IN INDONESIA

Indonesia was able to transform itself successfully from the world's largest rice importer to a country that has attained self-sufficiently in rice beginning 1984. This was possible with the Green-Revolution package of inputs (new rice varieties, irrigation systems, fertilizers and pesticides). Pesticide consumption in Indonesia, which was heavily subsidized by the government, constituted about 20% of the world's total consumption of fertilizer.

Through the years, however, the extensive use of chemicals caused crops to be pest-resistant, resulting in the resurgence of pests, and consequent crop losses. A massive plant hopper outbreak destroyed a substantial portion of the harvest in Indonesia in the late 1970s. Although the use of plant hopper-resistant rice varieties temporarily halted the damage in the early 1980s, the pest outbreak resumed a few years later, threatening over 50% of the rice harvest in Java.

Studies of the plant hopper's life cycle and its natural predators, as well as results from pilot studies of the IPM technique, finally convinced the Indonesian government in 1986 to phase out pesticide subsidies and divert the funds to support the IPM programme. With this new approach, rice harvest increased by 15%, while pesticide consumption declined by 60% in that year. In 1990, the IPM approach was also able to successfully arrest the outbreak of the white rice stemborer, a traditional sporadic pest, that could have caused heavy damage to crops.

The Indonesian government was able to save about $120 million per year by eliminating pesticide subsidies, and farmers were able to save out-of-pocket costs of pesticides and equipment as well. In 1990, the estimate of the IPM's economic impact was well over $ 1 billion (WRI, 1994). The programme realized positive gains for the environment as thousands of tonnes of toxic contaminants were eliminated, with consequent health benefits accruing to farmers, villagers, rice consumers and wildlife. Based on the Indonesian experience, the IPM approach has proven to be an effective alternative in promoting a more stable and sustainable agriculture.

Source: WRI, 1994

Apart from the extensive use of agricultural inputs, management practices play an equally important role in enhancing agricultural productivity. While traditional productivity improvements focused mainly on cost minimization and output maximization, more recent agricultural management practices have stressed the need to take into account the environmental aspects of farming operations. Environmental consciousness has been introduced into farm management practices arising from concerns about environmental degradation caused by unsustainable agriculture. In Thailand, the use of environmental-friendly pesticides in vegetable planting has proven to be economically feasible (Box 5.2). The Integrated Pest Management (IPM) programme, which seeks to reduce the use of chemicals, has been introduced in many ASEAN countries (Box 5.3).

The IPM system has proven to be an effective alternative to the use of chemicals in controlling pests. The IPM approach considers both crops and pests as part of a dynamic ecosystem and capitalizes on the biological factors that limit pest outbreak. Under the system, chemical applications are used only as a last resort. It has proven effective not only in increasing output, but also in safeguarding against health hazards arising from chemical-based pest management systems. An IPM network has been set up in the ASEAN region under the auspices of FAO.

D. Food Security

Food security has improved considerably in most ASEAN countries since the 1970s (Table 5.4). Over the last decade, food production per capita in Indonesia, Malaysia and Vietnam increased substantially by 44%, 87% and 29%, respectively. Thailand maintained its per capita production level while

Table 5.4: Selected Food Security Indicators

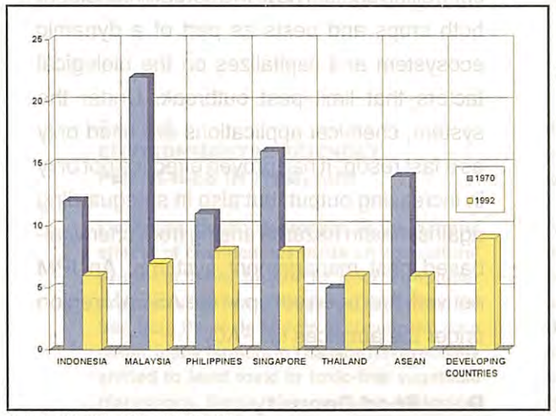
Country	Food production per capita index, 1992 (1979/8=100)	Cereal imports (thousand metric tonnes) 1992	Food aid in cereals (thousand metric tonnes) 1992
Brunei D.	na	na	na
indonesia	144	3178	82
Malaysia	187	3198	1
Phillipines	87	1833	78
Singapore	49	784	na
Thailand	103	992	75
Vietnam	129	583	96
All Developing Countries	121	125,360	

Source: UNDP, 1995
na : data not available

the Philippines and Singapore experienced declines in their per capita production levels by 13% and 50%, respectively. In Singapore, food production was constrained due to the allocation of available land to the industry and service sectors. In the Philippines, food production has suffered periodic setbacks due to several natural calamities that visited the country in the 1970s.

ASEAN has gradually reduced its dependence on food imports in a span of 20 years. Food imports as a percentage of total merchandise imports have been reduced from 14% in 1970 to 6.4% in 1992 (Figure 5.10). On the whole, increased agricultural production was able to supply the food needs of the population except in cases of severe natural calamities and disasters. Even in these situations, food aid has reached only a maximum of 82,000 tonnes in any given year on an individual country basis.

Figure 5.10: Food Importation in ASEAN (% of Merchandise Imports)



Source: ADB, 1978; 1995; and UNDP, 1995
Note: Brunei and Vietnam not inluded in ASEAN aggregate

Notwithstanding notable improvements in ensuring a stable supply of staples (i.e., rice and fish) at affordable prices for the ASEAN population, food security remains an important concern of ASEAN Governments. The conversion of choice croplands into industrial estates and golf courses, especially around the major cities, has considerably reduced prime agricultural land available for food production. Apart from affecting agricultural productivity, land conversions have rendered existing agricultural infrastructure in the area no longer useful. It has also affected the environment by disturbing the local ecological balance. In recent years, ASEAN countries have instituted policies to regulate land conversions. In most cases, permits are required to convert farmland into other uses. The protection of the rights of the farmer-tenants is considered in granting such permits.

Most ASEAN countries maintain a certain level of food reserve (mostly cereals) to ensure food supply. Price ceilings for some basic food items are also enforced. Through the ASEAN Food Security Reserve Scheme, Member Countries have agreed to provide assistance whenever food supply in one of the Member Countries is threatened. Some Mem-ber Countries have availed themselves of this scheme on several occasions in the past.

II. AGRICULTURE AND THE ENVIRONMENT

Agriculture and the environment are inextricably linked. Agricultural activities are highly dependent on climate and natural resources such as good quality soil and clean water. At the same time, agricultural activities can affect the environment. For one, inadequate soil conservation practices, especially in vulnerable areas, can cause severe soil erosion. For another, fertilizers can cause pollution problems when used excessively or indiscriminately. The harmful effects on air, water, land and soils of various human activities, both from agriculture and non-agriculture practices, can affect agricultural productivity, and consequently, the incomes of farmers. The impact on rural communities are likely to be severe because of their limited capacity to absorb and mitigate such impact and the absence of alternative means for them to make a living.

The deterioration of the environment can adversely affect agriculture in many ways. Air pollution from sulfur dioxide can damage agricultural crops, livestock and human health. Water pollution discharged to coastal areas by factories can damage crops and marine life. In Thailand for instance, tannery factories in the coastal areas south of Bangkok have polluted and damaged coastal aquaculture. Depending on the characteristics of the soil, topography and cultural practices, the extent of soil erosion from inappropriate agricultural practices can range from less than one tonne per year to as high as 900 tonnes per year (MOSTE, 1995). Eroded soils are carried through run-off as sediments in rivers, streams, and lakes and as such, can shorten the useful life of dams and reservoirs.

A. Impacts on Land

The sustainability of agriculture depends on the availability, proper exploitation and utilization of land. In the past, land was available almost everywhere and so farms were established on land best suited for agriculture. Most farms initially located on the coastal land areas, plains and valleys where the soil is fertile, the climate favorable, and the water abundant. Later, competing demands for other land use drove land prices up and provided the incentive for owners to convert them into industrial sites, human settlements, golf courses, and other uses. Meanwhile, increased demand for food and other agricultural products by an expanding population required more land for agriculture. Agriculture had to expand into less favorable areas including the uplands and even the highlands. Forested or woodland areas were subsequently opened to accommodate such expansion.

Agricultural land expansion, especially in highly vulnerable areas, imposes high risks in terms of soil erosion and sedimentation. Without adequate soil conservation measures, soil erosion can take place in just a few years, causing crop yields to drop dramatically and farmers' incomes to decline. When this happens, farmers begin to exploit new and often marginal lands. If these inappropriate agricultural practices continue, the cycle of unsustainable agriculture would repeat itself and ultimately reduce overall national productivity.

In Thailand, approximately 17 million hectares of land are moderately and highly vulnerable to water erosion resulting from agricultural expansion to the uplands and highlands. To mitigate the adverse impact of these developments on the environment, Thailand has initiated several programmes towards the development of sustainable highland agriculture (Box 5.4).

Some ASEAN countries have successfully mitigated the adverse impacts of mono-culture farming by shifting from cash crops to large scale industrial plantations. Malaysia for one, currently maintains large plantations for rubber and palm oil. These plantations are carefully managed by applying appropriate technologies to prevent harmful effects on the environment.

Modern agricultural practices introduced under the Green Revolution also required the establishment of irrigation systems and

Box 5.4
HIGHLAND AGRICULTURE IN THAILAND

The northern region of Thailand has an area of nearly 17 million hectares or about one-third of the country's total land area. Around half of this territory is located in highland areas, populated mostly by hilltribes who depend mainly on shifting agriculture for their livelihood. Many of them are engaged in opium cultivation especially in the remote areas near the common borders with Burma and Laos. Because of the complex social, political and environmental problems caused by this situation, the government decided to implement alternative programmes to promote sustainable agriculture and to prevent the cultivation of opium in highland communities.

Through the initiatives of H.R.H. King Bhumibol, several key projects on highland development were implemented in northern Thailand. Government efforts focused mainly on providing infrastructure for health and educational services. Bilateral and multilateral agencies have extended technical cooperation and support for a number of these initiatives.

One of the more successful projects is the Doi Sam Meon Development Project that received funding support from UNDP. Doi Sam Meon is a community located between Mae Hong Son and Chiangmai Province with an area of 1,864 square kilometers. It has a population of 11,256 of several ethnic origins, namely; Karen, Lua, Hmong, Musue and Hor. The project aims to upgrade the quality of life of the hilltribes through integrated rural development that includes appropriate land and forest management, production of cash crops for livelihood, and prevention of drug cultivation. The project also features community participation in the protection and management of the environment.

Source: MOSTE, 1995

reservoirs. Thus, irrigated farmland in ASEAN expanded to 26% of total cropland by 1992. Indonesia in particular, has placed more than 37% of its croplands under irrigation (ESCAP, 1994). Most irrigation systems are incorporated in hydroelectric dams that also provide electricity. Multi-purpose dams can significantly alter existing land use patterns of the surrounding areas.

The expanded use of irrigation water altered cultural practices in the farm with the attendant environmental consequences. The construction of irrigation reservoirs have often flooded forests, and in some cases drained marshes, swamps and ponds, destroying existing habitat for plant and animal life. Some reservoirs have permanently altered the pattern and quality of river flows. The socio-economic impact of these bio-physical changes on adjacent communities, as well as on the environment, have now been included in the evaluation of irrigation projects, as required by the national laws and regulations in ASEAN countries.

B. Impacts on Water Resources

Farms need sufficient water to sustain their productivity. Thus, it has to compete with other sectors of society for water resources. On the other hand, improper agricultural practices often contaminate the same water it needs for sustenance. These practices could also affect the water used for fishing and other purposes.

1. Water Quality

Water for agriculture requires less stringent quality standards compared to other uses. Hence, under normal conditions, agriculture is least-affected by water pollution. Water quality of major rivers in the region, although being degraded continuously, is still permissible for agricultural use. Industrial pollution has not yet reached critical levels to cause detrimental effects on agriculture. On the whole, water pollution in ASEAN is not likely to cause any adverse impact on cropland productivity in the near future.

The presence of organic pollution in water is still tolerable for farm production. Theoretically, organic water pollution can affect farming if it causes irrigation water to have

Box 5.5
SHRIMP FARMING IN THAILAND

Shrimp culture has been one of the most important contributors to the growth of the seafood processing industry in Thailand. In the early 1970s, traditional shrimp farming consisted of obtaining shrimp fries from their natural habitats in mangrove forests next to the farms of about 10,000 hectares in size. Yield was low and farmers earned moderate incomes from shrimp farms. By the end of the 1980s however, shrimp farms expanded to more than 45,000 hectares with yields increasing from 30,000 tonnes to about 150,000 tonnes. Government promotion of the industry, as well as investment relocation from Taiwan, accounted for the massive expansion of shrimp farming. By the 1990s, shrimp farms in Thailand covered nearly 65,000 hectares with a total production of about 170,000 to 180,000 tonnes.

Intensive shrimp farming first occurred in the coastal provinces close to Bangkok, notably, Samut Sakhon and Samut Songkhram. At the end of the 1980s, shrimp farming in these two provinces reached a peak coverage of more than 17,000 hectares. However, since 1990, the area under shrimp culture in these provinces dropped by more than one-half as farms were abandoned on account of severe water pollution. This was caused mainly by unconsumed food retained as pond sediments and flushed out of the pond into the sea during cleaning after harvest. In one case, less than one-fourth of nitrogen and only about 13% of the phosphorous applied as food was assimilated by the harvested shrimps. Approximately 16,000 hectares of shrimp ponds throughout the country have been abandoned and can no longer be used.

Currently, shrimp farming has moved to the Southern and Eastern coasts of Thailand. In one province alone, the shrimp farm area increased from 1,600 hectares in 1975 to 14,000 hectares in 1995. Mangrove areas in the south of the country have been converted to shrimp farms, starting from the upper south of Surat Thani province down to Phuket island. It has become necessary to manage the existing shrimp farms more carefully to prevent the collapse of the industry.

Source: MIDAS Agronomics Co. Ltd, 1995

near zero oxygen level (euthrophication) causing all living organisms in the water to die. Otherwise, organic pollutants could even be beneficial to plant life. Nevertheless, it is important to control activities that generate large amounts of wastewater containing high concentration of organic pollutants that can make water unsuitable even for agricultural use.

Inorganic pollutants found in most ASEAN countries are manganese, copper, zinc, lead, chromium and cadmium. Like organic pollution standards, inorganic effluent standards in ASEAN are based on potential effects to human health. Toxic wastes can contaminate water and affect human health through the food chain. Crops irrigated by toxic contaminated water can have toxic residues in grains and fruits that can enter the human body when consumed.

Inappropriate agricultural practices can also contaminate groundwater. Intensive application of agrochemicals increases the level of residuals carried by run-off that may not only contaminate nearby surface water but also percolate into the ground and affect the quality of groundwater. This can render the water unsuitable for domestic use.

2. Fishing and Aquaculture

Wastewater discharge, degradation of mangrove forests, overfishing, and the misuse of fishing gears are among the factors that have contributed to the degradation of fishery resources in ASEAN. The widely held view that fishing grounds are common resources that can be exploited freely and without limits underpins most of these problems. The heavy traffic of sea-going vessels and occasional

sea accidents have also exacerbated the problem of marine pollution in the region.

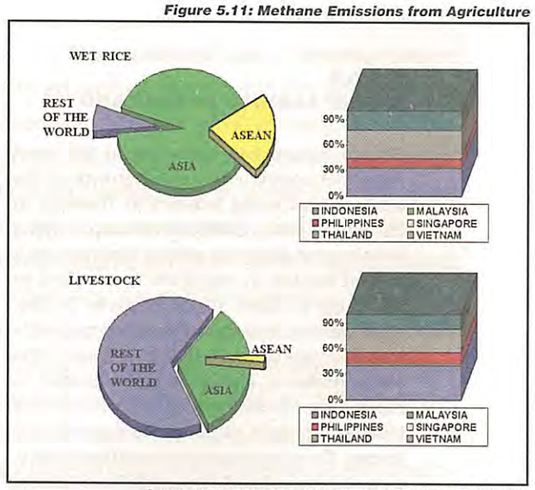
Inappropriate aquaculture practices have also led to water pollution and unsustainable harvests. In particular, the practice of shrimp culture, which has increased substantially over the last decade especially in Thailand and Indonesia, has highlighted the issue of sustainability in agriculture. Apart from destroying mangrove forests, modern shrimp farming generates a significant volume of wastewater from the extensive use of chemicals and antibiotics. Wastewater from shrimp farms, which consists of nutrients, as well as salt, could damage nearby crops and pollute coastal waters, thus adversely affecting water quality and decreasing shrimp yields substantially. As experienced in some parts of Thailand, unsustainable practices make shrimp farms profitable only for a short span of five years. Indonesia and Vietnam have the same experience.

The threats to fisheries resources have prompted ASEAN Governments to take measures to ensure sustainable fish harvests for a burgeoning seafood processing industry. Agro-based industrial expansion has recently focused on the need for effective coastal resources management to ensure their proper and sustainable exploitation.

C. Impacts on Air

Apart from their impacts at the local level, emissions from the agriculture sector also contribute to the effusion of greenhouse gases. These gases trap infrared radiation falling on the earth's atmosphere and cause the temperature to rise, resulting in the phenomenon called "global warming". The important greenhouse gases are carbon dioxide, methane, nitrous oxide and chlorofloucarbons. Among these gases, carbon dioxide emissions and most of methane emissions are generated from agricultural activities.

Figure 5.11: Methane Emissions from Agriculture



Sources: ADB, 1994a; ADB, 1994b; TDRI and TEI, 1993; and WRI, 1994
** - does not include Vietnam*

The major sources of carbon dioxide emissions are fossil fuel combustion, changes in land use, and industrial activity. The conversion of forests into cropland contributes to emissions of atmospheric gases by reducing the available sink that absorbs carbon dioxide emitted from various sources. Methane, on the other hand, is mainly generated from agricultural activities such as lowland paddy cultivation and livestock raising. In addition, application of chemical fertilizers also generates methane and nitrous oxide. To a lesser extent, other activities such as sanitary landfills and coal mining emit methane as well.

The extensive paddy cultivation under the Green Revolution has contributed to increased methane emissions from agriculture. Rice cultivation in ASEAN contributed 18% to world methane emissions while livestock raising contributed 2% (Figure 5.11). For both activities combined, ASEAN contributed less than 10% to total world emissions of methane. Among the ASEAN countries, Thailand and Indonesia, being major rice producers, contributed most to methane emissions. The extent of future methane emissions from agriculture would depend on future developments in the sector.

The long-term impacts of global warming to agriculture and other sectors are not fully

known. However, there are enough illustrative cases that indicate the possible serious consequences of global warming. The worst scenario could involve a drastic rise in sea level that could put productive lowland agricultural farms under water. Extreme fluctuations in climatic conditions could drastically affect agricultural productivity. Severe weather disturbances like typhoons could destroy crops and affect the stability of food supply.

D. Health Impacts

Although intensive use of fertilizers has significantly increased crop yields, it has affected the quality of soil with consequent effects on the environment. Nitrate leaching, emissions of gaseous nitrogen, ammonia volatilization and soil erosion commonly result from intensive fertilizer use. Residuals from chemical fertilizers also increase nutrients in water that could cause eutrophication in streams. Monitoring of eutrophication in major ASEAN rivers has already indicated substantial concentration of nitrate and phosphorus (UNEP, 1993).

Like fertilizers, pesticides can also affect the environment. Not all pesticides applied are used by plants; in fact, only a small percentage of pesticides applied in the field reaches the target organisms. The residuals become environmental contaminants that infect the soil and water in rivers and lakes (WRI, 1994). Pesticides can also dissipate in the air as vapor, in water as runoff, or in the soil as residues that can be leached into the groundwater below. Since groundwater is the main source of domestic water supply in the rural areas, the increased use of pesticides could impose higher risks to people's health in these areas.

Contamination of pesticides destroys insects and affects the ecosystem. Some pesticides are toxic to water-dwelling insects, planktons, crustaceans and fish. In addition, residuals of pesticides in fruits and vegetables further exacerbate the toxic effects through the food chain. As more intensive farming techniques are applied to increase productivity, increased utilization of pesticides could produce wide-ranging effects that could ultimately affect the natural ecological balance. This further increases the potential to induce more pests and insects as they become more resistant to chemicals. Consequently, larger doses of more potent chemicals have to be applied.

Besides pesticide contamination, improper handling, application and storage practices, as well as undue exposure, have resulted in pesticide poisoning in developing countries. Farmers in ASEAN countries have tended to use chemicals carelessly due to lack of knowledge and proper training. Plantation workers and farmers growing cash crops are most likely to suffer from pesticide exposure. The World Resources Institute (WRI) reported that in the 1980s, more than 7% of pesticide users in Malaysia suffered some form of pesticide poisoning, and almost 15% experienced such poisoning at least once in their lives (WRI, 1994). In Thailand, 10 persons for every hundred thousand suffered from pesticide poisoning in 1989 compared to only two per hundred thousand in 1977 (MOSTE, 1995). Better education on proper handling and application of pesticides has gradually reduced the incidence of pesticide poisoning in the 1990s.

The harmful effects of pesticides are not confined to users alone. Excess residuals in food and vegetables are harmful to consumers of agricultural produce as well. In Thailand, the Department of Medical Science reported that some fruits and vegetables contained pesticides exceeding safety limits. At the same time, residues were also found in cereals, dried nuts and meat products. These findings prompted the Government to take several measures to control and manage the use of pesticides in agriculture. For example,

the Toxic Substances Act of 1967 was revised initially and replaced subsequently by the Hazardous Substances Act of 1992. The new Act regulates the specification of the types and categories of hazardous wastes generated from the production sectors. It also regulates the use of toxic and hazardous substances in industry, agriculture and other sectors. Since 1992, the Department of Agriculture has prohibited the production and use of 23 types of hazardous substances. In addition, the Ministry of Agriculture and Cooperatives and other related agencies have launched several projects on proper pesticide use including training of growers by the Department of Agricultural Extension. These efforts to regulate pesticide use through legislation, enforcement, and investment incentives have greatly enhanced consumer protection.

Extensive information dissemination and education programmes in ASEAN have made consumers more aware of the desirability of patronizing "green" (toxic-free) agricultural products instead of those contaminated with chemicals. ASEAN consumers are now willing to pay a premium for green agricultural products. This change in consumer preferences will likely encourage producers to use less chemical pesticide in their farms.

References

ADB. 1994a. *Climate Change in Asia : Indonesia.*

ADB. 1994b. *Climate Change in Asia : Philippines.*

ADB. 1978. *Key Indicators of Developing Asian and Pacific Countries.*

ADB. 1995. *Key Indicators of Developing Asian and Pacific Countries.*

ASEAN Secretariat. 1994. *ASEAN Macroeconomic Outlook, 1994-1995.* Jakarta.

ESCAP. 1994. *Statistical Yearbook for Asia and the Pacific.*

ESCAP. 1995. *State of the Environment in Asia and the Pacific.*

Midas Agronomics Co. Ltd. 1995. *Interim Report on a Pre Investment Shortly Project on Coastal Resources in Thailand submitted to the Office of Agricultural Economics.* Ministry of Agriculture and Cooperatives and the World Bank.

MOSTE. 1995. *State of Environment Report : 1992-1993.* Bangkok.

Napaporn Phromchana and Somkiat Harnnarong. 1995. *A Comparative Cost and Return Analysis of Neam Extraxt and Insecticide Applications in Chinese Kale Production,* A research report submitted to national Research Council. Bangkok, Thailand.

TDRI and TEI. 1993. *Preparation of a National Strategy on Global Climate Change : Thailand,* A research report submitted to the Government of Thailand.

UNCTAD. 1994. *UNCTAD Comodity Yearbook.*

UNDP. 1995. *Human Development Report.*

UNEP. 1993. *Environmental Data Report, 1993-1994.*

WRI. 1994. *World Resources : 1994-1995: A Guide to the Global Environment.* Oxford University Press.

World Bank. 1995. *Vietnam Environmental Programme and Policy Priorities for a Socialist Economy in Transition.* Washington, DC.

Chapter 6
Industry

For the past few decades, industry has been primarily responsible for the rapid growth of the ASEAN economies. All ASEAN countries have expanded their industrial base and some have attained newly industrializing status. The rapid growth of industry has created many benefits such as higher employment, increased export, more stable currencies and greater affluance for its population. These benefits, however, are not without the corresponding costs, among them, pollution, urban problems, and the degradation of natural resources. Recognizing these impacts, ASEAN has become increasingly concerned about sustainable industrialization in recent years.

This Chapter discusses the effects of rapid industrialization in ASEAN on the environment. The significance of industry to the ASEAN economies, which is presented in the first section, puts the problem in perspective. The trends and transformation in industrial development are further discussed in the succeeding section. Finally, the major environmental impacts of industrial development on land, water and air are explored. Potential impacts on the ozone layer, human health and natural resources are also discussed.

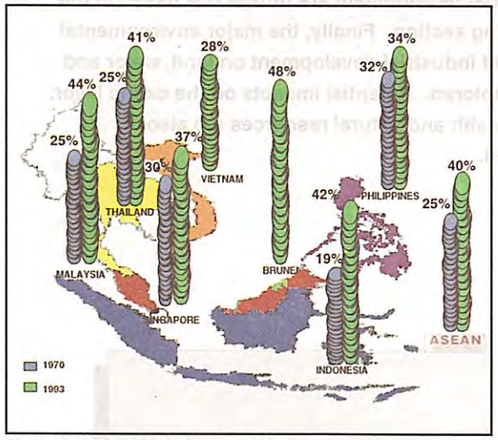
ASEAN Facts and Figures

Industry contribution to GDP (1993)	US$163 Billion
Percent contribution of industry to Total GDP (1993)	40%
Industry sector growth rate (1994)	8.7%
Manufacturing contribution to industry output (1994)	67%
Manufacturing value added (1992)	US$ 145 Billion
Direct foreign investment (1993)	US$ 15.8 Billion
Employment in industry as percent of total (1992)	15%

I. THE IMPORTANCE OF INDUSTRY TO ASEAN ECONOMIES

The remarkable performance of the ASEAN economies during the last two decades was led by the rapid growth of the industry sector which became the centerpiece of an outward-looking and export-oriented strategy. As ASEAN countries diversified their economic base away from the traditional sectors, industrial output expanded with the growth in the manufacture of higher value-added products for export. The contribution of agriculture to national output gradually declined in favor of industry , thus marking a structural transformation in the ASEAN economies, some of which have now reached the status of newly industrializing countries (NICs) .

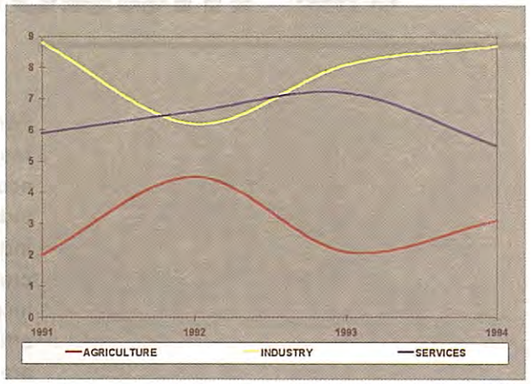
Figure 6.1: Industry Contribution to GDP (%)



Source: ASEAN Secretariat 1997; World Bank, 1995
*Note: *Brunei Darussalam and Vietnam not included; na -- data not available*

The contribution of the industry sector to the aggregate gross domestic product of ASEAN increased from 25% in 1970 to 40% in 1993 (Figure 6.1). Industrial output increased remarkably by 25 times during the same period. This expansion surpasses the growth rate of industrialized countries like Japan and Germany. The rapid expansion of industry is also reflected in the rapid rise in ASEAN's

Figure 6.2: Growth Rates of Different Sectors in ASEAN, 1991-1994 (percent)



Source: UN, 1995
Note: Data for 1993 are preliminary, and those for 1994 are estimates. For ASEAN, 1994, Brunei Darussalam is not included and Vietnam is not included in all years

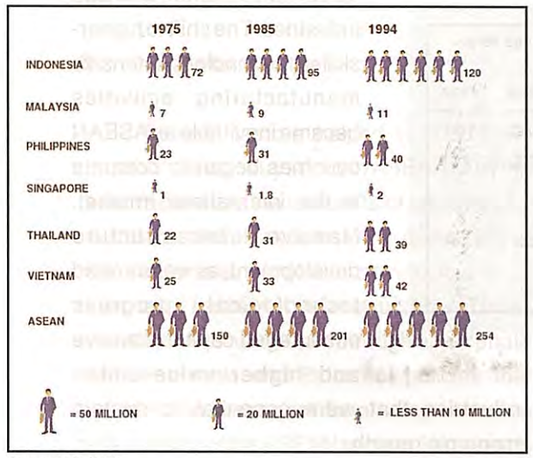
aggregate industrial production index that measures the value of the industrial outputs in relation to 1980 levels. During the period 1983 to 1992, industrial production index rose faster than the ESCAP region and the world total (UN, 1995).

During the period 1991 to 1994, the annual growth of the industry sector in ASEAN ranged from 6% to 9% (Figure 6.2) and is expected to continue at this rate throughout the 1990s. Slower rates of growth were recorded by the service sector at 6% to 7% and agriculture at 2% to 4%. Industry is expected to be the driving force propelling the fast-paced expansion and dynamic growth of the ASEAN economies in the 21st century. Projected industrial production in ASEAN countries (ADB, 1995a).

Despite its major contribution to the national output, the industry sector in ASEAN accounted for only about 13% to 15% of total employment during the period 1985 to 1992 (UN, 1995). With about 54% of the ASEAN population living in the rural areas in 1993 (ASEAN Secretariat, 1997), agriculture still remains to be the major source of employment for half of the region's population. In recent years, however, the number of persons employed in the agriculture sector has been decreasing gradually in favor of increasing shares in the industry and services sectors.

In the coming years, the employment

Figure 6.3: Economically Active Population (EAP) in ASEAN (million)



Source: ADB, 1995b
*Note: EAP refers to population in age bracket 15-65; * Brunei Darussalam not included*

share of the agriculture sector will likely decline further as agricultural expansion is limited by natural resource constraints as well as increasing farm mechanization. During the period 1985 to 1994, the average annual increase of 2.6 % in ASEAN's economically active population (EAP) could not be absorbed by the agriculture sector that expanded by only 2.5% during the period (Figure 6.3). The industry, as well as the service sectors, which has been expanding at a faster rate, should be able to absorb excess labor in the ASEAN economies.

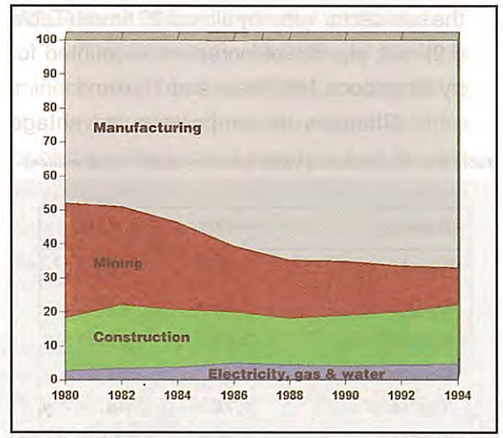
II. INDUSTRY PROFILE OF ASEAN

The combination of import substitution and export promotion strategies adopted by ASEAN to sustain growth and competitiveness has given the industrial sector a unique profile. Although many small and medium enterprises continue to dominate the sector, industries for large scale production and export were also established. Through the years, there has been a gradual shift from the simple processing of agricultural products to higher value-added and capital-intensive industries.

Manufacturing led the growth of the industry sector, accounting for more than two-thirds of industry contribution to GDP in 1994 from a level of less than 50% in 1980 (Figure 6.4). During the same period the manufacturing sub-sector expanded at an annual rate of around 19% (ADB, 1995b). The construction and utilities sub-sectors also expanded with rising per capita incomes as well as increased manufacturing activity — share of construction to industrial output increased from 15.6% in 1980 to 17.4% in 1994 while utilities was 2.7% to 4.7% over the same period. Meanwhile, resource-based industries such as mining and quarrying contracted from 33.8% of industrial output in 1980 to only 10.9 % in 1994.

The employment distribution in the

Figure 6.4: Contribution to GDP of Industry Sub-sectors in ASEAN (percent)



Source: ADB, 1995b
Note: Brunei and Vietnam are not included; for Thailand, 1993 figures were used for 1994; for Malaysia, GDP contributions at constant prices were used

different industry sub-sectors followed their relative size as measured by their contribution to the gross domestic product. Employment in industry was absorbed by manufacturing at slightly higher than 70% of the total number persons employed in 1992 (Table 6.1). Labor absorption was relatively low in the mining and utilities sub-sectors (i.e., 4% and 2%), respectively as these are mostly capital-intensive and highly mechanized. On the other hand, the labor-intensive construction sub-sector absorbed 20% of the labor force in

Table 6.1: Employment Distribution in Industry Sub-sectors in ASEAN (thousand persons)*

	1985	1990	1992	average annual increase (percent)	Percentage Share 1985	1990	1992
Industry	15,833	20,572	22,707	5.4	100	100	100
Manufacturing	10,961	14,794	16,067	5.8	69	72	71
Mining & quarrying	663	762	847	3.5	4	4	4
Construction	3,906	4,627	5,353	4.6	25	22	24
Electric, gas, water	303	389	440	5.7	2	2	2

Source: UN, 1995
*Note: * Brunei Darussalam and Vietnam are not included*

the same year.

A. Manufacturing

The manufacturing sub-sector in ASEAN countries performed remarkably well during the period 1970 to 1992. During this period, the sub-sector grew by almost 22 times (Table 6.2) with significant increases accounted for by Singapore, Indonesia and Thailand.

Changes in comparative advantage through the years have transformed the structure of the manufacturing subsector in ASEAN. As individual ASEAN countries graduated into higher stages of development, they began to lose their comparative advantage in low-wage industries. The shift to higher-skilled, technology-intensive manufacturing activities became inevitable as ASEAN countries began to compete in the international market. Massive infrastructure development, as well as rapid technological progress encouraged capital intensive and higher value-added industries that were essential to sustain economic growth.

Table 6.2: Manufacturing Value Added in ASEAN (US$ million)*

Country	1970	1992
Indonesia	1,889	49,302
Malaysia	1,040	15,909
Philippines	2,131	17,615
Singapura	569	17,910
Thailand	1,763	43,347
ASEAN*	7,392	144,083

Source: World Bank, 1995
*Note: * Brunei and Vietnam are not included*

The last two decades witnessed shifts in the manufacturing groups of ASEAN countries from low capital, low value-added (food processing) industries to capital-intensive, higher-value added industries (machinery and transport). The contribution to manufacturing value-added of the food, beverage and tobacco groups declined from 37% in 1970 to 18% in 1992 while that of the machinery and transport groups increased significantly from 7% to 30% during the same period (Table 6.3). This trend was more pronounced in the faster growing economies such as Indonesia, Singapore and Thailand.

Meanwhile global competition greatly influenced the performance of certain manufacturing industries such as textiles and chemicals. The value-added contribution of the textile and garments groups increased only slightly while that of the chemical sector decreased on account of stiff competition in

Table 6.3: Share of Various Manufacturing Groups to Total Manufacturing Value Added in ASEAN (percent)*

Country	Food, beverages and tobacco 1970	1992	Textiles and clothing 1970	1992	Machinery, transport equipment 1970	1992	Chemicals 1970	1992	Others 1970	1992
Indonesia	65	23	14	16	2	14	6	7	13	40
Malaysia	26	10	3	6	8	34	9	11	54	39
Philippines	39	37	8	13	8	11	13	12	32	27
Singapore	12	4	5	3	28	54	4	9	51	30
Thailand	23	16	14	16	4	40	25	5	34	23
ASEAN*	37	18	10	12	7	30	13	8	32	31

Source: World Bank, 1995
*Note: * Brunei Darussalam and Vietnam are not included*

the international marketplace.

B. Growth Factors

Several factors helped to foster the growth of the industry sector in ASEAN. Among these factors are the low costs of labor inputs, abundant natural resources, the availability of raw materials, and the development of adequate industrial infrastructure. These elements were harnessed through appropriate macroeconomic and industrial policies that provided the framework for a comprehensive restructuring of the ASEAN economies towards rapid industrialization. Foreign direct investments added the necessary impetus for increased capital flows and technological advancement. By the start of the 1990s, a number of ASEAN countries have reached the status of "newly industrialized economies" (NIEs), while other Member Countries are fast approaching the NIE threshold .

The availability of low cost labor has been an attraction for the more developed countries to relocate their labor intensive industries in developing countries. This was a major incentive for Japan, the United States and the developed countries of Europe to invest in ASEAN during the early stages of the region's development. In recent years, however, increasing labor cost in some of the more developed ASEAN countries has led foreign investors to consider other factors for locating in ASEAN. Industrial infrastructure, quality of labor and economic and political stability became the motivating factors for investors to locate in the region.

The growth of the mining and quarrying sectors in ASEAN has surpassed the world average for the last 10 years. However, there are only a few major metal reserves in ASEAN countries compared to other countries in Asia and the rest of the world (Table 6.4). In terms of value, Asia accounts for about 10% of total world metal reserves, with ASEAN accounting for only 1.7%. The major metal reserves in ASEAN are copper, tin, nickel and bauxite.

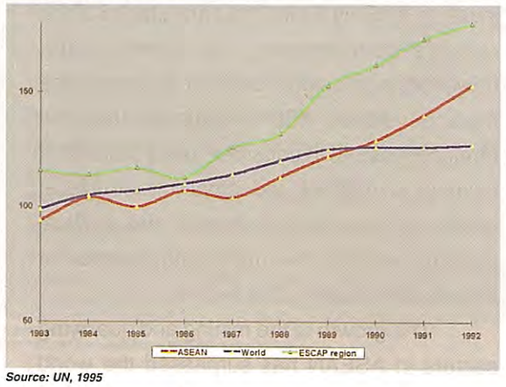
The intensive exploitation of available mineral resources in ASEAN contributed to the development of the extractive industries such as mining and quarrying. Over the last decade, the expansion of the mining and quarrying industries in ASEAN grew by approximately 5% to 6% annually, compared

Table 6.4: Values of Major Metal Reserves in ASEAN, 1989*

	World	Asia	Indonesia	Malaysia	Philippines	Thailand
Copper	731,880	68,400	6,840	2,759	22,800	0
Lead	43,389	5,903	0	0	0	246
Tin	43,002	26,550	4,933	7,979	0	1,959
Zinc	119,161	19,044	0	0	33	828
Iron ore	20,249,087	211,348	499	1,061	0	na
Manganese	114,575	3,981	0	0	0	na
Nickel	272,920	16,284	8,006	0	1,021	0
Chromium	87,340	5,652	43	0	605	na
Cobalt	25,143	152	152	0	0	0
Molybdenum	41,454	4,069	0	0	0	0
Tungsten	16,804	9,989	0	123	0	208
Vanadium	68,908	9,815	0	0	0	0
Bauxite	536,764	26,629	9,750	210	0	0
Rutile	43,363	2,652	0	0	0	0
Ilmenite	20,660	6,525	0	na	0	0
total value	4,190,350	416,993	30,223	12,132	24,459	3,241
Reserve value index (world=100)	100	9.95	0.72	0.29	0.58	0.08

Source: WRI, 1994
Note: Brunei and Vietnam are not included; na — data not available

Figure 6.5: Production Index of Mining and Quarrying in Selected Regions (1980=100)



Source: UN, 1995

to about 3% for the world. In the early 1980s, mineral production in ASEAN expanded faster than the ESCAP region although the trend reversed in the latter half of the decade (Figure 6.5). Although the mining sector is expected to gradually lessen its contribution to industrial output, it is expected to support economic growth through its contribution to the downstream industries. Mining of non-metallic products such as limestone will continue to support the construction industry that has gained strong momentum in the last decade.

The abundance of agricultural raw materials in ASEAN has also contributed to the growth of the processing industries. ASEAN countries are important producers of rubber, palm oil, coconut, spices, fruits and flowers, and fishery and marine products. Through the years, higher value-added industries evolved from the downsream processing of these commodities as the industry sector began to acquire more sophisticated technology to compete in the global market. For instance, the coconut industry that originally exported copra gradually shifted into the production of processed coconut products such as coconut oil and eventually into cocochemicals. A similar pattern was observed for other commodities. Industrial development in ASEAN was accompanied by an expansion in the infrastructure and utilities sectors (the latter covers the production and distribution of electricity, gas, and water). Although it is difficult to assess the adequacy of infrastructure and utilities development in relation to the pace of industrial growth, they tend to keep pace with increases in national incomes. Selected indicators of infrastructure development show that ASEAN countries compare favorably with countries in the same average per capita income level in terms of electricity production, provision of telephone mainlines, paved road density, and access to safe drinking water. The comparison becomes grossly unfavorable with the more advanced countries like Japan and the United States or even some of the newly industrialized countries (Table 6.5).

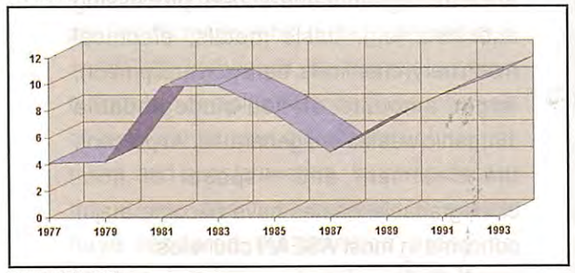
Government support to industry, including infrastructure development, has been improving as measured by the level of public expenditures for economic services (Figure 6.6). Despite this, however, substantial amounts of funds are still needed to cope with the demands of industrialization and economic growth. Meanwhile, the funding requirements for infrastructure projects have escalated because of additional but necessary

Table 6.5: Selected Infrastructure Indicators in ASEAN, 1992

Country	Electricity production (kwh per person)	Telephone mainlines (no. per 1000 persons)	Paved road density (km per million persons)	Population with access to safe water (% of total) 1991
Brunei Darussalam	na	na	na	na
Indonesia	233	8	160	42
Malaysia	1612	112	na	78
Philippines	416	10	242	81
Singapore *	6353	415	1049*	100
Thailand	1000	31	841	72
Vietnam	139	2	na	50
India	373	8	893	75
Sri Lanka	200	8	536	60
Japan	7211	464	6426	na
United States	12900	565	14453	na

Source: World Bank, 1995
*Note: na -- data not available; * figure from Yearbook of Statistics, Singapore 1995*

Figure 6.6: Total Government Expenditures on Economic Services Including Infrastructure, Electricity, Gas and Water, Transport and Communications in ASEAN (US$ billion)*



Source: ADB, 1995b
Note: Brunei Darussalam and Vietnam are not included

requirements imposed by stricter environmental standards. Given the competing demands on limited public funds, private resources are now being actively mobilized for infrastructure development (Box 6.1). Innovative schemes such as "build, operate and transfer" (BOT) and "build, operate and own" (BOO) have allowed varying degrees of private participation in the financing, operation and ownership of infrastructure and utilities. In these schemes, the government's role is confined essentially to the formulation of the policy and regulatory framework to safeguard public interest. At present, power supply, as well as transportation and telecommunications services in most ASEAN countries are already provided by private enterprises under the BOT scheme.

The combination of low-cost labor, rich resource endowments, and accelerated infrastructure development enabled ASEAN to maintain its status as an attractive location for foreign investments. Since the 1980s, foreign direct investments have played a significant role in sustaining ASEAN industrial growth by providing capital that the limited domestic capital market could not mobilize. In addition, foreign direct investments have also provided access to new markets and new technologies that enhance product competitiveness. Over the last two decades, ASEAN countries have actively encouraged foreign investments through various fiscal and financial incentives packages, facilitation measures, development of adequate infrastructure for the efficient conduct of business, and improvements in the general business climate. In 1993, foreign direct investments in ASEAN stood at US$15.8 billion,

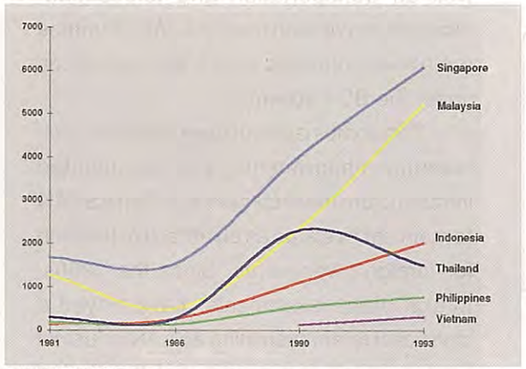
Box 6.1.
PRIVATE SECTOR PARTICIPATION IN INFRASTRUCTURE DEVELOPMENT: MALAYSIA

Since the mid-1980s, Malaysia has strongly promoted private sector participation in various infrastructure development projects such as power plants, road construction, airport and railroad expansion, sewerage and others. During this period, 18 major projects involving a total investment of about US$13 billion were awarded to private enterprises. Lately, Malaysia has also begun to privatize some of its environmental services such as the management and operation of a national air and water quality monitoring system.

The renovation of the existing national sewerage system was awarded to a private consortium under a BOT scheme in 1992. The project, involving US$2 billion, will connect 92% of urban households to sewerage networks linked to a central treatment facility, while the remaining 8% will connect to individual septic tanks. The construction will be in phases over a period of 18 months. After this period, the consortium will be allowed to operate the facilities for 10 years before transferring its ownership to the government. A monthly user fee at an average rate of about US$2.0 will be charged to each household. Project funding would come from several sources including commercial bank loans of US$ 600 million; soft loans from the Government of US$ 200 million; equity from shareholders of US$ 40 million; and the balance of the funding requirement would come from operating revenues.

Source: O'Connor, 1994.

Figure 6.7: Foreign Direct Investment in ASEAN (US$ million)



Source: ADB, 1995b
Note: Brunei Darussalam is not included

representing more than 150% increase over the 1981 level of US$3.5 billion (Figure 6.7).

III. ENVIRONMENTAL IMPACT

The success of industrial development in ASEAN is not without its consequences. The continuing exploitation of natural resources by the extraction industries, the transformation of manufacturing industries from low to high value-added processing activities; as well as the accelerated development of infrastructure continue to pose serious threats to the environment. The management of environmental problems arising from a rapidly expanding and highly diversified industry sector is one of the most important issues confronting ASEAN today.

The generation of industrial wastes and the industrial consumption of energy have contributed to air and water pollution. The nature and severity of environmental problems however, vary with industrial structure at particular stages of industrial development. Most agriculture-based industries involving simple processing generate organic wastes that are biodegradable. However, since these industries use large amounts of water, most of the organic wastes generated, if left unmanaged, could pollute major water systems. As the industry sector expands towards higher value-added processing activities (e.g. basic metals, electrical machinery, chemicals, transport equipment), larger amounts of non-biodegradable inorganic wastes are generated. At present, the treatment and disposal of non-biodegradable wastes have become major concerns in most ASEAN countries.

In Thailand, the increasing generation of toxic and hazardous wastes (Chongpeerapien et.al., 1990; Phantumvanit et.al., 1991) require complex handling and treatment systems to contain their potential effects on human health. In some cases, the generation of toxic substances and hazardous wastes have affected the health of workers as well as the people living near manufacturing plants. There were also some cases of consumers affected by toxic substances through the food chain (Wangwacharakul, 1992).

A. Impacts on Land

The impacts on land of ASEAN's industrial expansion are diverse. They include changes in the pattern of land use, depletion of mineral land resources used as feedstocks, and land degradation due to the effects of industrial activities such as resource extraction and pollution.

Although industries do not need much land (the requirement ranges from one to 10 hectares per plant), their establishment normally changes land use patterns in the surrounding areas. Support facilities like housing for employees would soon attract various upstream and downstream industries in the area. Commercial establishments are eventually set up to cater to the needs of a growing local population. Thus, agricultural areas are gradually transformed into urban centers. This has been the experience in many places in the region especially around the major cities in ASEAN (see Chapter 5 on

Agriculture).

Mining and other extractive industries are largely responsible for land degradation in ASEAN. In the past, the disposal of mine tailings has directly affected significant areas of land and caused the siltation of natural rivers and coastal waters. In some cases, the volume and toxic contents of wastes have rendered the affected areas as wastelands for many years. To address these problems, the handling and disposal of mine tailings are now strictly regulated by ASEAN Governments. In most cases, complete containment is required. Mining firms are also required to rehabilitate mined-out land.

Increasing industrial demand for feedstock has put strong pressure on producers to increase outputs by exploiting more land. The increasing cement requirements of the booming construction industry for instance, has pushed the quarrying sector for higher outputs of limestone. Although less surface area is disturbed because of the availability of huge limestone deposits in thick sediments (i.e., in hills or mountains), land topography will inevitably change with the attendant consequences on the environment.

B. Impacts on Water

Agro-based industries in ASEAN are major sources of water pollutants. These industries include sugar and oil mills, distilleries, fertilizer plants, refineries, pulp and paper mills, and food processing. Large amounts of wastewater discharged by plants or factories can extensively damage water resources and can adversely affect the ecology of the receiving water. These wastes are primarily responsible for BOD pollution of waters.

In Thailand, the major sources of water pollution are the textile, food processing, metal fabrication, plastics and chemicals industries. A limited survey in 1992 showed that the BOD loading of the textile and food industries accounted for more than 80% of total loadings

Table 6.6: Major Water Polluting Industries in Thailand, 1992

	BOD loadings (tonnes/year)	Percent of total	Number of factories
Textile	49,000	41.0	2,000
Food	48,000	40.0	3,000
Fabricated metals	9,000	7.0	5,000
Plastic product	3,000	2.0	2,000
Electrical products	2,000	2.0	154
Chemical products	2,000	2.0	559
Paper & paper products	2,000	1.0	44
Glass & glass products	1,000	1.0	28
Machinery	1,000	1.0	200
Industrial chemicals	1,000	1.0	78
Transport equipment	839	1.0	114
Beverage	394	0.33	24
Total	119,000	100	12,000

Source: TEI, 1994

from major water polluting industries (Table 6.6). In urban centers, the BOD loading from industries constitutes about one-half of the loading from domestic sources (TEI, 1994). This suggests that industry contributes about one-fourth of the total BOD water pollution in the country. The situation is similar in the other ASEAN countries except for Singapore where agri-based industries are few.

The potential impact of wastewater from industry cannot be underestimated. Aside from the need to ensure proper treatment, wastes must also be handled properly to avoid accident and spillages. In 1992, for example, an accidental leakage of molasses from a sugar mill in northeastern Thailand killed 400 tonnes of aquatic animals including fish, shrimp, snail and crab (Thailand MOSTE, 1994). In Malaysia, palm-oil and rubber effluents, along with other industrial wastes, sewage, and land development have caused water quality deterioration in the major rivers of the country. In Indonesia, the Government has identified industrial zones where critical levels of hazardous wastes are discharged into rivers and oceans.

Apart form surface water, groundwater can also be affected by the percolation of industrial wastes into the ground. In Jakarta,

large amounts of detergent, organic materials and nitrogen compounds have been found in shallow groundwater. In the industrial areas of the Bangkok Metropolitan Region (BMR), waste waters from industry as well as domestic sources have contaminated groundwater such that water at the upper aquifer was found to be unsuitable for use as process water in factories. Deeper aquifer has to be tapped at higher costs.

ASEAN countries have taken a regulatory approach to controlling pollution. Effluent standards are set by law and enforcement is used to ensure industry compliance. However, rapid industrial expansion has rendered the enforcement of pollution laws difficult in many ASEAN countries. While the regulatory system has been able to handle pollution from large factories, this has not been the case for small and medium enterprises (SMEs). Moreover,

Box 6.2
MANAGING POLLUTION PROBLEMS OF SMES: THE EXPERIENCE OF INDONESIA AND THAILAND

In terms of numbers, small and medium enterprises or SMEs dominate the industry sector in ASEAN. Among the 51,500 registered industries in Thailand, more than half are SMEs. Ten thousand of these industries are in food processing, 6,000 in fabricated products, and another 6,000 in machinery fabrication. In 1989, that there were about 20,221 water polluting firms and 17,057 firms that generated hazardous wastes. In Indonesia, there are more than 1,400,000 household enterprises and another 95,000 non-household SMEs. Majority of these enterprises are in food processing, textiles and garments, and wood industries.

The large number of SMEs in most ASEAN countries has made the enforcement of environmental regulation difficult. Since wastes generated by individual firms are small, it is not economical for them to set up their own waste treatment facilities. To address this problem, common waste treatment facilities have been established for firms with similar and complementary wastes.

An example of such facility is the hazardous waste central treatment facility that has been set up at Bang Khuntian in the Bangkok Metropolitan Region (BMR). The plant was constructed in 1988 to treat wastewaters contaminated by heavy metals and solid wastes from around 200 SME factories mostly in the electroplating and electronic industries. The facilities, which were constructed with funding from the government, are managed by a private contractor who is responsible for the collection, transport, treatment and disposal of the wastes. A waste treatment fee is levied by the contractor to the users.

An innovative approach was implemented to force factories to use the treatment facilities instead of dumping their untreated wastes. The scheme requires a potential pollutant to sign a contract with the Ministry of Industry to deliver a specified amount of waste each year for treatment and disposal. The firm is required to deposit an amount equivalent to the clean-up cost of dumping the waste without treatment which represents a fraction of the actual fee charged by the central treatment plant. After the agreed amount of wastes has been delivered, the difference between the imputed clean up cost of the wastes delivered if untreated, and the actual cost of treating the waste using the central facility, is returned to the firm with interest. To supplement the scheme, an environmental audit is also conducted for purposes of providing incentives to firms that are able to reduce their wastes.

Owing to the success of the scheme in Bang Khuntian, three other similar facilities are being planned for construction in Ratchaburi, Chonburi and Saraburi provinces. These will require an additional investment from the Government of around US$40 million.

In Indonesia, SMEs are encouraged to locate at various industrial estates where centralized waste treatment facilities are available. At the P.T. Sier industrial estate in Surabaya, for example, allowable standards are set for wastewaters generated by resident firms. Firms that exceed the standards are required to set up their own pre-treatment facilities to meet the standards. A graduated charge for wastewater treatment is levied based on both the quality and quantity of the wastes.

Similar facilities are being constructed for each cluster of industries in the Bikan Industrial zone and the Karawauy Industrial zone. Centralized domestic and industrial wastewater treatment plants are also under construction in Batam Island which is the site of a large industrial estate complex.

Source: O'Connor, 1994

most SMEs do not have the resources — both financial and technical — to handle pollution problems. This limitation, and the more complex requirements for regulating pollution from SMEs, are increasingly the focus of special attention in ASEAN in recent years (Box 6.2).

The difficulties inherent in the regulatory approach to environmental protection have prompted ASEAN countries to consider economic instruments in managing industrial pollution. The Government of Thailand has recently proposed the adoption of the "polluter pays principle" in environmental management that would allow affected parties to file for compensation from the polluters. Financial incentives are also used to induce manufacturers to move their factories out of Bangkok. In Malaysia, a combination of both economic and regulatory instruments has proven effective in reducing wastes generated by the palm oil processing industry (Box 6.3). Economic instruments have provided the flexibility or the incentives system to operate and for technological developments to be exploited as better options for waste treatment.

C. Impacts on Air

Manufacturing, together with the energy and transportation sectors, are the major sources of air pollution. These sectors

Box 6.3
WATER POLLUTION ABATEMENT IN THE PALM OIL INDUSTRY IN MALAYSIA

Crude palm oil production in Malaysia was the country's greatest source of water pollution in the 1970s. It has been estimated that pollution caused by the industry was equivalent to that generated by 10 million people. No proven treatment technology for palm oil effluent existed then. Since that time, preventive measures were instituted such that in 1985, the population-equivalent pollution load fell to about 0.08 million people. Malaysia's success in reducing palm oil effluent represents a good example of how an industry was able to cope with pollution without unnecessarily hindering its growth.

Palm oil effluent is a mixture of wastes generated during the process of extraction, sterilization, clarification and hydrocycloning of palm oil. The typical mill generates 2.5 tonnes of palm oil effluent for every tonne of crude palm oil produced. In the early 1970s, crude palm oil mills disposed their wastes by dumping them, untreated, into the nearest body of water. In 1977, 42 rivers in Malaysia were so severely polluted from palm oil wastes that freshwater fish could no longer survive in them.

To address the problem, licensing requirements for crude palm oil mills were established in the mid-1970s. Representatives from industry and Government investigated possible treatment technologies for the industry. Joint research was undertaken until a promising technology was found after two years of cooperative effort. In 1977, a specific set of palm oil effluent standards consisting of eight parameters was imposed. Compliance with standards became the basis for approving applications for an operating license required for all firms every year. Monitoring reports on effluent discharges and their composition, done by independent laboratories, are submitted regularly by all palm oil processing plants.

To help ease the burden on industry, compliance with standards was phased over a period of four years. For example, Biological Oxygen Demand (BOD) concentration in the effluent was reduced gradually from 5,000 ppm to 500 ppm during this period. Along with setting effluent standards in phases, license fees were charged in proportion to the extent of pollution discharge by the plant. This provides monetary incentives for firms to reduce pollution levels. In the early stages of implementation, mills were allowed waste discharges in excess of standards provided that extra fees were paid. This gives the mills sufficient time to install new treatment technologies for water pollution abatement. The scheme also provided for a partial or full waiver of effluent-related license fees to mills conducting research on palm oil effluent treatment.

Source: TEI, 1994

generate a number of major air pollutants, namely: particulate from cement, petrochemical and similar plants and combustion of solid fuels; sulfur dioxides from chemical plants (acid production, fertilizer, etc.) and burning of fuels containing sulfur; carbon monoxide from incomplete combustion of fuel; hydrocarbon from various chemical plants; obnoxious odor from refineries, carbon, leather and other plants; greenhouse gases from burning of fossil fuels; ozone-depleting gases from refrigeration; and air borne toxic and hazardous chemicals. The effects of these emissions are widely known and are further discussed in Chapter 3 on Air.

High concentration of sulfur dioxide can form acid rain in the surrounding areas depending on wind speed and direction. Acid rain can cause soil quality deterioration leading to losses in crops and forest growth, and damage to physical structures that pose hazardous effects on health. Meanwhile, nitrous oxide emissions are still limited and could be prevented by proper combustion control and other mitigation technologies.

Although the extent of air pollution from industrial activities in ASEAN is difficult to quantify, various estimates are available. For instance, the industry sector in Thailand generated about one-fourth of the total sulfur dioxide emissions in 1991 and more than one-half of country's total particulate emissions. The sector also produced about 15% of the country's total carbon dioxide emissions in recent years (UNEP, 1994). The rapid expansion of the industrial sector in ASEAN would likely exacerbate air pollution in the future, unless appropriate abatement measures are installed.

D. Impacts on the Ozone Layer

Chlorofluorocarbons (CFCs) and halons are two common man-made gaseous substances that deplete the ozone layer in the stratosphere. CFCs are used mostly in refrigeration, air conditioning, solvent cleaning, foam blowing, and aerosol foaming, while halons are used mostly for fire extinguishing applications. Because of their effect on the ozone layer, these chemicals are known as ozone depleting substances (ODS). ODS emissions normally increase as a country's industrialization progresses.

The ozone layer in the stratosphere plays a critical role in maintaining the welfare of living things on earth. It prevents excessive ultraviolet radiation from the sun from reaching the earth's surface. Exposure to too much ultraviolet radiation can cause discomfort and, in worst cases, cancer to humans. About two decades ago, "holes" in the ozone layer were discovered resulting from excessive emissions of ODS. As of 1991, about 3% of the earth's protective layer of stratospheric ozone is estimated to have been depleted, resulting in 6% more ultraviolet radiation falling on earth's surface. When present in the lower atmosphere, ODS produces the greenhouse effect that contributes to global warming.

Compared to other regions in the world, ASEAN uses only a small amount ODS. In 1989, ASEAN emitted about 8,000 metric tonnes of CFCs compared to 140,000 metric tonnes emitted by Asian countries, and 580,000 metric tonnes emitted by the rest of the world (WRI,1992). Following the entry into force in 1989 of the Montreal Protocol, to which ASEAN countries are signatories, Member Countries began to phase out the production and use of ODS. These measures were initiated in compliance with the schedule under the Protocol to eliminate these substances by 2005.

In 1991, or in less than three years after the Protocol's effictivity, ASEAN countries have reduced CFC emissions by 25% to 6,000 metric tonnes. Considering the advantages of promoting environment-friendly products, ASEAN countries will likely find it beneficial to eliminate the production and use of ODS earlier than the schedule in the Montreal Protocol. In

Malaysia alone, 2,500 metric tonnes of ODS are scheduled to be phased out for 61 projects by 1996 (Malaysia DOE, 1995).

E. Impacts on Health

Toxic and hazardous wastes are generated principally by higher value-added industries such as basic and fabricated metals, chemicals, electronic plating, and electronic parts and products. If not properly managed, toxic and hazardous substances can persist in the environment for years, imposing high risks to plants and animals, as well as human life and welfare.

Many ASEAN countries are experiencing problems associated with toxic and hazardous substances. Several old, small-scale factories in Malaysia engaged in textile manufacturing and metal finishing works have been discharging hazardous wastes and are unable to meet government-set standards. In the Philippines, heavy metal concentrations have been found in several rivers, especially those near large-scale mining and smelting operations. In particular, concentrations of heavy metals such as lead, chromium, copper and nickel were found in the Agno and Bued Rivers of the Baguio mining district. In Thailand, the effects of toxic and hazardous wastes on human health have been increasing since 1988, affecting not only the workers directly involved in handling these substances but also students and residents in areas near factories (Table 6.7).

Table 6.7: Number of Patients Poisoned by Toxic Substances in Public Hospitals in Thailand

Types of toxic substances	Number of patient					
	1988	1989	1990	1991	1992	1993
Lead	32	18	4	26	12	18
Manganese, cadmium	6	11	6	10	8	16
Petroleum products	16	23	7	25	28	51
Fumigants	51	43	6	52	28	27
Silica dust	-	-	-	-	3	23

Source: Thailand MOSTE, 1994

The effects on health of toxic and hazardous substances can be pervasive (Box 6.4). The Bhopal tragedy that occurred in India in 1984 was a testimony to the insidious effects of toxic substances on life and health. The incident caused several hundreds in human fatality but the full impact on health was not felt until after many years.

Toxic substances can impair the development of the young, even at low levels of exposure. Lead poisoning can affect the brain and nervous system of children after long periods of exposure. Toxic chemicals consumed through the food chain can accumulate in the body and may lead to reproductive defects. Toxic compounds can induce mutagenesis whose effects are carried forward to future generations. Toxic materials and hazardous wastes can also cause imbalances in the ecological or geophysical systems (WRI, 1994).

Comprehensive measurements on the extent of hazardous wastes generated in ASEAN are not available. Based on the rate of industrial expansion however, hazardous and toxic wastes could increase at a rate of about 5% to 7% a year. A preliminary survey in 1985 indicated that industries in Malaysia generated about 200,000 tonnes of hazardous wastes while those in Thailand generated about 106,000 tonnes. A more recent survey in Malaysia (1994) reported the quantity of wastes generated in Malaysia at 420,000 tonnes (Malaysia DOE, 1995). Most of these are in the form of dross/slag/clinker and mineral sludge, with 46% coming from the metal sector and 23% from the chemicals sector (Figure 6.8).

Based on various estimates, hazardous wastes generated in individual ASEAN countries (not including Brunei Darussalam), could range from 500,000 to over one million tonnes per year. In 1993, the Industrial Hazardous Waste Treatment Plant at Samae

Box 6.4
HEALTH EFFECTS OF TOXIC AND HAZARDOUS WASTES IN THAILAND

Although Thailand's rapid pace of industrialization has benefited the economy, it has also generated substantial amounts of industrial residuals including toxic and hazardous wastes. The complexity of the problems caused by the toxic and hazardous wastes has led to greater public awareness of their harmful effects on health and human welfare. As a consequence, the public is now more involved in reporting problems cased by toxic substances to mitigate or prevent their adverse health impacts.

In 1986, three incidents were reported. One incident involved the outbreak of skin disease and other illnesses in several villages in Nakhon Sri Thamarat province due to the release of untreated tin mining wastes into the waterways. Another incident involved lead poisoning of students in a school surrounded by 20 iron melting factories. A study revealed that the growth and mental development of these students were affected. Similar results were observed for students in schools located in heavy traffic areas. Lastly, respiratory illnesses, including lung cancer, were reported for factory workers using asbestos as raw materials.

In 1987, workers in shoe factories using benzene developed chromosome defects. The following year, there were reports of factory workers in Pathum Thani province that developed illness due to exposure to mercury.

In early 1991, a fire that broke out in chemical warehouses in Bangkok released toxic substances into the atmosphere, including methylbromide and formaldehyde. More than 2,000 people in the surrounding communities were hospitalized and an additional 10,000 suffered minor illness. Some of the chemicals released were believed to cause cancer although no follow-up studies were conducted to prove this. Consequently, the chemical warehouses were transferred to Kanchanaburi province, about 250 kilometers from Bangkok. Two years later in 1993, a second fire broke out in Klong Toei Port affecting 1,400 types of chemicals, of which 317 were highly toxic. Five people died, 45 were seriously injured, more than 3,000 were hospitalized, and 5,000 others were affected in various ways. About 642 houses were burned as a result of the fire.

In late 1991, reports were made public on the potential danger of poisoning from lead and solvents used in making computer parts. The report revealed several hundred workers getting sick and subsequently resigning from their jobs because of the risks involved.

In 1992, a ship containing vinyl chloride monomer capsized, releasing carcinogens into the Gulf of Thailand. No case of illness due to the incident was reported, however.

In 1993, a leak in the concrete landfill for toxic wastes at the Klong Tei Port was discovered. Public complaints on the potential risk to water resources in the area prompted the Port Authority to repair the leak and ensure proper management of the disposal site. A committee of experts and community representatives was set up to monitor the work.

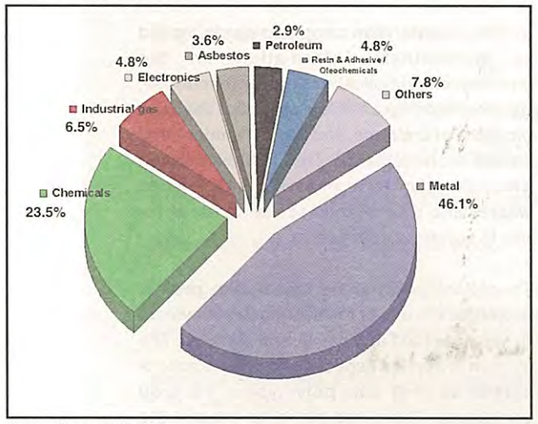
During the same year, nine workers from Lam Phun Industrial Estate died. Although the causes of death could not be ascertained, toxic substances were believed to have caused the workers' death. Several factories in the Lam Phun Industrial Estate producing and/or using highly toxic substances lack safety standards and proper management to safeguard workers' welfare. Another case was reported in 1993 on the illegal disposal and burning of semi-conductor materials in the Huay Kha Kaeng Wildlife Sanctuary. The smell and smoke emitted affected households in three villages in the area.

Sources: Wattanayingyong (ed.), et.al., 1993; Thailand MOSTE, 1995

Dam Sub-District in Bangkok treated 300,000 tonnes of hazardous wastes of which only 40,000 tonnes were disposed at the Ratchaburi Province landfill. Based on this situation alone, almost one million tonnes of hazardous wastes were either untreated or improperly disposed.

In recent years, almost all the ASEAN countries have instituted and/or upgraded legislation for the safe handling, treatment and disposal of toxic and hazardous substances.

Figure 6.8: Industry Source of Scheduled Waste Generated in Malaysia December 1994



Source: Malaysia DOE, 1995
Note: Total quantity of waste generated: 417,413 mt/year

Reporting, which has been made mandatory, should be able to generate more reliable data on the amount of wastes generated. Stricter regulatory measures would ensure that adverse impacts on health are avoided or mitigated in the long-run.

F. Resource Depletion and Degradation

Industrial production in ASEAN is highly dependent on primary resources as inputs. Industrial raw materials generated from mineral extraction and agriculture production induce increasing exploitation of land resources. In addition, industries consume energy resources for their power needs. These stresses on natural resources, if not properly managed, may cause irreversible damage to the environment.

The pace of exploitation of mineral resources depends on market prices. Although the volume of existing reserves may change due to technological advancement, the proven commercially viable reserves are likely to last for only a few decades. The availability of fuel resources in the region is now causing shifts in the use of certain types of fossil fuels. While crude oil production has been slowly declining, lignite and coal production, as well as gas production, have increased substantially since the 1980s. Production of other minerals have also declined in varying degrees. Copper production remained important while bauxite production has been fluctuating (Table 6.8).

Ideally, non-renewable resources should be exploited only when the renewable ones become insufficient. In practice, however, non-renewable resources are being exploited for higher profit margins since they are less costly to extract. The most practical way to maximize non-renewable resources is to increase the efficiency of their exploitation and use. Recycling of used materials is one of the most effective ways to reduce the rate of

Table 6.8: Trends of Mineral Extraction in ASEAN

Mining and quarrying	1983	1984	1985	1986	1987	1988	1989	1990	1991
Crude petroleum(mil. tons)	8,186	7,841	7,684	7,629	7,105	6,752	6,720	6,798	7,350
Natural gas (petajules)	1,314	1,620	1,717	1,998	2,100	2,253	2532	2694	3047
Coal (000 tons)	1,668	2,684	3,203	3,807	3,081	4,077	5,787	8,570	14,977
Lignite and brown coal	1,997	2,362	5,188	5,476	6,901	7,259	8,901	12,421	14,689
Iro-bearing ores (000 tons)	163	191	231	225	257	288	293	351	439
Copper-bearing ores (000 tons)	336	327	297	297	297	322	334	305	315
Nickel bearing ores (000 tons)	37	30	38	50	52	63	79	85	84
Bauxite (000 tons)	1,280	1,685	1,322	1,215	1,117	874	1,217	1,562	1,619
Tin bearing ores (000 tons)	88	86	75	70	71	72	78	74	62
Manganese (kilograms)	9	11	20	6	9	9	11	15	5
Gold bearing ores (kilograms)	27,968	27,156	36,039	39,262	37,151	35,228	36,195	35,748	38,817
Salt, unrefined (000 tons)	1,171	906	1,359	925	1,888	1,261	1,268	1,309	1,323
Tungsten bearing ores (tons)	594	766	606	479	652	604	560	169	300
Antimony bearing ores (tons)	134	17	12	0	129	0	0	0	0
Silver bearing ores (tons)	237	283	409	580	850	55	51	47	35
Zince bearing ores (000 tons)	5	35	51	72	75	82	88	81	87
Wood Manufacturing									
Sawnwood, broadleaved (000 cum)	16,080	15,123	14,912	15,375	18,796	19,357	114,263	20,297	20,033
Plywood (000 cum)	5182	5532	6195	7328	8243	9609	10687	9733	11740

Source: UN, 1995

Box 6.5
EXPANDED POLYSTYRENE: THE REUSE OF WASTES IN THE PHILIPPINES

Polystyrene, particularly those foamed and expandable, is one product that contributes in a major way to environmental degradation. To address the problem, the Polystyrene Packaging Council of the Philippines (PPCP) initiated a project to promote the effective use and recycling of polystyrene. The project's objectives are to disseminate information, as well as to extend technical assistance, on environmentally sound solid waste management; and to help public officials, consumers, and local businesses in effectively tackling waste disposal problems.

About 1,200 tonnes of foam polystyrene is produced in the Philippines every year. More than 85% is sold or used in Metro Manila and the remaining is sold in the provinces. Because a substantial amount is used in the capital city alone, a potentially large volume can be collected and reused, thus contributing to improvements in environmental conditions in Metro Manila. High impact polystyrene production at about 5,000 tonnes per year can also be reused.

In 1994, an extensive campaign was launched to disseminate information on the environmental implications of polystyrene use, its non-biodegradable form that causes clogging of drainage, and its CFC content that causes ozone depletion. The PPCP established a recycling plant for repropcessing segregated wastes into a semi-finished raw material for use in non-food containers.

To collect polystyrene waste, the project promotes the use of the two- trash bin system to separate food and paper, and plastics. The system is applied especially in private school cafeterias that use polystyrene as food containers. There are plans to expand the collection system to include polystyrene board or containers from industrial zones.

The collected wastes then undergo a secondary sorting to remove non-polystyrene plastics and other foreign materials. It is then washed, dried, and melted into blocks. The semi-finished raw material is exported to China and Hong Kong for application into other types of non-food containers like hangers, cassette tapes and pencil cases.

Source: PPCP, 1995.

depletion, as well as the quantity of residuals.

Recycling has been widely adopted in developed countries but the pace of adoption in ASEAN countries is relatively slow. Used paper is the most common recycled product in region. About 40% of used paper in Thailand is recycled each year. Other recycled products are glasses and plastics (Box 6.5). A particle board factory in Thailand and a pulp mill in the Philippines use bagasse (wastes from sugar mills) as raw materials. Waste recovery and recycling are increasingly used in ASEAN to extend the life of existing resources, to save on costs, and to contribute to environmental protection in the long-run.

The generation of more toxic materials and hazardous wastes in the next decades of ASEAN industrial expansion will make require effective systems for managing industrial wastes and controlling air and water pollution. Economic development and industrial growth cannot be sustained without adequate protection to the environment.

References

ASEAN Secretariat. 1997. *ASEAN Statistical Indicators*. ISEAS.

ADB. 1995 a. *Asian Development Outlook.*

ADB. 1995 b. *Key Indicators of Developing Asian and Pacific Countries.*

ADB. 1996. *Asian Development Outlook.*

Chongpeerapien, T. et.al. 1990. *Energy and Environment: Choosing the Right Mix*. Research Report No. 7, The TDRI Year-End Conference on Industrializing Thailand and its Impact on the Environment. Ambassador City Jomtien, Chon Buri. December, 1990.

Malaysia DOE. 1995. *Project Management Office for the Montreal Protocol.* Montreal Protocol Unit. April, 1995.

O'Connor, David. 1994. *Managing the Environment with Rapid Industrialization*. OECD.

PPCP. 1995. *Summary Note from Secretary General*, PPCP Inc. Manila, Philippines. March, 1995.

Phantumvanit D. et.al. 1991. *Industry and Environment in The Environment '91*. Proceedings of The Second Conference on Natural Resources and Environment Conservation in Thailand edited by Prilya Nutalai and others (in Thai), 15-16 June. Bangkok.

TEI. 1994. *Applying Polluter-Pays-Principle-Time for Action*, Annual Conference, New Solutions for Sustainable Development, Linking Policies with Action, 29 July, 1994. Ambassador Hotel. Bangkok.

Thailand MOSTE. 1994. *State of Pollution for Thailand, 1993*. Department of Pollution Control, Ministry of Science, Technology and Environment.

Thailand MOSTE. 1995. *State of Environment, 1992-1993*. Office of Environmental Policy and Planning, Ministry of Science, Technology and Environment.

UNEP. 1994. *Environmental Data Report, 1994-1995.*

UN. 1995. *Statistical Yearbook for Asia and Pacific Region, 1994*. New York.

World Bank. 1995. *World Development Report, 1995 Worker in an Integrating World.*

WRI. 1992. *World Resources, 1992-1993: Toward Sustainable Development*. Oxford University Press.

WRI. 1994. *World Resources, 1994-1995: People and the Environment*. Oxford University Press.

Wangwacharakul, Y. 1992. *Environmental and Consumer Protection Aspects of Agro-Industry in Thailand*. A research report submitted to FAO.

Wattanayingyong, S.N. (ed.) et.al. 1993. *Environment '93, Public Participation in Environmental Management is Needed*, Proceedings of the Fourth Natural Resources and Environment Conservation in Thailand, 18-19 December, 1993. Sirikit National Conference Center.

Chapter 7
Energy & Transport

Energy is vital to economic and social development and transport is a major user of energy. At the same time, energy development and utilization create impacts on the environment. Energy use in the transport sector causes local air pollution problems especially in urban centers. Energy use, in general, is responsible for most of the greenhouse gases released to the atmosphere.

In this chapter, the importance of energy resources and its profile in the ASEAN region are discussed in the first and second sections. Utilization of energy resources in ASEAN is then explored in the third section. The fourth section is devoted to energy aspects of the transportation sector. Finally, the environmental implications of energy utilization to the region are concluded.

ASEAN Facts and Figures

Annual commercial energy used	129.3 million TOE
Annual growth rate (1980-92)	7.5%
Annual per capita commercial energy use	441 KOE
Total power production	181,000 Gwh
Annual growth rate (1980-92)	6.5%
Energy intensity per US100 GDP	43 KOE
Oil share to total commercial energy use	70%
Net oil importation per year	58 million barrels
Energy self reliance	137%
Annual production.of charcoal & fuelwood	25 million cubic meters
Share in final energy consumption	
Industry	33%
Transport	39%
Paved road per thousand population	0.7 kilometer
Annual air passenger-km	93,000 million
Annual air tons-km	4,300 million
Total annual CO2 emission per capita	1.24 tonnes

*Note: *Data are for 1992 unless otherwise stated.*

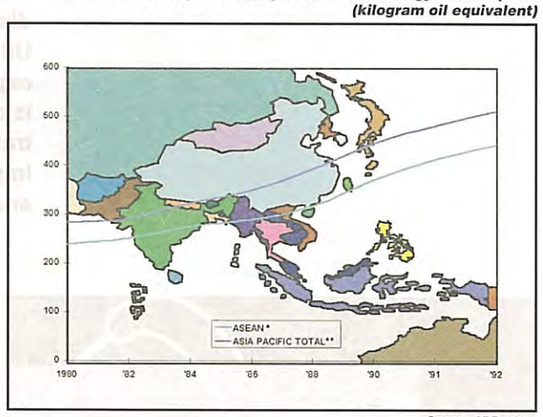
I. ENERGY AND THE ECONOMY

Energy is an essential factor in economic development. In the past, energy consumption has been used as an indicator of a nation's affluence and level of development. Higher per capita energy use implied a higher degree of industrialization and a higher level of per capita income. In recent years, however, environmental considerations have led even the industrialized countries to deliberately reduce their energy consumption. While high levels of energy utilization usually accompanied the early stages of economic development, as in the case of most ASEAN countries, the relationship between the level of development and energy consumption is no longer fully applicable today.

In the past, the concern for energy resources centered on the need to ensure sufficient and cheap energy supplies to meet growing demand. The oil shocks of the 1970s however, demonstrated the vulnerability of many countries to the supply of fossil fuels. Thus, the concern for energy resources began to focus on the development of alternative and indigenous sources of supply and efficiency in utilization. At the same time, the world also began to realize the risks of greenhouse gases generated mostly from energy use. The attainment of higher growth with less energy consumption has become a global challenge.

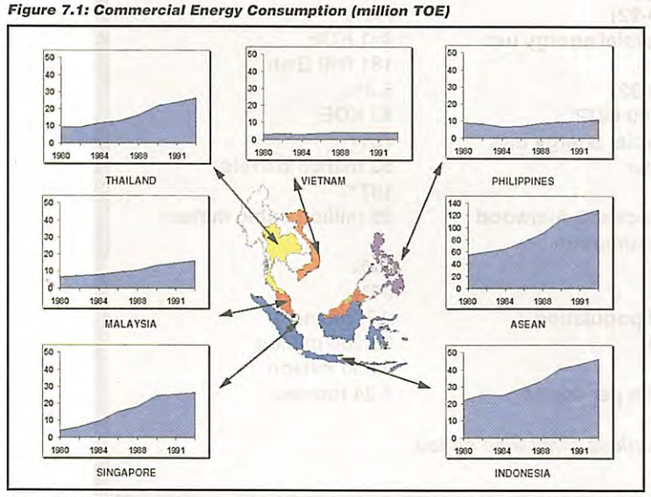
During the past few decades, ASEAN's energy consumption has been increasing as a result of rapid industrial expansion and high population growth. Aggregate commercial energy consumption in ASEAN more than doubled to over 129 million tons of oil equivalent (TOE) in 1992. This translated to an average annual growth rate of 7.5% during the period 1980 to 1992, a level that is significantly higher than the 5.6% for all the Asia-Pacific developing countries (Figure 7.1).

Figure 7.2: Per Capita Primary Commercial Energy Consumption (kilogram oil equivalent)



Source: ADB, 1995a
*Note: * Energy consumption of Brunei not included; ** Regonal total includes NIEs, North Asia, ASEAN and South Asia*

Figure 7.1: Commercial Energy Consumption (million TOE)



Source: ADB, 1995a
*Note: * Energy consumption of Brunei not included; ** Regonal total includes NIEs, North Asia, ASEAN and South Asia*

Despite this high growth rate, commercial energy use in ASEAN on a per capita basis is still low compared to other countries and regions in the world. It grew at an average rate of 5.3% annually from 1980 to 1992, similar to other Asia-Pacific countries (Figure 7.2). In absolute terms, energy consumption per capita in ASEAN is only 86% of the average per capita consumption in Asia Pacific. Compared with developed countries, ASEAN energy consumption per capita is about one-tenth of Japan's and one-twentieth of the USA's (WRI, 1994).

Energy consumption is likely to increase further as the ASEAN economies continue to expand. Higher levels of energy utilization however, could be offset by increasing energy utilization efficiency or decreasing energy intensity (i.e., energy consumed per dollar of output produced). Almost all developed and industrialized economies have attained declining energy intensity (UNDP, 1995). In ASEAN, however, energy intensity has been increasing for the past 13 years, at a very gradual pace (Figure 7.3). In 1992, energy intensity in ASEAN was 3.7 times that of Hongkong and 1.2 times that of Korea. Compared with South Asia, energy intensity in ASEAN is 40% less.

The long-term prospects for increasing

Box 7.1
DEMAND-SIDE ENERGY MANAGEMENT PROGRAMME IN THAILAND

An average increase in power demand of 1000 megawatt per year has put pressure on Thailand to seek new sources of power supply. In 1992, it was estimated that investments of about US$2,000 million in power: generation and transmission facilities would be required annually to serve increased demand. To complement efforts in providing additional power supply, demand-side management (DSM) was adopted as a viable approach to cope with increasing power consumption.

Demand-side management seeks to promote efficiency in the utilization of energy. Consumers are not necessarily induced to consume less electricity per se, but to get the same level of goods and services by using less energy. Thus, the costs of electricity services is automatically reduced. Consumers are given the choice to participate in the programme, with Government providing the necessary incentives and support measures. A budget of US$189 million has been allocated for the scheme in 1993.

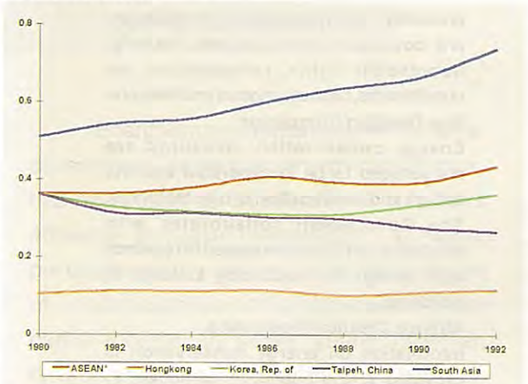
The DSM programme started in 1993. From an energy savings level of about 75 Gwh and 14.3 MW peak capacity in the first year, it is expected to reach the target of 1,427 Gwh and 238 MW peak capacity when the programme is in full swing. Several measures are currently being implemented under the programme as follows:

- Energy Efficient Appliances Programme. Power savings are promoted by implicitly or explicitely subsidizing the cost of installation of more efficient appliances. Different approaches to induce the public to acquire energy efficient appliances are promoted. Six types of electric appliances are covered in the program, namely: fluorescent lights, refrigerators, air conditioners, ballasts, motors and freezers.
- New Dwelling Programme. Energy conservation measures are encouraged to be incorporated into the design and construction of new buildings. The Government collaborates with academic institutions engaged in research and design for electricity savings in buildings.
- Attitude Creation Programme. Information on energy conservation is provided to the public, in particular, to students. Activities to introduce energy conservation concepts to more than 30,000 schools across the country have been planned. By 1996, energy conservation courses will be introduced nationwide.
- Load Management Programme. Appropriate technologies to improve power loading are applied in large buildings. The initial cost absorbed by the DSM capital fund and refunded by the participants from monthly tariff saved.

The successful implementation of the DSM is expected to generate energy savings of more than 1,400 Gwh per year. If normal transmission and distribution losses and reserve requirements are taken into account, the savings will reach 1,600 Gwh per year. The estimated cost of the DSM programme (at 10% discount rate) is between 1.2 to 4 cents per Kwh while the cost avoided from power generation is 4.3 cents per Kwh. The net benefit of the program is approximately 0.27 baht (1.1 cents) per Kwh.

Source: TDRI and TEI, 1993

Figure 7.3: Energy Intensity in Gross Domestic Product (TOE per '000 US$ at 1992 prices)



Source: ADB, 1995a
*Note: * Brunei not included; Viet Nam included starting 1986*

energy utilization efficiency throughout the world is promising — countries will be able to diversify production and use more efficient technologies. ASEAN countries are pursuing this goal steadily and deliberately through energy programmes that promote adequate and diversified supplies, efficient utilization (Box 7.1), and environmmental protection. Most ASEAN countries are in transition to becoming more energy-efficient economies, moving towards the level of efficiency that has been attained by many industrialized countries.

The importance of energy to the economy goes beyond the sector's direct contribution to the gross national product. It acts as a catalyst for various economic activities, allowing them to expand as long as reliable energy supply is assured. It is a vital element in the overall industrial infrastructure that has made ASEAN an attractive place to invest. On the other hand, shortage of energy supply can cause serious disruption to the economy. This was experienced by the Philippines during the late 1980s and early 1990s and was a major factor for its economic slowdown during the period (Box 7.2).

Box 7.2
ECONOMIC COSTS OF POWER SHORTAGE IN THE PHILIPPINES

Shortage of power is one of the major factors responsible for the economic slowdown in the Philippines in the early 1990s. Industry was the hardest hit of all sectors. It recorded a negative growth of 4% in 1991, recovering slightly to negative 0.5 % in 1992, and posting a modest gain of 1.8% in 1993. Metro Manila, where most industrial development is concentrated, experienced frequent brownouts which stalled production and caused a decline in industrial output.

In 1992, the power shortage cost the manufacturing sector about 17.4 billion pesos (about US$ 682 million) in terms of gross value added, with the Luzon region where Metro Manila is located, accounting for 71%. Within the manufacturing sector, cement, which is energy intensive, incurred the largest losses (4.9 billion pesos or US$ 192 million), followed by chemical products (2.7 billion pesos or US$ 106 million) and footwear and garments (1 billion pesos or US$ 39million).

Loss of production potential was estimated by the government at nearly 10 billion pesos (US$368 million) for the first quarter of 1993. The private sector, on the other hand, estimated a higher loss at 20 billion pesos (US$735 million). During this year, food manufacturing experienced the largest production cutback amounting to 3.4 billion pesos (US$125 million), followed by footwear and garments and chemical products.

The degree to which industries were affected by the power shortage demostrated their relative adaptation capabilities. Large-scale and higher value-added industry (such as oil refineries and chemical) were in a better position to absorb the effects of power outtages. They were able to acquire generators which small and medium industries were not able to do because of limited capital and absence of economies of scale. On the whole, small and medium enterprises carried the brunt of the power crisis.

The Government acted decisively to avert the power crisis. The legislature immediately passed a special law that restored the Ministry of Energy and gave the President emergency powers to act expeditiously on energy matters. Construction of several power plants was put on the "fast track'. Most of these are diesel plants that supplied additional power to the grid. Private sector financing for power projects was mobilized through the "build, operate and transfer" (BOT) schemes. Meanwhile, the government also started the construction of bigger power plants to expand the base load of the power grid.

Source: Government of Philippines

II. ENERGY RESOURCES

Energy resources can be classified as non-renewable and renewable. At present, practically all commercial energy sources used world-wide are from non-renewable energy resources, of which more than ninety (90) percent come from fossil fuels. This is also the case in ASEAN which relies primarily on crude oil as its primary energy source. Two ASEAN countries—Brunei Darussalam and Indonesia—are major producers of oil.

In the 1980s, oil comprised more than 86% of ASEAN's primary energy source (ADB, 1995a). In the aftermath of the oil crisis in the 1970s, ASEAN countries took steps to reduce its dependence on oil and to diversify its energy sources. In 1992, the share of oil was reduced to less than 70%, while the share of coal and natural gas increased to 7.8% and 17.4%, respectively. The increasing use of natural gas is encouraging because its impact on the environment is relatively less severe. In comparison, other countries are shifting to coal, although ASEAN's use of this resource has also been increasing.

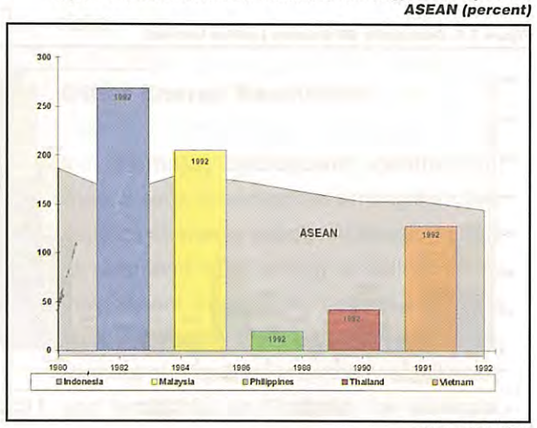
Under Ideal conditions, the choice of energy sources should be based on economic efficiency. In reality, however, other factors have affected the choice of energy sources, among them, the availability of indigenous alternatives, the urgency of the need, and the imperatives of environmental protection. Because energy sources take a long time to develop, the more expedient, though not necessarily efficient source is used. In solving the 1993 power crisis, for example, the Philippines opted to take the interim step of installing several hundred megawatts of diesel engine power plants to service Metro Manila for about two years. Hydropower plants would have been the least costly alternative, but these would take about 4-6 years to construct and commission.

In recent years, environmental considerations have been included as a criterion in selecting the appropriate energy source. This criterion has been integrated into the decision making process primarily through the environmental impact assessment of energy projects.

ASEAN countries have also taken steps to develop indigenous sources of energy to reduce their dependence on oil imports and to cushion their economies from the volatility of external supply. Notwithstanding these efforts however, ASEAN continues to rely heavily on imported oil. Although ASEAN has been a net exporter of energy, its self-reliance ratio (measured by the share of indigenous energy production to total primary energy consumption) has been declining over the past ten years because of the rapid increase in energy consumption (Figure 7.4).

ASEAN's self-reliance ratio declined from 176% in 1980 to 137% in 1992. Conditions

Figure 7.4: Self-Reliance in Commercial Energy Consumption in ASEAN (percent)



Source: ADB, 1995a
*Note: *Self-reliance is defined as percentage share of indigenous energy production to total primary energy consumption; *Brunei not included in aggregate for ASEAN*

in individual countries vary widely. During the period 1980 to 1992, the Philippines, Singapore and Thailand have been net importers of energy. Singapore has consistently imported all of its primary commercial energy supply, while Vietnam has shifted from being a net importer to a net exporter of oil. There have been perceptible improvements however, in the the self-reliance ratios of Malaysia, the Philippines and Thailand.

Crude Oil

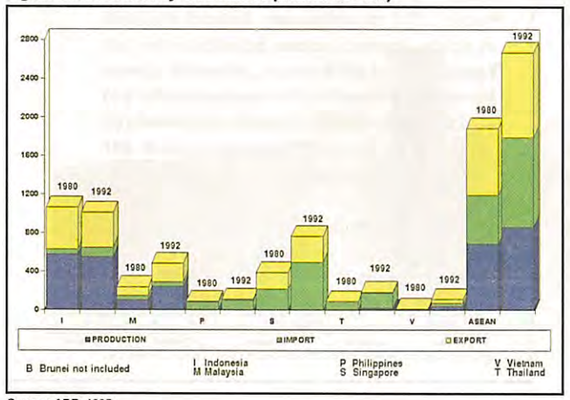
The major fossil fuels in the world are coal, petroleum and natural gas. Coal constitutes about 57% of the proven commercial energy reserves in 1990. The balance is shared almost equally by oil and natural gas (UNEP, 1994). At 1990 production rates, total world coal reserves can last for another two centuries whereas oil and gas only for another five decades.

Crude oil is the most important fossil fuel in ASEAN. The region produces roughly 100 to 110 million barrels of crude oil every year representing less than 5% of total world production (UNEP, 1994). During the last decade however, ASEAN's crude oil consumption increased more rapidly than production, making ASEAN an importer of crude oil in the 1990s (Figure 7.5).

In 1992, the proven oil reserves in ASEAN (excluding Brunei Darussalam) have been estimated at more than 10 billion barrels or about half of the total for developing countries in the Asia Pacific region. Using 1992 production rates, ASEAN's proven oil reserves would be equivalent to about 12 years of production. In Brunei Darussalam, crude oil production is estimated at only 4% of proven reserves (UNDP, 1995).

Oil production in ASEAN is increasing, but not as fast as the increase in oil consumption that grew by more than 41% from 628 million barrels in 1980 to 887 million barrels in 1992. Although oil exports have increased, the faster rate of growth in oil imports will likely continue to make ASEAN (excluding Brunei Darussalam) a net importer of oil in the future. The situation in other Asia-Pacific developing countries is less favorable, as they are more dependent on external sources of oil supply.

Figure 7.5: Commodity Oil Balance (million barrels)



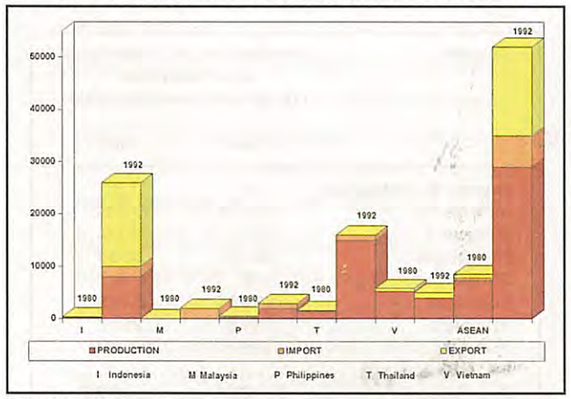
Source: ADB, 1995a
Note: Brunei not included

Coal

Less than one-half of total coal reserves in the world is recoverable. Most of them are of anthracite and bituminous types although there are also sub-bituminous and lignite coals covering about 40% of total coal reserves. In 1992, total coal reserves in ASEAN was placed at 37 billion metric tonnes, most of which are of the sub-bituminous and lignite types (ADB, 1995). These are soft coals with low energy content and high carbon content. Most of these coals are found in Indonesia, with small quantities found also in Thailland, Malaysia and Viet Nam. ASEAN accounts for less than 1% of the total world production of coal.

Coal consumption in ASEAN has increased significantly from 6.6 million tonnes in 1980 to 32 million tonnes in 1992 (Figure 7.6). The shift to coal is economic driven and for some countries, part of a deliberate move to reduce dependence on imported oil and save foreign exchange. The growth in coal consumption comes from increases in

Figure 7.6: Commodity Balance for Coal in ASEAN (thousand tonnes)



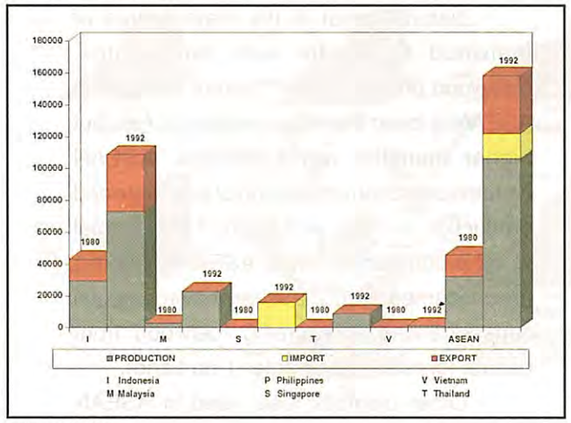
Source: ADB, 1995a
*Notes: na = data not available; * Brunei not included in total for ASEAN; ** Regional total includes NIEs, North Asia, South East Asia, South Asia and Fiji*

local production that is growing at an annual rate of 12% and importation that is growing at an average annual rate of 23%. ASEAN has started to export coal in commercial quantities amounting to about 17 million tonnes in 1992.

Natural Gas

Natural gas is another important fossil fuel resource in the ASEAN. In 1992, total natural gas reserves in the region was estimated as more than 4,000 billion cubic meters, or about 3% of total world reserves (Figure 7.7). This is equivalent to about 42 years of production based on 1992 levels. The presence of natural gas is more evenly distributed among ASEAN countries compared to other fossil fuels, although substancial volumes are found in Indonesia and Malaysia. In 1991, ASEAN contributed about 5% to total world production of natural gas.

Figure 7.7: Commodity Balance for Natural Gas in ASEAN (million cubic meters)



Source: ADB, 1995a
*Notes: na = data not available; * Brunei not included in total for ASEAN; ** Regional total includes NIEs, North Asia, South East Asia, South Asia and Fiji*

Natural gas is becoming an important source of energy in ASEAN because of the rapid depletion of crude oil reserves. Over the last 15 years, consumption rose more than 5 times to a level of 29 billion cubic meters in 1992. Indonesian export of natural gas increased three times to 36 billion cubic meters in the same year. In Malaysia, the share of natural gas to primary energy sources is expected to increase substantially to 30% by the year 2000. Apart from its use as an energy source in power generating plants and as feed stock for gas-based petrochemical plants, natural gas is also used for air-conditioning, water heating and cooking in households and commercial buildings etc. (National Steering Committee on Environment and Development, 1992). The possibility for using natural gas for transportaion is also being studied.

Environmental problems associated with the use of natural gas is less compared to other sources of fuel. Natural gas causes much lower pollution. It is the only commercial fuel so far that meets most of the present environmental standards in terms of emissions and associated environmental risks.

Other Energy Resources

Biomass, hydropower, geothermal, wind, solar and nuclear are among the other sources of energy supply. Although the use of solar and wind energy is still relatively insignificant in ASEAN, several initiatives have been taken to harness these resources. Present applications are mostly small scale and traditional. In Thailand, for example, solar energy has been used for drying salt

ponds and rice paddies since many centuries ago. A small solar water heating industry has been established for almost a decade, using solar collectors for water heating in hospitals, hotels and a small number of private houses. Development of appropriate designs for solar driers and solar stills is continuing, although efforts have been generally hampered by high development costs compared to the more conventional sources.

The potential of wind energy is also limited because of relatively low wind velocity throughout the region except along the coasts.

Besides fossil fuels, ASEAN has a small reserve of uranium all of which is found in Indonesia. In fact, Indonesia is the only country in Asia that has uranium, comprising less than 0.5% of the world total reserves. Although there is no operating nuclear power source in ASEAN at present, nuclear power is expected to become an important substitute to fossil fuels in the long-run. However, the capability of ASEAN countries to manage the associated risks from nuclear plant operation remains to be a major concern. Biomass, hydropower and geothermal resources are the non-fossil fuel sources that will likely be tapped for commercial utilization in the near term.

1. Biomass

Biomass is the most important source of energy in the rural communities. At the global level, biomass in all forms supplies about 14% of the world's primary energy, although the extent of usage between countries varies widely. Biomass can contribute up to 70% of national energy consumption (UNEP 1993). Because biomass has a relatively higher hydrogen to carbon ratio compared to fossil fuels, it contributes less to greenhouse gases for the same amount of energy generated.

Biomass fuels come in processed or unprocessed forms. Processed biomass includes charcoal and methane; while unprocessed biomass includes fuelwood, straw, dung, vegetable matter and agricultural wastes. Biomass is the major source of energy that supplies rural households with their daily fuel requirements, especially for cooking and space heating. In many cases, electricity in rural areas does not directly substitute for biomass since it is used mostly for other household accessory items such as lighting, television, and to limited extent, irrigation.

Table 7.1: Production of Fuelwood and Charcoal

Country	Production of Fuelwood and Charcoal (1000 cubic meter per year)	
	1979-81	1992
Brunei Darussalam	8	8
Indonesia	11553	14628
Malaysia	671	916
Philipines	2632	3504
Singapore	0	0
Thailand	2900	3486
Vietnam	1945	2516
ASEAN	19709	25058
All Developing Countries	124304	163352

Source: UNDP, 1995

Firewood and charcoal are still extensively used in most of ASEAN countries (Table 7.1). Production of fuel wood and charcoal has increased by 27% from the period 1979-81 to 1992. ASEAN accounted for 15% of developing countries' total production of firewood and charcoal over the same period.

Natural forest is the main source of fuelwood supply for rural households. Fuelwood production per hectare of forest in ASEAN is lower than the average for Asia but higher than the world average. ASEAN conntributed about one-fourth of total fuelwood production in Asia and about 11% of total world production in 1990. ASEAN countries are concerned about the severe environmental consequences of sourcing fuelwood from natural forests (see Chapter 1 on Land).

Other biomass fuels used in ASEAN include crop wastes, biogas, animal dung and

industrial wood wastes. The uses of these fuels vary among the ASEAN countries depending on their availability and existing alternative uses in specific areas. Indonesia and Thailand use crop wastes for biomass energy, Malaysia uses biogas from different raw materials while the Philippines uses agricultural and industrial wastes. There are other biomass fuels such as biogas energy generated from anaerobic digestion of sewage and landfills, but these are not yet commonly used commercially in ASEAN (UNEP, 1994).

Table 7.2: Estimates of Forest Area and Fuelwood Production in Selected Countries

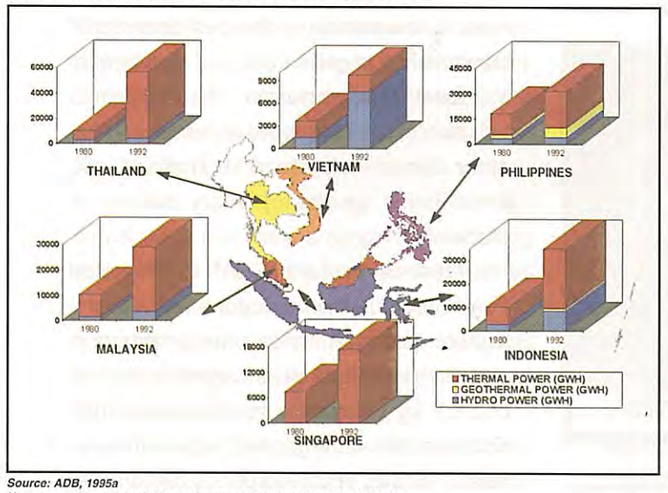
Country	Total Forest Area (million hectares)	Productive Forest Area (million hectares)	Fuel Wood Production (thousand tonnes)	Fuel Wood Production per hectare
World	3,878	2,542	1,415,168	0.56
Asia	518	346.8	605,521	1.75
ASEAN	179.4	92.5	157,940	1.71
Brunei**	0.5	0.15	110 cu.m.	0.73*
Indonesia	119	75.6	102,179	1.35
Malaysia	21.0	15.6	6,318	0.41
Philippines	15.9	1	24,322	-
Thailand	23.2	-	25,064	-

Source: UNEP, 1993*
** including other traditional fuel sources taken from WRI, 1993*
*** figures from national statistics.*

2. Hydropower

Hydropower is the second most important sources of electricity in ASEAN, although its contribution to total electricity supply is still rellatively small. The share of hydropower electricity to total electricity supply peaked at 20% in 1984 (ADB, 1995a), but gradually declined to about 15% in 1992 (Figure 7.8). While the region has very high theoretical potentials for hydropower resource of more than 3700 Terawatt hours, it has tapped only less than one percent of this resosurce as of 1992. In some countries like the Philippines, however, higher levels of utilization of up to 7% have been reached.

Figure 7.8: Commodity Balance for Electricity in ASEAN



Source: ADB, 1995a
*Notes: na = data not available; * Brunei not included in total for ASEAN*

Over the peiod 1980-1992, hydropower generation in ASEAN has increased from 10500 to 28400 Gwh, or an average of 13% annually. Although the rate of increase is substantial, hydropower generation contributes only a small portion to total energy supply. The impediments to the development of hydropower resources are high investment costs, long construction periods, and potential adverse impact on the environment. Hydropower development can cause the displacement of people, especially cultural minorities, and wide destruction of biodiversity, Largely because of these factors, its share to total electricity production in ASEAN is likely to remain small.

3. Geothermal

Geothermal resources is another source of energy in ASEAN. Power generated from geothermal resources is found mostly in the Philippines, with some limited quantities found also in Indonesia. Similar to hydropower, the theoretical potential for geothermal power in ASEAN is very substantial (45000 terawatt) although all are concentrated in Indonesia and the Philippines. In 1992, the amount of geothermal power generated was only 0.02% of total geothermal

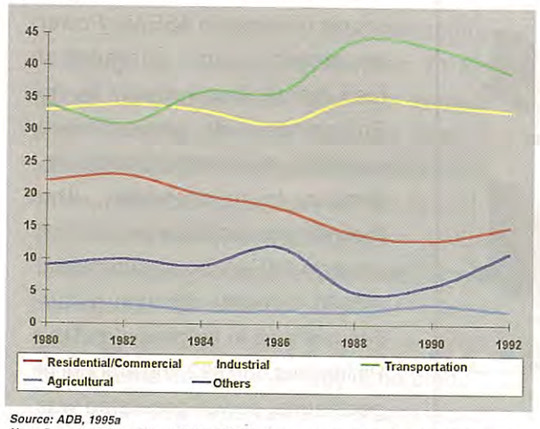
potential and only 3.8% of total electricity supply.

On the whole, the energy production structure in ASEAN indicates that fossil fuels will remain the most important energy source in the near future, while biomass will continue to be the major source of traditional fuels. Increased fossil fuel utilization would result in higher levels of carbon emission. Meanwhile, the utilization of traditional fuel (in particular fuelwood) would reduce the available carbon sink especially if land is converted to other uses. In countries where forest land is already limited, further deforestation could escalate associated environmental problems.

III. ENERGY UTILIZATION

The transportation, industry and commercial/residential sectors are the largest consumers of energy (Figure 7.9). In 1992, the transportation and industry sectors combined accounted for almost 70% of total consumption in ASEAN. The structure of energy consumption did not change much during the period 1980 to 1992, except for a slight increase in the share of the transportation sector, and a slight decrease in the share of residential and commercial consumption.

Figure 7.9: Sectoral Structure of Final Energy Consumption in ASEAN (percent)



Source: ADB, 1995a
*Note: Brunei not included in total for ASEAN; *Energy consumption refers to primary energy supply prior to transformation to other end use fuels such as electricity and refined petroleum products, whereas, consuming sectors are the ultimate users of these end fuel products*

A. Power Generation

Electricity production in ASEAN is growing rapidly in line with the rapid expansion of the industry sector. Most electricity in the region is generated from fuel oil in thermal power plants and this pattern is expected to continue in the long-term. In 1980, 83% of total electricity production came from thermal power plants, increasing slightly to 84% in 1992 (ADB, 1995b). In contrast, the share of electricity generated by hydropower plants increased during the 1980s but declined gradually in the 1990s.

ASEAN per capita consumption of electricity essentially reflects the level of development of Member Countries. Singapore has the highest per capita electricity consumption of 5,656 kwh while Vietnam has the lowest at only 100 kwh. Per capita electricity consumption in Indonesia, Malaysia, Singapore and Thailand, has increased significantly during the last two decades (ADB, 1995b). Different rates of increase among Member Countries largely correspond to the levels of economic growth that results in increased demand for higher value-added goods and services requiring electricity.

The type of primary energy used by individual Member Countries is determined by resource availability and the economics of its use. The Philippines used fuel oil to produce most of its electricity in the past because of convenience in generation and distribution. In recent years, however, the Philippines has diversified its sources of power. On the other hand, Malaysia and Thailand use natural gas as their primary source of electricity.

Most electricity in ASEAN is generated from fuel oil, which unfortunately, has the highest carbon emission rate compared to other sources. Fuel oil has an emission rate of 21.1 kg of carbon per Gigajoules (Gj) compared to natural gas that has an emission rate of 15.3 kg of carbon per Gj. Solid fuels,

which are increasingly becoming important in the region, emit higher carbons ranging from 25.8 to 27.6 kg of carbon per Gj.

B. Industry

Industry consumes about one-third of total energy in ASEAN. With rapid economic growth, industry's share to total energy consumption will likely increase. Industrial energy consumption in Malaysia is 40% of total energy, compared to 33% for Indonesia and the Philippines, and 27% for Singapore and Thailand (Table 7.3).

Table 7.3: Energy Consumption in the Industry Sector in ASEAN (thousand TOE)

Country	1980	1982	1984	1986	1988	1990	1992
Indonesia	5,350	6,668	6,774	6,616	7,754	10,411	12,215
Malaysia	2,867	3,152	3,294	3,412	3,710	5,263	6,451
Philippines	4,248	3,719	2,515	2,517	3,161	3,376	3,336
Singapore	1,739	2,816	4,560	7,171	8,615	10,587	11,523
Thailand	2,722	2,454	2,743	3,064	3,941	5,258	7,484
Vietnam	751	858	1,004	1,060	1,166	1,169	1,032
ASEAN*	17,677	19,666	20,891	23,839	21,327	28,384	42,042

Source: ADB, 1995b
*Note: * Brunei not included*

The structure of energy consumption in ASEAN countries varies depending on the availability of the energy source, the types of products and the production technology used. The amount of energy consumed also varies depending on the efficiency of production. These factors consequently determine the composition and amount of energy used and the attendant environmental impacts.

The types of energy used in the industrial sector vary among manufacturing activities. In the Philippines, most industries use fuel oil, except cement and some mining firms that use coal. Diesel is used in almost all industries but primarily in transportation and for back-up power generation.

Energy intensity in most ASEAN countries is 0.2 TOE per US$1,000 of industrial output. Energy intensities and utilization efficiencies vary by industry depending on the production processes and technologies used. The energy intensities of two factories producing the same product can vary by as much as 100% (ESCAP, 1994). In general, manufacturing industries in advanced countries are more energy efficient than those in developing countries.

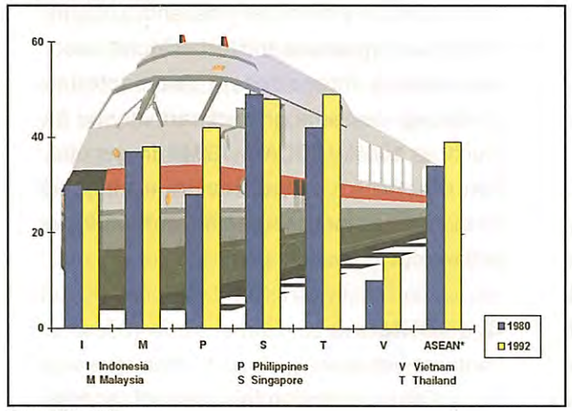
C. Others

Other commercial uses of energy include those for residential and commercial, agriculture, mining and construction purposes. Energy used for residential and commercial purposes is mainly in the form of electricity, LPG and kerosene. Renewable energy sources such as fuelwood, charcoal, and paddy husk are used in the residential sector as well. In Thailand, the major energy sources in agriculture are fuelwood and charcoal, followed by high-speed diesel, while those in the construction sector are mainly high-speed diesel (Thailand MOSTE, 1992)

IV. TRANSPORTATION

The transport sector in ASEAN takes about 40% of total energy consumption (Figure 7.10). Through the years, transportation has been undergoing important structural developments in line with the rapid growth of the ASEAN economies as well as advances in science and technology. Road transport has replaced navigation in canals or rivers. International travel has become more important

Figure 7.10: Share of Transportation Sector in Total Energy Consumption in ASEAN (percent)



Source: ADB, 1995b
*Note: * Brunei not included*

with the rapid growth in trade and tourism . At the same time, ocean freight continues to play an important role for the import and export of goods.

The composition and level of energy consumption in the transport sector have changed in the face of these developments. Congestion and traffic problems have affected the efficiency of vehicle fleet operations as well as the levels of fuel consumption. The consumption of non-renewable fuel resources has increased, causing higher levels of emissions at sea and in the air.

A. Land Transport

Land transport links most parts of four ASEAN Member Countries and is extensively used in all individual ASEAN countries. The length of paved roads has grown significantly at an average rate of 7.4% annually for the period 1983-91. Paved road length per thousand population has also increased from 0.3 km per thousand in 1970 to 0.7 km per thousand in 1990. Notwithstanding this expansion however, the length of paved roads in ASEAN is still much lower compared to 7 km of paved road per thousand population in the developed countries (UNEP, 1994).

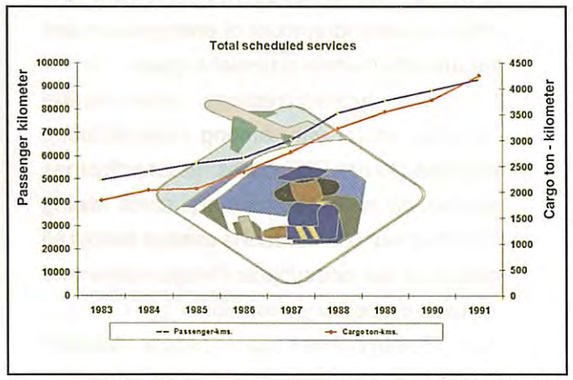
Compared to the growth in the length of paved roads, the number of passenger and commercial cars grew even faster at an average of 10% and 7%, respectively. The rapid increase in the number of passenger cars resulting from higher standards of living and urbanization has caused serious traffic congestion in the region (see Chapter 4 on People).

Railway transport did not progress much in the region. Countries like Malaysia and the Philippines have not invested substantially in this mode of transport. Nevertheless, the growth in the volume of passengers and goods transported by rail indicate that it continues to be an important mode of transport in the region. In recent years, some ASEAN Member Countries have begun to invest in rail-based mass transit system in the urban areas as a means to solve traffic problems.

B. Air Transport

The emergence of ASEAN as the fastest growing region in the world has spurred a dramatic growth in air transport activities during the last decade. During the period 1983-1991, passenger and freight transported by air increased at an average rate of 8% per year in terms of flown milleage and passenger-kilometres. Cargo ton-kilometers increased at an even higher rate of of 11% per year during the same period (Figure 7.11). The growth of passenger and air cargo transport in ASEAN

Figure 7.11: Selected Air Transport Indicators for ASEAN (in million)

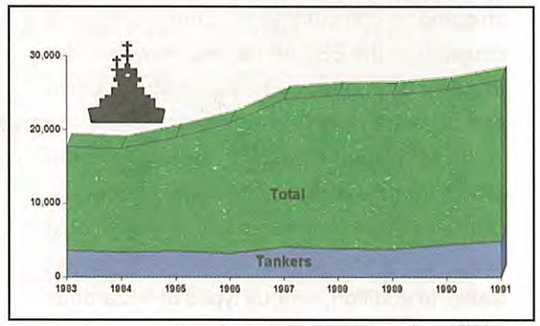


Source: ESCAP, 1994a
Note: Excluding Brunei and Viet Nam

surpassed the average growth rates in all regions of the world during the 1980s (ESCAP, 1994a).

The growth in ASEAN air traffic has created increased demand for airport services in many parts of the region. Thailand has made huge investments on new airports, as well as other related infrastructure. Singapore is considering to develop the facilities at Changi Airport into a one-stop engineering service centre for newer aircraft flying nonstop to Asia from Europe or the United States. Malaysia is also constructing the new Kuala Lumpur International Airport in Selangor. Similar airport improvements are being planned in other ASEAN countries. At the turn of the century, ASEAN will have one of the most well-established airport facilities in Asia.

Figure 7.12: Merchant Shipping Fleets in ASEAN (thousand gross registered tonnes)



Source: ESCAP, 1994a

C. Sea Transport

Ocean freight is an alternative mode of transport for the carriage of goods and services overseas. During the period 1983 to 1991, total merchant fleet in the region grew at an average rate of about 6% per year while tanker fleet grew at approximately 4% (Figure 7.12).

Box 7.3
MANAGEMENT OF SEA TRANSPORT IN SINGAPORE

The port of Singapore is the world's busiest port in terms of shipping tonnage. At any given day, there are at least 800 ships in the port, departing or arriving every three minutes. These include container ships, general cargo vessels, tankers and ferries. In addition, local vessels, among them barges of all sizes, and domestic passenger craft, also use the port facilities.

The Port of Singapore Authority (PSA) is responsible for the development, promotion and maintenance of the port including the protection of the surrounding marine environment. The PSA has recognized the serious potential of oil spills, considering the heavy volume of traffic in the port.

To guard against unnecessary pollution, the PSA enforces strict compliance with rules and regulations on all ship callers. All vessels must comply with certain minimum requirements for sea worthiness, and the proper training and orientation of the crew on proper operation and emergency procedures in case of accidents. The facilities of the port are continuously being upgraded to provide satisfactory and safe services. These facilities include reception and disposal facilities for treatment of wastes such as oil slops, sludge, ballast water and tank washing. No waste can be discharged into the sea without proper treatment.

Because of strict enforcement of rules and regulations and proper overall management of the port, the number of oil spills by ships in Singapore waters, including minor cases of accidental leakages during bunkering, is small.

To handle oil spills and other marine emergencies, the PSA has promulgated the Marine Emergency Action Procedure (MEAP) which provides the framework for activating responses to emergencies such as an oil spill incident. The PSA has adopted a tiered response in deploying oil pollution combat resources depending on the nature and degree of the incident.

Singapore's success in mitigating the impact of marine pollution has been translated into profitable port operations and a declining number of incidents of oil spills. Marine life has been flourishing in Labrador Beach at the fringes of Singapore's busy waterways.

Source: Ministry of Communications Report, Singapore, 1995

The rate of expansion in ASEAN's merchant shipping is comparable to other developing countries in the ESCAP region. However, the trend for developed countries, such as Japan and Australia, has been declining.

Maritime transport poses certain environmental risks to oceans and ports. Contamination of oil slicks and tar balls could occur along the sea lanes of heavy tanker traffic. In addition, various types of hazardous cargoes such as sulfur, fertilizers, petro-chemicals, caustic soda, acids, pesticides and herbicides can contaminate the sea as they are transported. It is estimated that approximately 3.2 million tonnes of oil contaminate the sea annually, 47% of which comes form maritime transportation (ESCAP, 1994b).

Since the busiest seaport in the world are located in ASEAN, the risk of accidents and spills from large tankers or freight ships are quite high. Oil spills in the sea can destroy sea-birds and marine mammals and can damage fisheries and coastal aquaculture. When collected and buried in the sand, hydrocarbons can leach out slowly and could remain in the surrounding areas for a long time. The expansion in maritime transport as a result of the rapid growth of ASEAN economies has increased the risks of environmental damage from ocean freight. Many ASEAN countries have therefore instituted proper management measures to guard against the risks from increasing maritime traffic (Box 7.3).

V. ENVIRONMENTAL CONCERNS

While energy may be the prime mover of ASEAN economic growth, it has affected the environment in various ways. The primary concern is air pollution, especially those emitted by transport and industry, which are the major users of energy. Besides air pollution, ocean freight may cause oil spills and other potential environmental risks to the sea and coastal habitats.

A. Impacts of Fossil Fuel Production and Consumption

Combustion of fossil fuels generates air pollutants that include sulfur dioxide, carbon monoxide, hydrocarbon, nitrogen dioxide and particulates including lead. It also generates greenhouse gases, such as carbon dioxide, methane, and nitrous oxide (NOx). Carbon dioxide is the most dominant among the greenhouse gases generated from fossil fuel combustion.

Local environmental problems vary in different places depending on the types of end uses and the characteristics of the surroundings. In general however, local air polllution problems are closely related to the degree of urbanization and the centralization of development. Congested traffic conditions in Bangkok and Manila have caused serious air pollution problems while conditions in smaller urban cities are more manageable. ASEAN countries are allocating huge amounts of resources to address these problems both through regulatory measures as well as infrastructure expansion.

Fossil fuel combustion and certain

Table 7.4: Carbon Dioxide Emissions from Industrial Process, 1990 (thousand tonnes)

Country	1990
Brunei Darussalam	1,421
Indonesia	38,506
Malaysia	16,216
Philippines	11,752
Singapore	10,279
Thailand	25,535
Vietnam	6,337
ASEAN	107,046
USA	1,310,341
Japan	289,288
World	5,824,051

Source: WRI, 1993
*Note: * Brunei and Viet Nam are not included*

Table 7.5: Methane Emission from Different Sources, 1991 (thousand tonnes)

	Solid Fuel	Coal Mine	Oil &Gas	Wet Rice	Livestock	Total
World	40,000	40,000	26,000	72,000	76,000	250,000
Asia	8,200	17,000	3,200	67,000	25,000	120,000
ASEAN*	936	91	1,053	12,190	1,349	15,702
Indonesia	480	82	720	5,100	650	7,100
Malaysia	65	0	250	290	39	640
Philippines	220	na	na	1,00	220	1,900
Singapore	0	na	na	na	na	0
Thailand	110	9	83	5,300	440	6,000

Source: WRI, 1993
*Note: *Brunei and Vietnam not included*

industrial processes are largely responsible for the emission of carbon dioxide which is the most significant of the greenhouse gases (Table 7.4). Total ASEAN emission of carbon dioxide is only less than 2% of total world carbon dioxide emission and about 6% of the total for Asia. Besides carbon dioxide, ASEAN also generates about 13% of Asia's methane emissions, mostly from rice paddy planting (Table 7.5).

Although ASEAN contribution to global warming is still small, this will likely increase because of the growth in energy demand resulting from economic expansion. Energy demand for energy in ASEAN is forecasted to increase three-fold by the year 2010 from the 1988 level (AEEMTRC, 1993). The potential contribution of energy consumption to greenhouse gases will increase at about the same rate if not higher

The options available to ASEAN to control emission include the shifting of energy sources from high carbon to less carbon content, increase in energy utilization efficiency, and the preservation of natural resources (reforestation) that serve as carbon

Box 7.4
INITIATIVES TO IMPROVE ENERGY EFFICIENCY IN VIETNAM

The demand for firewood, which accounts for 87% of total demand for wood in Vietnam, has been the leading cause of deforestation in the country. Used mostly for cooking, firewood accounts for 85% of total energy consumption in the residential sector. To mitigate the serious consequences of this practice, the government, with technical assistance from UNDP/ESMAP has started a programme to promote the use of fuel-efficient cookstoves. The programme provides incentives to the manufacturers of stoves and conducts information campaigns to disseminate the advantages of using the stoves. The sensitivity of cost to price is continuously assessed to ensure the long-term sustainability and wide coverage of the programme.

The UNDP/ESMAP technical assistance programme is also supporting improvements in the technology of coal briquette-making. Coal briquettes are made of coal dust and clay and are extensively used for cooking in regions where wood is scarce. Technology improvements are intended to modernize the making of coal briquettes and to minimize wastage in their production. Raw materials sourcing, distribution and transportation, technology adaptability, marketing practices, and end-use utilization are also being addressed by the technical assistance programme.

Vietnam is currently analyzing the best strategy to harness its hydropower resources in a sustainable manner and with minimal impact on the environment. The viability of mini-hydro plants are being studied. These plants can be constructed quickly, have less environmental impacts and are appropriate for the less accessible and poorer areas in the country.

Source: World Bank, 1995

sink. Meanwhile, the technical solutions include the application of abatement technologies; introduction of energy technologies producing less pollutants; utilization of nuclear energy and; improvement in utilization efficiency and conservation. Since most of these options are not economically attractive at present, the least-cost and most viable option is to use demand-side management to reduce energy consumption and consequently, carbon emission. Several ASEAN countries are now initiating programmes in various sectors to mitigate the effects of energy consumption on global warming, while other countries are taking steps to improve energy efficiency through the use of appropriate technologies (Box 7.4).

B. Impacts of Oil Spills

The impacts of major oil spills have been clearly demonstrated in previously recorded disasters. For instance, the 1989 oil spill in Alaska killed between 100 to 300 thousand sea birds. Only 800 were successfully cleaned and released to the wild. More than US$18 million were spent for the capture and rehabilitation of sea otters alone (UNEP, 1993).

Experiences with oil spills in other regions of the world suggest that in most cases, these could have been prevented through better operation and management. Small to moderate quantities of oil spilt are mostly generated on account of inefficiencies in loading and discharging operations, while larger quantities are mostly caused by accidents (Table 7.6). In 1992, a ship loaded with 60,000 liters of fuel oil was sunk at the mouth of Chao Praya River because of the failure of crew to turn off the proper valves. Oil spread as far as four kilometers along the river length and oil concentration in the area reached five times beyond permitted levels. Singapore, as a major refining centre, has also experienced occasional oil spill incidents because of massive volumes of oil transferred or processed at its ports and refineries.

Table 7.6: Number of Oil Spill Incidents by Causes and Magnitude of Spill

	Number of spills by magnitude of oil spill			
	< 7 tonnes	7-7000 tonnes	> 700 tonnes	Total
OPERATION				
Loading / Discharging	2,708	254	13	2,975
Bunkering	540	23	-	563
Others	1,143	42	-	1,185
ACCIDENTS				
Collisions	134	177	71	382
Grounding	207	159	86	452
Hull failure	523	58	29	610
Fires & explosion	142	10	21	173
Others	2,181	157	43	2,381
TOTAL	7,578	880	263	8,721

Source: UNEP, 1993.

C. Impacts of Nuclear Power

Nuclear power was once considered as the most promising solution to increasing energy demand throughout the world. In recent years, however, this view has been tempered by environmental risks experienced with the use of nuclear energy. Issues associated with the safety of operations, the storage and disposal of radioactive wastes, and the inadequacy of trained personnel and facilities to cope with emergency situations, have raised serious concerns about the desirability of putting up nuclear power plants.

Attempts to use nuclear power as a source of energy have met stiff opposition from many sectors in the region. This was demonstrated clearly in the case of the US$3 billion Philippine Nuclear Power Plant which was mothballed by the government, despite acute power shortage problems in the 1980s, on account of strong opposition from many sectors. Other ASEAN countries have similarly experienced strong apprehensions on the use of nuclear power (Box 7.5).

Box 7.5
NUCLEAR POWER PLANT IN THAILAND: SOME UNANSWERED QUESTIONS

The rapid growth of the economy prompted the Thai Government in 1992 to revive a plan to construct a nuclear power plant. With electricity demand increasing at about 1,000 MW per year, there was a compelling reason to expand and diversify sources of energy. The construction of more hydropower plants as well as oil-fired plants, has been constained by both natural resource limitations and environmental considerations. Thus, the nuclear power alternative seemed to be an attractive option.

The idea to construct a nuclear power plant was conceived as early as 1966. It was approved by the government in 1977, but strong public opposition blocked the implementation of the project then. The government revived the plan in 1992 and allocated about US$36 million for studies of nuclear power potentials in the country. If found feasible, the plant would be constructed in 1997 at a cost of about US$2,720 million.

To make the project acceptable to the public, various sectors would have to be properly informed about several aspects of the nuclear power plant. Several questions that need satisfactory answers have been raised by a concerned public.

* Safety.
  The effects of nuclear accidents have shown devastating effects that could linger for many years. How can the safety of the public be ensured? Who can guarantee the safety of the plant?
* Wastes.
  A 1,000 MW plant needs 41 tonnes of uranium per year, equivalent to 1.8 million tonnes of oil. This will generate about 25 tonnes of nuclear wastes which would be added to 84 thousand tonnes of nuclear wastes left untreated as of 1990. What are the reliable methods of handling nuclear wastes? Are these methods sufficiency safe to ensure the future of the next generation?
* Location.
  Because of its huge water cooling requirement, the nuclear plant has to be located near a sufficiently large body of water. The potential sites for this are limited. Moreover, consultation with the local people would be necessary. What steps have the government taken to address the question of plant location and the attendant consultations with the affected public?

Source : Green Earth Foundation, 1994

D. Impacts of Hydropower

Hydropower will supply energy without any emission and waste discharges when the surrounding bio-physical conditions have adjusted to the altered environment after construction and start-up operation. However, its construction and initial operation phase can cause severe impacts on the environment. Large hydropower projects inundate large portions of the land located upstream to the dam, drastically and permanently altering the plant and animal life in the area. The downstream flow is also altered during operations and could affect local communities. Since hydropower projects are mostly located in remote areas where ecological systems are highly diversified, their impacts could be critical to both the natural and social environments.

Power generation from hydropower sources in ASEAN has declined gradually in the 1990s, despite the large potential that exist in the region. Because of the extensive areas affected by hydropower projects, they are likely to generate opposition from affected local communities. They also entail higher investment costs and longer construction periods compared to other power options.

E. Impacts of Geothermal Power

Compared to other sources of energy, geothermal resources are not used as extensively by ASEAN countries. There are a number of reasons for this. Compared to fossil-based fuel resources, transmission of

geothermal power to generate electricity takes longer time to develop as it is sourced from site-specific reserves. It emits hydrogen sulfide which has a characteristic odor unacceptable to most local residents. Prior to the technology on re-injection, it has generated high levels of liquid effluents that contain objectionable pollutants. Notwithstanding these factors, however, evidence has shown that geothermal sources of energy is more environmentally friendly than other sources. Greenhouse gases emitted by geothermal plants are found to be just a fraction of those emitted by thermal plants of the same generating capacity.

Box 7.6
GEOTHERMAL ENERGY DEVELOPMENT

Geothermal energy comes form the heat of the earth. Heat is generated by the magma that comes about two to three kilometers below the earth's surface. The heat can be harnessed by tapping the high pressure steam which at times could be mixed with water.

Development of geothermal energy sources can affect the environment in various ways. Civil works can cause surface disturbance, including cutting of trees in forested areas with consequent soil erosion, and possible impact on biodiversity. Geothermal effluent containing natural chemicals leached out from rocks by geothermal hot water can contaminate lakes, rivers and other water resources.

Emission of carbon dioxide, hydrogen sulfide and other non-condensable gases could be harmful at certain concentration levels. Noise pollution can be generated during well discharge testing, and operation of even small non-condensing power plants.

These potential impacts however, are seen to be less than other energy sources and can be mitigated. Geothermal sources of energy compare favorably with other alternatives in terms of enviromental considerations. Compared to fossil fuels, it emits much less greenhouse gases, only 155 kilograms per hour for one MW of power generated. In fact, UNDP categorizes geothermal energy as a non-greenhouse energy option.

Geothermal plants have other built-in advantages. Its infrastructure requirements are less, it does not require processed water and there is less disturbance on the earth's surface since the resource being exploited is two to three kilometers below the earth's surface. The use of reinjection technology allows geothermal plants to operate on a closed loop basis without any liquid waste discharge.

Geothermal resources are indigenous and therefore its utilization as a source of power enhances self-reliance. The investment requirement of a geothermal plant is lower and its running cost is competitive with other sources.

For 120 MW Plant	Investment Cost (million US$)	Electricity Cost (Philippine Peso per KwHr)
Geothermal	240	0.68
Hydropower	391	0.32
Dendrothermal	330	2.38

The Philippines is expanding geothermal development as part of the plan to balance its energy sources. Since the start of geothermal power development during the early 1970s, the country has installed a total generating capacity of 1044 MW in 1992. This makes the country the second largest geothermal power user in the world, next to the United States. An additional 1673MW capacity will be installed by the year 2000, bringing the contribution of geothermal sources to 20% to 30% of the total electric power generating capacity.

Souce : PNOE, 1994

References

AEEMTRC. 1993. *ASEAN Energy Profile.* Indonesia.

ADB. 1995a. *Energy Indicators for Developing Countries of Asia Pacific.*

ADB. 1995b. *Key Indicators of Developing Asian and Pacific Countries.*

ESCAP. 1994a. *Statistical Yearbook for Asia and the Pacific Region.*

ESCAP. 1994b. *State of the Environment Report in Asia and the Pacific : 1995.* Bangkok.

Green Earth Foundation. 1994. *Environmetal Situation in Thailand.* A Proceeding on the Seminar on Thai Environment.

Ministry of Communications Report. Singapore. 1995.

National Steering Committee on Environment and Development. 1992. *Country Report, Malaysia.* Ministry of Foreign Affairs.

PNOE. 1994. *Northern Negros Goethermal Power Development.* Philippines.

TDRI and TEI. 1993. *Preparation of a National Strategy on Global Climate Change : Thailand,* a research report submitted to the Government. Thailand.

UNDP. 1995. *Human Development Report.*

UNEP. 1993. *Environmental Data Report : 1993-1994*

UNEP. 1994. *Environmental Data Report : 1994-1995.*

World Bank. 1995. *Vietnam Environmental Program and Policy Priorities for a Socialist Economy in Transition.*

WRI. 1993. *World Resources : 1993-1994.* New York.

Chapter 8
International Trade & Tourism

During the last two decades, the expansion of the trade and tourism sectors have become significant components in the development of the ASEAN economies. This Chapter reviews the structure of these two sectors and traces their contributions to regional growth in the context of international developments. The relationship between trade and the environment is discussed as an important international issue that has emerged in the multilateral fora. The Chapter also discusses the impacts of tourism on the environment and how increasing awareness of related issues has led to new trends in tourism packaging and promotion. Finally, the Chapter presents recent ASEAN initiatives to reconcile the objectives of trade and tourism with those of the environment within the framework of sustainable development.

ASEAN Facts and Figures

Gross domestic product (1993)	US$ 460 billion
Real growth of GNP (1993)	6.6%
Total imports (1993)	US$ 232 billion
Total exports (1993)	US$ 212 billion
Intra-ASEAN trade (1993)	US$ 84 billion
Foreign direct investment (1993)	US$ 15.8 billion
Tourist arrivals (1992)	30 million
Total tourist receipts (1995)	US$ 27.6 billion
Intra-ASEAN tourist arrivals (1992)	15.0 million

I. LIBERALIZATION OF ASEAN ECONOMIES

The rapid expansion of the ASEAN economies during the last two decades was largely propelled by a deliberate policy shift towards liberalization. ASEAN Member Countries recognized that sustaining development gains at home meant expanding their markets abroad and responding to the challenges of global competition. Thus, many ASEAN countries began to combine their import-substitution policies with an outward-looking strategy anchored on industrialization. This required a market-oriented policy environment that encouraged competition as a means to promote producer efficiency and consumer welfare.

ASEAN global trade has grown very rapidly in the past two decades, reaching US$443 billion in 1993 or 5.7% of the total world merchandise trade. In the same year, ASEAN exports were equivalent to 46% of its aggregate GDP, and its imports, at a slightly higher proportion of 50% (ASEAN Secretariat, 1997). The growing internationalization of the ASEAN economies has made them more sensitive to changes in the global environment and to the domestic developments in their major trading partners.

ASEAN's rapid growth in the 1970s and early 1980s coincided with the expansion in world demand caused by the upturn in the economies of its major trading partners. ASEAN countries were able to expand markets for their products, some of which were accorded preferential access. As the developed countries slid into recession during the late 1980s and the early 1990s, ASEAN countries were similarly affected. GNP growth rates in the developed countries decreased from 2.5% in 1990 to 0.9% in 1993. The ASEAN economies also experienced declining growth rates from 8% to 6.6% during the same period. As the developed economies recovered in 1994 and 1995, ASEAN's GNP growth rates also increased. Notwithstanding the slower rates of growth experienced by ASEAN countries in the early 1990s, they remained ahead of the developed economies and most of the developing countries in terms of economic performance (Table 8.1).

In the meantime, the world economy underwent significant changes. Although the United States remains the world's largest economy, its global influence has weakened with the emergence of Japan, and to a certain extent, Germany, as the new growth poles. Most of the developed economies are in the middle of their de-industrialization process, with manufactured goods constituting less of their national output. The pursuit of free trade has resulted in dramatic shifts in comparative advantage, with advanced countries devolving certain manufacturing activities to the developing economies. Product cycles, technological changes, foreign direct investments and regional trading arrangements within specific regions in Asia, Europe and North America are accelerating the process of industrialization and changing the patterns of

Table 8.1: Real GNP Growth in the World Economy, 1990 - 1995 (in percent)

	1990	1991	1992	1993	1994	1995
WORLD	2.0	0.5	0.8	0.9	2.2	3.2
DEVELOPED MARKET ECONOMIES	2.5	0.7	1.5	0.9	2.3	2.9
UNITED STATES	1.0	(1.2)	2.1	3.0	3.3.	3.0
JAPAN	5.6	4.0	1.5	(0.3)	1.3	3.3
DEVELOPING COUNTRIES	2.8	3.4	5.1	5.6	5.3	5.5
ASEAN	8.0	6.2	5.7	6.6	6.8	7.0
EASTERN EUROPE AND CIS	(0.4)	(17.8)	(16.0)	(10.0)	(0.7)	1.0

Source: ASEAN Secretariat, 1994
Note: Figures for 1994 and 1995 are estimates. Figures in parenthesis represent negative values.

development worldwide.

The changing global economic matrix has important implications for ASEAN. Although global trade liberalization continues to be pursued, the emergence of new economic power blocs has introduced new elements of competition into the international trading arena. As tariffs were reduced, non-tariff barriers became pronounced — making protectionism less transparent and more complex. The de-industrialization process in most developed countries have opened opportunities for ASEAN to develop high value-added manufactures for export. The global trend towards the establishment of regional trading blocs such as the North America Free Trade Area (NAFTA) and the Single European Market (SEM) have raised new concerns about tariff disadvantages and limitations on market access for ASEAN products. The newly emerging economies of China, India and some countries in Latin America now compete with ASEAN as alternative sources of cheap labor and raw materials.

Amidst these changes in the global environment, ASEAN countries have remained committed to liberalize their economies to sustain economic growth and prosperity. The policy on liberalization was adopted unilaterally and in most cases without discrimination to countries not belonging to ASEAN. It was based on the premise that maintaining an open economy will generate benefits from the advantages offered by free trade. The open trade policy in ASEAN has made industries more efficient and internationally competitive, eventually leading to higher external trade. This policy has also led to the diversification of manufactured products for both the domestic and export markets. The remarkable performance of the ASEAN economies in the 1990s was, in large part, the result of a sustained liberalization policy that provided the foundations for the region's economic success.

Macroeconomic policies in ASEAN countries have been complemented by accelerating trade liberalization and deepening industrial cooperation at the regional level. On 28 January 1992, the ASEAN Heads of Governments, at their Fourth Summit Meeting, agreed to establish an ASEAN Free Trade Area (AFTA). AFTA's goal is to reduce tariffs in ASEAN to a level of 0-5% in 15 years through the Common Effective Preferential Tariff (CEPT) Scheme with effect from 1 January 1993. The Scheme calls for a progressive reduction of tariffs on manufactured products and processed agricultural products among ASEAN Member Countries taking into account each country's structure of protection and industrialization policy. This was followed by subsequent decision to further accelerate AFTA by reducing the time frame to 10 years and expanding the list of product coverage (Box 8.1).

With the investment-trade nexus driving economic integration in the region, subregionalism has recently emerged as a new phenomenon in ASEAN. Subregionalism involves economic exchanges between geographically proximate, but politically separated, border areas. These exchanges are motivated by the locational advantages of different but complementary factor endowments. An outstanding example of economic subregionalism in ASEAN is the Singapore-Johore-Riau (SIJORI) Growth Triangle — also known as the Southern Growth Triangle. Two other growth areas have been established recently: the Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT), also known as the Northern Growth Triangle; and the East ASEAN Growth Area (EAGA). The latter involves the participation of Brunei Darussalam; Sarawak, Sabah and Labuan in East Malaysia; East and West Kalimantan and North Sulawesi in Indonesia; and Mindanao in Southern Philippines. Cooperation among these geographically adjacent areas has made it easier for investors to operate with lower transport, communications and other

Box 8.1
THE ASEAN FREE TRADE AREA

The Fourth Summit Meeting of the ASEAN Heads of Government held in Singapore in January 1992 agreed to establish an ASEAN Free Trade Area (AFTA) over the next 15 years. The objective of AFTA is to reduce tariffs and eliminate non-tariff barriers for trade in manufactures, including capital goods and processed agricultural products. Through the Common Effective Preferential Tariff Scheme (CEPT), ASEAN Member Countries have agreed to a progressive reduction of tariffs to a 0-5% level by 2008. There are two programmes of tariff reduction under the CEPT Scheme.

However, in September 1994, the ASEAN Economic Ministers (AEM) agreed to reduce the time frame from 15 to 10 years, so that AFTA will be realized by the year 2003. At the same time, the Ministers decided to expand the coverage of the CEPT Scheme by phasing-in products in the Temporary Exclusion List into the Inclusion List by the year 2000 and including unprocessed agricultural products. This represents the first major effort to accelerate AFTA.

In September 1995, the ASEAN Economic Ministers (AEM) agreed to maximize the number of tariff lines in the 0-5% categories in the year 2000 and in the 0% tariff by the year 2003. This call for further acceleration of AFTA was also echoed at the Fifth ASEAN Summit in December 1995.

Since then, Member Countries have been accelerating their tariff reduction schedules on a voluntary or unilateral basis. Tariff reductions for these began on 1 January 1996.

The elimination of tariff barriers under the CEPT scheme is intended to increase ASEAN's competitiveness as a production base geared for the world market. Trade liberalization through the elimination of tariff and non-tariff barriers would have the effect of making ASEAN's manufacturing sector more efficient and competitive in the world market. As this happens, consumers will source goods from the more efficient producers in ASEAN, thus contributing to an expansion in intra-ASEAN trade. As the cost-competitiveness of manufacturing industries in ASEAN is enhanced, and with the larger size of the regional market, investors would be encouraged to locate their production facilities in ASEAN to take advantage of economies of scale in production, Increased investments will stimulate the growth of supporting industries and ultimately increase output, employment and incomes.

Source: ASEAN Secretariat

transaction costs.

Along with measures to enhance aggressive merchandise export trade, ASEAN countries have also taken steps to promote tourism. During the last two decades, tourism in ASEAN countries expanded rapidly, contributing significantly to foreign exchange earnings and the growth of supporting industries. ASEAN countries promoted easy access by tourists through the liberalization of visa requirements (for non-ASEAN nationals) and customs facilitation. In 1992, direct revenues from the tourism industry accounted for 7% of the aggregate ASEAN GDP (World Tourism Organization, 1994). When treated as an export, total tourist receipts are estimated at 10% of total earnings from all merchandise exports.

II. ASEAN INTERNATIONAL TRADE

ASEAN's liberalization policies were applied, not only to trade, but also to other economic sectors. Capital flows, both official and private, were promoted to fund investments in infrastructures and new industrial facilities, thus providing a conducive environment for the sustained growth of the ASEAN economies.

In support of its industrialization policy, ASEAN liberalized imports as a means to acquire competitively priced intermediate and capital goods for the manufacture of exports.

As tariff and other border restrictions were gradually eliminated, domestic industries became less protected — thus motivating them to become more efficient and competitive. Import liberalization has become an important ingredient for an export-led industrialization strategy for ASEAN.

The import liberalization policies adopted by ASEAN countries led to an increase in the level of imports from 8% during the period 1970-1980 to 8.4 % during the 1980s and the early 1990s. In 1993, aggregate ASEAN imports reached US$232 billion or 6.2% of total world imports (ASEAN Secretariat, 1997). The substantial increase in ASEAN's imports from 1970 to 1993 has made the region the fastest growing market for exporting countries during the last two decades. This has made ASEAN a very attractive location for investments.

Among the ASEAN Member Countries, Indonesia, Malaysia, Singapore and Thailand recorded the most significant increases in imports as a result of the rapid expansion of their economies and increasing per capita incomes. The increase in Vietnam's imports is also significant, although it has just recently started to open its economy. Imports of other ASEAN countries also increased but at a lesser pace.

Recent changes in the structure of ASEAN imports reflected the pattern and pace of industrialization in the region. ASEAN imports of machinery and capital goods, especially telecommunications equipment, increased significantly, while imports of food and primary commodities decreased substantially during the period 1970 to 1993 (ASEAN Secretariat, 1997).

ASEAN exports grew at an annual rate of 10.9% during the period 1980 to 1990 compared to only 5.8% during the decade of the 1970s. ASEAN's outstanding export performance has made it the fastest growing region in the world during the 1980s. In 1993, ASEAN's total exports reached US$212 billion — accounting for approximately 6% of total world exports (ASEAN Secretariat, 1997). Malaysia, Singapore and Thailand were the major contributors to ASEAN's high export performance. Vietnam's exports increased by as high as 30% in recent years.

The composition of ASEAN exports has also undergone significant changes as a result of rapid industrialization and increasing diversification of products. In 1970, the majority of ASEAN exports consisted of agricultural and mineral commodities, including fossil fuels. After more than two decades, the structure of exports shifted to manufactured products, including machinery and transport equipment, that now constitute more than half of total exports. While the share of commodity exports declined correspondingly.

Growing industrialization has allowed ASEAN to export a variety of manufactured products and even capital goods. ASEAN countries have reduced their dependence on the export of commodity or semi-processed raw materials to generate foreign exchange. However, while the exploitation of fast depleting natural resources may be decreasing, industrial growth and diversification have given rise to environmental problems such as toxic and hazardous wastes.

A. Direction of ASEAN Trade

The United States, Japan and members of the European Union are ASEAN's most important trading partners. During the last two decades, however, the shifts in global comparative advantage, the emergence of newly industrializing economies, and the rapid growth of ASEAN itself, have changed the direction of ASEAN trade. ASEAN countries began to diversify their markets, relying less on their traditional trading partners and increasing their trade with the developing countries and the rest of the world.

The share of intra-ASEAN trade to ASEAN total trade has remained at less than

20% for the past two decades. In recent years, however, intra-ASEAN trade began to pick up, increasing by 58% from US$54 billion in 1990 to US$84 billion in 1993 (ESCAP 1994). Intra-ASEAN trade is expected to increase faster as the full impact of AFTA is realized.

B. Foreign Investment

Foreign direct investment (FDI) was one of the principal factors that fueled ASEAN's export-led industrialization strategy. Capital flows from external sources was necessary to offset the constraints posed by limitations in the domestic capital markets in financing the establishment of industrial capacity and the required infrastructure support. From 1981 to 1993 the total annual net FDI to ASEAN countries increased by 450% from US$3.5 billion to US$15.8 billion (Table 8.2). In addition to capital, FDI has brought in technology, management assistance, and market access that have served to enhance ASEAN's competitive position in the world market.

Japan continues to be the main source of FDI in ASEAN, followed by the United States and the United Kingdom. Intra-ASEAN investments, mostly in the manufacturing sector, have also increased in recent years. Moreover, ASEAN industrialists have begun to invest in countries outside the region such as in Cambodia, Laos, China and even in Europe and North America.

Liberalization policies, as well as the establishment of AFTA, have further enhanced investment opportunities in ASEAN. Industries locating in ASEAN can enjoy the advantages of a large regional market of over 400 million people with increasing purchasing power, the gradual lowering of tariff and non-tariff barriers through AFTA, and the availability of industrial infrastructure.

III. TRADE AND ENVIRONMENT

The expansion in global trade brought about by liberalization has recently raised concerns on the sustainability of resources used in the processing of traded goods. Rapid depletion of natural resources as well as heightened pollution have made countries more aware that unless properly managed, increased economic activities could have serious consequences on the nature of development. This awareness has led to trade policies that are sensitive to environmental considerations. However, these policies have been increasingly used in the international marketplace as a leverage to gain trade advantage. Linking environment policies with trade has emerged as a critical issue in the international arena.

A. ASEAN and the International Trading Environment

ASEAN's participation in previous rounds of multilateral trade negotiations under the General Agreement on Tariffs and Trade (GATT) was less than enthusiastic compared to its involvement in the recently concluded Uruguay Round. For the most part, ASEAN felt that the trading regimes that have evolved under the GATT favored the developed countries and did not sufficiently take into account the circumstances of the developing countries. ASEAN countries pursued their trade interests mostly through bilateral talks with trading

Table 8.2: Foreign Direct Investment in ASEAN (Million US$)*

Country	1981	1983	1985	1987	1989	1991	1993
Indonesia	133	292	310	385	682	1482	2004
Malaysia	1265	1261	695	423	1668	3998	5206
Philippines	172	105	12	307	563	544	763
Singapore	1675	1085	809	2630	2004	4444	6062
Thailand	288	348	162	182	1726	1847	1493
Viet Nam	-	-	-	-	100	213	300
ASEAN	3533	3091	1988	3927	6743	12528	15828

Source: ADB, 1995
*Note: * Brunei Darussalam is not included*

Box 8.2
URUGUAY ROUND AGREEMENTS: SELECTED OUTCOMES

Trade barriers

Tariffs
- Average tariffs on industrial products cut by 38%
- Elimination of duties in 11 sectors
- Increase in proportion of bound duties

Non-tariff Measures (NTM)
- Prohibition of gray area measures
- Tariffication of NTMs in agriculture

Sectors

Natural Resources
- Tariff reduction; increase in proportion of bound duties; some progress on escaltion

Tropical products
- Reduction in tariff peaks, increase in proportion of bound duties; some progress on escalation

Textiles and clothing
- Four-stage phase out of the Multi-Fibre Agreement (MFA)
- Transitional safeguards
- Constraints on circumvention

Agriculture
- Tariffication of NTMs and their gradual reduction
- Constraints on non-decoupled domestic support
- Reduction in value and quality of products subject to export subsidies
- Affirmation of rights and objections in sanitary and phytosanitary measures
- Concessions for developing and least developed countries

GATT System

Safeguards
- Prohibition of gray area measures
- Explicit sunset arrangements
- Tighter criteria for application
- Limited provision for discriminatory subsidies; traffic light system introduced prohibited, "actionable", and dutiable countervailing duties
- Disciplines on use of Counter-Vailing Duties (CVDs)

GATT Articles
- Requirements that interventions under Articles XII and XVII be based on price
- Clarification and reinforcement of Article XXIV criteria
- Strengthening of procedures for calculating dumping margin under Article VI; as well as strengthening injury test and dispute settlement
- Strengthening of provisions on rules of origin and pre-shipment inspection

Multilateral Trade Negotiations (MTNs)
- New procedures for negotiation of compensation when bindings are modified to assist developing countries in negotiations

Trade-Related Investment Measures (TRIMs)
- Prohibition of TRIMs inconsistent with Articles III and XI
- Phase out of existing TRIMs
- Concessions for developing countries

New Issues

Trade-Related Intellectual Property Rights (TRIPs)
- General commitment to MFN where possible
- Specific provisions on copyrights, trademark, geographical indications, industrial design, patents, layout designs of ICs, trade secrets
- Phased transition for developing countries

Services
- General commitment to MFN where possible
- Arrangements of progressive liberalization
- Specific institutional provisions for : air transport, financial services, telecommunications

World Trade Organization (WTO)
- Creation of WTO "umbrella" organization
- Commitment to sustain the Trade Policy Review Mechanism (TPRM)
- Establishment of an integrated dispute settlement system

Source : UNCTAD, 1994

partners instead of through the multilateral system of GATT.

The comprehensive agenda of the Uruguay Round and its far-reaching implications on international trade compelled ASEAN to participate actively in the Round. The Uruguay Round, which is the eighth round of trade negotiations under the GATT and the most ambitious so far, sought to expand world trade through wider and deeper tariff cuts and by expanding the coverage of the GATT rules to make them more relevant to the trading environment. The Uruguay Round Agreement took effect on 1 January 1995. As distinguished from previous rounds, the Agreement included new areas as follows: i) trade in agriculture, ii) sanitary and phytosanitary measures, iii) textiles and clothing, iv) technical barriers to trade, v) trade-related aspects of investment measures (TRIMS), vi) trade-related aspects of intellectual property rights (TRIPS), vii) dispute settlement mechanism, and viii) trade policy review mechanism (Box 8.2). Given their outward-looking strategy, ASEAN countries have a large stake in many of these areas.

ASEAN's ability to expand its trade opportunities abroad depends largely on the extent to which it can respond to changes in international trade rules and the emerging environmentalism in foreign markets. Stringent and costly environmental measures that have been set up by ASEAN countries are likely to affect the competitiveness of their exports at least in the short term. ASEAN must be able to assess the impacts of these measures on trade and to identify opportunities in an increasingly environmental-conscious world.

Because of the open nature of the ASEAN economies, changes in the level and patterns of international trade and investment can have a substantial impact on the environment. Anticipating these additional stresses will allow ASEAN to put in place adequate environmental protection policies covering the wide spectrum of environmental

Box 8.3
COMPLEMENTARITIES BETWEEN TRADE AND THE ENVIRONMENT

The principles underlying trade liberalization and environmental protection are complementary. Sound trade and environmental policies both prescribe the internalization of all costs, including environmental protection costs. Government subsidies for environmental protection and those that distort trade should be avoided to promote efficient resource allocation and fairness in international trade. Prices of products should reflect the social costs of all environmental inputs. Doing otherwise, either by setting low environmental standards or failing to strictly enforce them, will induce the excessive use of inputs that will distort product prices as well as the cost of environmental protection. The economic cost of providing implicit subsidies are ultimately paid for by the producing country in terms of unwarranted environmental degradation.

Some of the perceived conflicts between trade and environmental objectives arise either from trade distortions or deficiencies in environmental policies. For example, the price of prawns that do not reflect the social costs of converting mangroves into prawn ponds will tend to be lower. The artificially low price of prawns will induce more exports that will, in turn, destroy more mangroves. In this case, it is not trade, but rather the failure of policy to capture the cost of mangrove destruction that caused damage to the environment. The proper corrective measure is to adjust environmental policy rather than to interfere in trade.

Trade can be used as a direct means to improve environmental quality. This can be done by allowing access to foreign pollution abatement products, technologies and services. Incomes derived from exports will provide added financial resources that can be used for better environmental protection. Higher incomes will stimulate increased demand for better services including environmental quality improvements.

Source : Training Materials, ASEAN-UNDP Workshop Series on Trade and Environment, 1995

Box 8.4
TRADE AND ENVIRONMENT ISSUES

Environmental Regulations and International Competitiveness

Compliance with environmental regulations could result in additional production costs and higher prices that could affect the international competitiveness of a product at least in the short term. To avoid additional costs of compliance with environmental regulations, investors could choose to locate in countries with lower environmental standards to take advantage of lower production cost. In the past, certain industries were located in ASEAN to avoid the high cost of compliance with environmental standards in the developed countries. These industries included pulp and paper, smelting plants, and fermentation plants. Recently however, ASEAN Member Countries have begun to enforce more stringent regulations to manage the environmental impacts of highly pollutive industries. With the gradual elimination of tariff and non-tariff barriers under AFTA, ASEAN countries should pursue its plans to harmonize environmental standards to remove any remaining distortions that could affect the competitiveness of traded goods.

It is important to remember, however, that in an open trading regime, there are market forces and other compensating measures that can shift competitive advantage. These include exchange rate adjustments, financing mechanisms for environmental protection, and the natural tendency of people to aspire for a cleaner environment. In many cases, the incremental costs associated with environmental protection are not significant in relation to total production cost. In some cases, net cost reduction is even achievable when environmental measures are implemented (e.g. waste minimization projects).

Environmentally Related Product Standards

Product standards are prescribed by importing countries to protect public health and welfare. In recent years, environmental considerations have become important criteria in setting product standards. Examples of environmentally related product standards include limitations on pesticide residues in food products, restrictions on the trade of endangered species of flora and fauna, and car emission standards, among others.

The Uruguay Round Agreement contains several provisions to safeguard the use of environmentally related product standards as covert trade barriers. The effectiveness of these provisions however, remain to be tested in many of the still unresolved cases on the implementation of product standards.

In ASEAN, small and medium-sized exporters are most affected by product standards because they lack the resources to comply with inspection requirements or to absorb the added costs. These problems will be compounded as and when importing countries begin to interpret product standard provisions to include production and process standards (PPM) to which compliance would be more difficult.

Trade Measures for Environmental Objectives

Many countries use trade measures to force compliance with national environmental standards in the absence of sanctions in environmental agreements. This strategy has been used in the case of the Montreal Protocol (which schedules the phasing out of CFC emissions), the Basel Convention (governing trade in hazardous wastes) and 17 others that employ trade restrictions to attain environmental objectives. In a number of cases, environmental standards are used as a means for trade protection.

ASEAN countries may be vulnerable whenever its trading partners resort to the use of trade measures to pursue their national environmental objectives. Most ASEAN countries still have limited access to technologies that will allow them to comply with stringent environmental standards such as the use of biodegradable packaging, or the processing of forest products under sustainable forest development schemes.

Effects of Trade Liberalization on Environmental Resources

Trade expansion resulting from an open trading regime will put more stress on environmental resources. As tariffs and other trade barriers are reduced, changes in production structures and investment flows will occur as competitve advantage shifts to the most efficient producers. Greater demand for resource-based goods could induce relatively poorer countries to increase production at levels that cannot be sustained. On the other hand, higher value-added manufacturing activities in the more affluent nations can exacerbate pollution. Technology and impact assessments of trade expansion on environmental conservation must be taken as a serious effort to promote sustainable development.

Source : Training Modules for the ASEAN-UNDP Trade and Environment Subprogramme, 1995

concerns such as the conservation of agriculture and natural resources, industrial pollution, management of toxic waste, rapid urbanization, poverty, sanitation and many others. The diversity of these concerns makes it imperative for ASEAN to participate actively in practically all international trade and environmental negotiations.

B. Trade and Environment Issues

ASEAN's concerns on trade and the environment are two-fold. One involves the impacts of changes in trading rules and regimes on the environment, and the other concerns the effects of changes in environmental regulations or environmentally inspired measures on trade. In principle, however, there should be no conflict between trade liberalization and sound environmental policy measures as the two complement each other (Box 8.3).

The issues on trade and environment are complex, overlapping and mostly interrelated. However, the important ones are: 1) those that involve the effects of environmental regulations on the competitiveness of traded goods; ii) product standards that involve environmental criteria; iii) the use of trade measures for environmental objectives; and iv) the effects of trade liberalization on environmental resources (Box 8.4).

C. Recent ASEAN Initiatives

In 1994, ASEAN Member Countries adopted the ASEAN Strategic Plan of Action on the Environment which consists of 10 strategic thrusts and 27 supporting actions. One of the key objectives of the Plan is the effective integration of trade policies with environmental policies throughout the region. An important element in the Action Plan is the conduct of a comprehensive study on the development of environmental and trade

Box 8.5
ASEAN-UNDP SUBPROGRAMME ON TRADE AND ENVIRONMENT

There are six areas of inquiry under UNDP-assisted ASEAN Subprogramme on Trade and Environment :

1. **Implications of the adoption by ASEAN of the Polluter Pays Principle (PPP), which could partially address the issue of international trade competitiveness;**
2. **Harmonization of environmentally inspired product standards;**
3. **Effects of regional efforts to internalize environmental protection costs;**
4. **Development of common guidelines and procedures to evaluate and monitor the environmental effects of foreign direct investment and the performance of multinational corporations;**
5. **Environmental effects of economic integration and trade liberalization; and**
6. **Development of a coordinated regional trade-related environmental policy.**

These six areas of investigation are being pursued in four Sub-programme modules that consist of the following :

1. **A series of four workshops (Bangkok, Jakarta, Kuala Lumpur and Manila) for Govenrment officials, private industry representatives, academe and Non-Governmental Organizations (NGO) representatives;**
2. **Research studies at the national, regional and international levels to develop a comprehensive information base on the use of trade measures for environmental purposes;**
3. **Six national-level studies on trade and environment policies to be undertaken by research institutions in the region and the findings to be presented at an ASEAN Policy Formulation Conference on Trade and Environment; and**
4. **A feasibility assessment of a research model study on the interactions of enviromental policies on economic growth in ASEAN.**

Source: ASEAN-UNDP Subprogramme on Trade and Environment Document

policies that support the principles of sustainable development in the region. To implement this activity, an ASEAN Sub-Programme on Trade and Environment was initiated with funding support from UNDP. The subprogramme provides technical and management information and training to ASEAN policy-makers on trade and environment matters to promote environmentally sound decisions. The Subprogramme deals primarily with six areas of inquiry (Box 8.5) that are in various stages of implementation.

As part of the implementation of the Action Plan, a series of case studies on trade and environment linkages involving some ASEAN countries have been initiated under the sponsorship of UNCTAD. In addition, various national efforts are being done to assess the economic impact on the environment of the emerging international trade regime.

IV. TOURISM AND THE ENVIRONMENT

For many years, western tourists have been attracted to spend their holidays in the tropical environment of the ASEAN region. Attractions in the region include beautiful beaches, rich terrestrial and marine life, perennially warm climate, hospitality of the local population, lush vegetation and rustic scenery, historic landmarks, and a distinctive socio-cultural heritage. About two decades ago, ASEAN countries realized the potential of tourism and started to professionally develop the sector. Vigorous tourism promotion efforts, as well as rapid expansion of trade in the region, combine to make ASEAN a major destination for tourists throughout the world.

The phenomenal expansion of tourism was not without its adverse consequences. In some ASEAN tourist spots, the carrying capacity of the bio-physical and socio-cultural environment was not able to cope with the rapid pace of tourism development. In other places, social and economic dislocations have resulted from improper planning and poor implementation of tourism programmes, making them ecologically and economically unsustainable. ASEAN countries are now beginning to address the need for a more sustainable tourism development in the region.

A. Growth of ASEAN Tourism

Aggregate tourist arrivals in ASEAN compare favorably with those of the traditional tourist destinations in the world (Table 8.3). In 1992, ASEAN ranked fifth among the top tourist destinations—ahead of more popular countries like the United Kingdom, Mexico, Germany and Switzerland. During the period 1980 to

Table 8.3: Top Tourist Destinations in the World

Rank 1992	Country	Average Annual Rank 1980	Average Annual Growth Rate (%) 1980/92	% Share of Arrivals Worldwide 1992	% Share of Arrivals Worldwide 1980
1	France	1	5.86	12.37	10.46
2	United States	3	5.88	9.27	7.82
3	Spain	2	4.49	8.23	8.13
4	Italy	4	1.41	5.42	7.67
5	ASEAN-5*	12	8.21	4.31	2.78
6	Hungary	10	6.55	4.19	3.27
7	Austria	5	2.70	3.97	4.82
8	United Kingdom	7	3.39	3.85	4.32
9	Mexico	8	3.12	3.59	4.15
10	China	18	13.80	3.43	1.22
11	Germany	9	2.61	3.15	3.86
12	Canada	6	1.13	3.06	4.47
13	Switzerland	11	3.10	2.66	3.08
14	Greece	17	5.70	1.94	1.67
15	Portugal	20	10.33	1.84	0.95
World Total		4.70	71.28	68.67	

Source: World Tourism Organization, 1994
Note: Brunei Darussalam and Vietnam are not included.
Figure for ASEAN was derived by adding total tourist arrivals from ASEAN countries.

1992, the annual growth rate of tourist arrivals in ASEAN was 8.2%. This growth rate was only exceeded by China and Portugal among the top 15 tourist destinations.

Indonesia, Malaysia, Singapore and Thailand are the countries that contributed most to ASEAN's estimated 30 million tourists in 1995. Other ASEAN countries also performed remarkably as indicated by high visitor arrival growth. The average growth rates in tourist arrivals registered by ASEAN countries were among the highest in the world. It grew by over 30% from 1991 to 1995 (ATIC, 1996).

Tourist receipts in ASEAN grew at an average annual rate of 14.7% between 1980 and 1992, a level that was exceeded only by the United States among the top tourist destinations. In 1992, the region earned US$16.2 billion in tourist revenues, accounting for 5.44% of total tourist receipts worldwide, and ranked fifth among the world's top tourism earners (Table 8.4). Since then, this has grown to US$ 18.9 billion in 1993 and US$ 23.5 billion in 1994 and US$ 27.6 billion in 1995 (ATIC, 1996). If the trend persists, the five ASEAN countries listed by WTO would probably rank among the top 20 earners in another decade. Tourism development programmes and investments in tourism-related infrastructure are expected to push double-digit growth rates even higher in the next several years.

Tourism has provided ASEAN with significant economic gains. For the past several years it was the single biggest source of foreign exchange for ASEAN countries. In 1992, tourism contributed 4% to ASEAN's aggregate GDP from a level of 2.4% in 1985 (Table 8.5). The share of tourism to total exports has also increased from 6.9 % in 1985 to 8.8 % in 1992. However, when compared with the more well-established tourist destinations in Europe and in the Americas, tourism's contribution to the ASEAN economies is still very small. Thus, tourism contribution to the economies in the region can still expand significantly. This bright prospect should make tourism a key factor in the growth of the ASEAN economies in the years ahead.

Unlike the market for merchandise exports that is concentrated on a few major trading partners, the ASEAN tourist markets are more diverse. Most of the arrivals are from countries in East Asia and the Pacific region. Intra-ASEAN tourists account for around 40% of total arrivals. The diversity and proximity of the ASEAN tourist markets have made the sector less vulnerable to external variables which is not the case with trade. In addition, income from tourism is more widely dispersed and benefits larger segments of the population.

Table 8.4: Top Tourism Earners in the World

Rank 1992	Country	Tourist Receipts (Million US$) 1992	1980	Rank	Average Annual Growth Rate (%) 1980/92	% Share of Receipts Worldwide 1992	1980
1	United States	53,861	10,058	1	15.01	18.08	9.71
2	France	25,000	8,235	2	9.70	8.39	7.95
3	Spain	22,181	6,968	4	10.13	7.45	6.73
4	Italy	21,577	8,213	3	8.38	7.24	7.93
5	ASEAN-5*	16,204	3,190	10	14,68	5.44	3.03
6	Austria	14,832	6,442	7	7.20	4.98	6.22
7	United Kingdom	13,683	6,893	5	5.88	4.59	6.66
8	Germany	10,982	6,566	6	4.38	3.69	6.34
9	Switzerland	7,650	3,149	9	7.68	2.57	3.04
10	Hongkong	6,037	1,317	19	13.53	2.03	1.27
11	Mexico	5,997	5,393	8	(1)	3.15	3.86
12	Canada	5,679	2,284	11	1.13	2.01	5.21
13	The Netherlands	5,004	1,668	15	9.59	1.68	1.61
14	Belgium	4,053	1,810	12	6.95	1.36	1.75
15	Australia	3,992	967	23	12.54	1.34	0.93
	World Total	216,732	73,904		9.48	74.00	72.24

Source: World Tourism Organization, 1994
Note: (1) Data for 1980 is not comparable with data for 1992 due to change of series.
Brunei Darussalam and Vietnam are not included. ASEAN figure for 1980 is from ASEAN Secretariat, 1997

Table 8.5: Role of Tourism in ASEAN Economies

YEAR	Total Receipts (US$ millions)	Receipts as of % of Current GDP	Receipts as of % of Export
1985	5,037	2.4	6.9
1987	6,715	3.1	7.9
1989	11,284	4.0	9.1
1991	13,695	3.8	8.3
1992	16,192	3.9	8.8

Source: ESCAP 1994, ADB 1995
Note: Vietnam not included; Brunei included up to 1989

B. Tourism and the Environment

Uncontrolled tourism can threaten and damage the environment. When the number of tourists is greater than the carrying capacity of the local environment, serious disruption of the social and physical environment can occur. Some local tourist sites in ASEAN have, in fact, reached a precarious state of deterioration and unless proper controls are put in place, these tourist havens may no longer be able to sustain additional stress. Local tourism administrators and planners must carefully consider the social and physical carrying capacities of tourist spots to promote sustainable tourism development.

Apart from its impact on the physical environment, tourism can also affect the population's attitudes, behavior and values. These effects can be more subtle and can have serious long term implications on local communities and society as a whole. As stakeholders in the environment on which tourism thrives, local residents should therefore be involved in the planning and implementation of tourism development projects. Their cooperation is essential to ensure that plans and programmes are compatible, not only with the local environment, but also with the local culture and way of life. Adequate training should be able to provide local residents with the opportunity to participate meaningfully in tourism development activities and environmental conservation.

In the past, ASEAN countries invested heavily in infrastructure to develop tourism sites. Apart from requiring substantial capital that is relatively limited in developing countries, this strategy did not prove compatible with environmental objectives in a number of cases. In addition, some ASEAN countries did not have the capability to support tourism development with adequate programmes for the conservation of the environment.

In recent years, ecotourism has emerged as an alternative to the type of tourism that thrives on massive infrastructure investments. It promotes environment protection and conservation by focusing the attention of tourists on the biodiversity of the region's flora and fauna, interesting terrestrial marine life, and the wealth of its cultural heritage. The World Wildlife Fund defines ecotourism as "traveling to undisturbed natural areas to study or just to admire and enjoy the scenery and its wild plants and animals as well as their exotic cultures". The market for ecotourism is growing fast, with an estimated potential of about US$25 billion every year (World Tourism Organization, 1994). Because it requires small scale and dispersed types of development, ecotourism has been particularly attractive to countries with limited resources. Ecotourism sites in ASEAN are mostly concentrated in several protected forests and coastal areas in the region.

C. Tourism Development Experience of Selected ASEAN Countries

ASEAN's experience in tourism development during the past two decades offer valuable lessons for charting tourism's future course in the region. ASEAN countries can benefit from mutual sharing of the measures and strategies employed in dealing

with critical problems encountered in tourism projects. Lessons learned from these experiences can help Member Countries improve future strategies towards the common goal of promoting sustainable tourism in ASEAN.

1. Thailand

Tourism expansion in Thailand is probably one of the fastest in the world. Industry revenues have consistently topped all other sources of foreign earnings for the past 10 years (World Tourism Organization, 1994). The rapid growth of the industry, however, has brought a number of undesirable consequences — pollution, untreated wastewater, garbage, traffic congestion, insufficiency of infrastructures, misuse of land, and premature degradation of tourist facilities, among others. But perhaps, what are most disturbing are the social costs. These include crime, drug abuse, prostitution, and cultural alterations from foreign influences. Aware of these problems, the Government has instituted several measures to arrest, if not reverse, the physical and social deterioration caused by tourism (Box 8.6).

Pattaya

Pattaya is located on the eastern seaboard of Thailand about 140 km from Bangkok and is probably the most famous international beach resort in the country. It used to be a small, quiet fishing village with nice sandy beaches stretching for about three kilometers. Before large scale tourism development set in, local tourists were the only ones patronizing the place for many years.

During the early 1970's, foreign visitors started coming to Pattaya. The number of tourists increased very rapidly, reaching

Box 8.6
ENVIRONMENTAL MEASURES FOR SUSTAINABLE TOURISM IN THAILAND

Thailand's experience in tourism development has enabled the country to set a number of useful guidelines in pursuing sustainable tourism. These guidelines combine the relevant factors for developing tourist destinations as well as conserving the environment. The following element are generally prescribed under these guidelines :

1. **Formulate a master plan to develop and rehabilitate tourist destinations, including infrastructure facilities and other basic services. Thailand is presently developing a master plan that would cover the traditional location of tourist attractions and new tourist destinations such as Pattaya, Phuket, Chiengmai, Had Yai, Cha-am, Huahin, Chiengrai, Samui Island/Surat Thani, Kanchanaburi, Ayudhya and the lower part of Northeastern Thailand.**

2. **Enforce laws governing the use of buildings, national parks and ancient ruins, buildings and other structures. These laws should control land use and the types of permissible business activities to prevent negative impacts on the environment.**

3. **Designate as "Environmentally Protected Areas" and/or "Pollution Control Zones" those areas that suffer pollution so that they can be monitored strictly and protected from further degradation. Restoration of these areas may be undertaken whenever feasible.**

4. **Encourage public organization, private sector and local residents to participate in tourism projects and related natural resources conservation activities to promote social and physical balance in tourism development.**

5. **Increase efficiency in the provision of infrastructure and other public utilities, emphasizing long-term use and tourist safety. In addition, measures should be taken to protect tourists and to keep business operators from taking advatntage of them.**

Source : Management of Sustainable Tourism Development, ESCAP Tourism Review, UN, 1993; Reports from the Government of Thailand, 1993.

400,000 in 1975 and increasing to 1,724,000 in 1987. The number of hotel rooms increased accordingly to 11,463 from a level of 2,260 in the mid-1970s. More than half of the tourists were foreigners.

Infrastructure in the area soon became inadequate to cope with increasing demand. Aside from swimming and water sports facilities, entertainment facilities such as restaurants, bars and nightclubs were constructed. Most of these establishments were constructed without adequate sewage facilities, causing severe water pollution. Meanwhile, the influx of tourists induced population growth due to rapid in-migration, as well as the expansion of trade and commerce. Traffic congestion, air and noise pollution, overcrowding, increase in solid wastes and shortage of water supply ensued. Social problems such as prostitution and drug abuse followed. These problems eventually caused tourism to decline during the late 1980's (World Tourism Organization, 1994).

The Government took strong and decisive interventions to arrest the deteriorating conditions in Pattaya. In January 1990, the Cabinet approved the implementation of the Pattaya Water Quality Management Plan. In 1992, declarations were issued under the National Environmental Quality Act of 1992, providing for the designation of Pattaya as a Pollution Control Area and an Environmentally Protected Area. The former designation required local authorities to prepare an action plan for environmental quality management to control, reduce and eliminate pollution that poses public health hazards or generates adverse impact on environmental quality. The implementation of the action plan was funded by the Environment Fund and the budget of the office for Environmental Policy and Planning.

The designation of Environmentally Protected Area was intended to protect and manage areas within national parks and wildlife reserves that are especially vulnerable to human activities. The National Environment Board was given the authority to delimit such areas and prescribe the necessary and appropriate protective measures. The local authorities have also been advised to integrate its action plan on the environment in the Provincial Action Plan. Since 1992, the Government has allocated nearly US$54 million for both action plans.

The experience in Pattaya clearly demonstrated the need to balance tourism expansion with infrastructure development based on the carrying capacity of the local environment. Otherwise, tourism cannot be sustained and corrective measures could be costly.

Phuket

Phuket is the biggest island in the country with an area of 550 sq km. It has beautiful sandy beaches, clear waters and extensive coral reefs. Among the more popular ones are Patong, Karon, Kata, Nai Han and Rawi. The island started to become a popular resort during the 1980's. The number of tourists in the island increased from 146,000 in 1981 to 500,000 in 1987. The number of hotel rooms also increased from 2,520 to 6,300 during the same period.

As a result of rapid tourist development, Phuket began to experience problems similar to those of Pattaya. However, the internationally-famous island resort was more fortunate because it had a much bigger area that can absorb environmental stress. The Government was also able to make timely interventions to arrest the physical deterioration of the area. In 1987, Phuket was selected as a demonstration project on Coastal Zone Management (CZM). This led to the formulation and implementation of the Phuket Action Plan that was intended to maintain water quality, protect the coral reefs, and establish land use planning. The plan involved active participation of the local residents.

Similar to Pattaya, in 1992, Phuket was declared a Pollution Control Area and an Environmentally Protected Area. For the period 1995 to 1996, the Government has allocated nearly US$33 million for the implementation of both action plans. Through the concerted efforts of the different sectors involved, it is expected that the deterioration of environmental quality in Phuket can be reversed to sustain tourism development.

2. Malaysia

Malaysia places considerable importance to tourism, both local and international. ASEAN is the primary market for Malaysian tourism, accounting for more than 70% of tourist arrivals.

In recent years, the Government has taken a number of initiatives to promote sustainable tourism in the country. The Ministry of Culture and Tourism was established in 1987 and was later expanded in 1990 to include the arts. The Ministry centralized the responsibilities for planning, coordination, regulation and enforcement of all tourism policies, strategies and activities. All the functions of Tourism Malaysia (formerly the Tourist Development Corporation of Malaysia) were transferred to the Ministry in 1992 so that it can concentrate on its primary role of tourism marketing and promotion. The Investment Incentives Act was revised to extend incentives to investments in tourism facilities and infrastructure. The Government also established a M$120 million Special Fund to support tourism development.

Government attention has recently focused on Pulau Langkawi as one of the fast developing tourist sites in Malaysia. The Langkawi archipelago consists of some 104 islands northeast of Peninsular Malaysia. It used to be composed of agricultural and fishing communities until tourism development began in 1987 following the establishment of a duty free port. In 1989, the Commonwealth Heads of Government Meeting (CHOGM) held in Pulau Langkawi resulted in the famous Langkawi Declaration that forged cooperation among commonwealth nations in addressing environmental problems and issues.

The CHOGM triggered the rapid development and construction of tourist facilities in the archipelago. The Langkawi Development Authority (LADA) approved a total of 114 development projects that included the construction of 72 hotels and condominiums with a total of 7,500 rooms that would be available by 2000. With these developments, several imbalances are anticipated to occur. These include power outages and voltage fluctuations; decrease in water pressure; overloading of sewerage and drainage facilities; shortage in construction materials; shortage in skilled and semi-skilled workers; inadequate airline services; inadequate ancillary attractions and facilities to attract enough tourists; and increase cost of land. These concerns prompted the Government to review its policies and strategies for sustainable tourism development in the area.

Tourism development, when not planned properly and implemented correctly, can compromise its economic and ecological viability. Decisive Government interventions are necessary to correct imbalances and prevent further deterioration of the bio-physical environment. It is reassuring that in ASEAN, efforts are being pursued to ensure that tourism development is in harmony with the environment and the socio-cultural development goals of the people.

References

ADB. 1995. *Key Indicators of Developing Asian and Pacific Countries.*

ASEAN Secretariat. 1994. *ASEAN Macroeconomic Outlook 1994-1995.*

ASEAN Secretariat. 1997. *ASEAN Statistical Indicators, ISEAS.*

ESCAP. 1993. *Management of Sustainable Tourism Development.* Tourism Review No. 11.

ESCAP. 1994. *Statistical Yearbook for Asia and the Pacific.*

UNCTAD. 1994. *UN Conference on Trade and Development.* UN TD/B/WG.4/13. July, 1994.

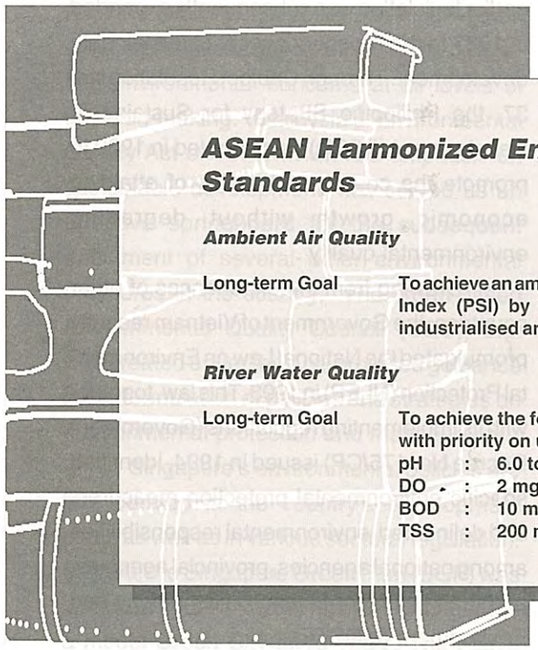
World Tourism Organization. 1994. *Yearbook of Tourism Statistics Vol. 1.*



Chapter 9
Legislation & Institutions

Adequate institutions and legislation are necessary to address the challenges of environmental protection and management in the wake of rapid economic growth in ASEAN. These institutions must be developed as a means for positive change towards sustainable development.

This Chapter reviews the development of the legislative framework for environmental management in ASEAN. It traces how earlier command and control approach eventually evolved into marked-based measures for securing compliance with environmental norms. It discusses the common features of environmental framework legislation as well as specific measures that have been promulgated to control sectoral activities that adversely affect the environment. The institutions responsible for formulating and implementing environmental policies are also described, including some of the factors that influence their effectiveness in performing their tasks. Finally, the Chapter describes ASEAN cooperative efforts in promoting the shared goal of sustainable development. These include initiatives for strengthening regional cooperation on environmental matters and active parpicipation in the debate on international environmental issues and concerns.



ASEAN Harmonized Environmental Quality Standards

Ambient Air Quality

Long-term Goal	To achieve an ambient air quality below 100 Pollutant Standards Index (PSI) by the year 2010 with priority on urban and industrialised areas.

River Water Quality

Long-term Goal	To achieve the following river water qualilty by the year 2010 with priority on urban and industrial areas: pH : 6.0 to 8.5 DO : 2 mg/l or more BOD : 10 mg/l or less TSS : 200 mg/l or less

I. ENVIRONMENTAL FRAMEWORK LEGISLATION

ASEAN countries have formulated comprehensive legislation to provide the national policy framework for environmental objectives and actions towards sustainable development. Such framework legislation articulates various concerns on environmental protection and conservation and defines the strategies and the means for addressing them. In some cases, it consolidates existing piecemeal legislation and serves as the basis for updating existing laws and enacting new ones. It also provides the basis for the establishment of institutions tasked with managing the environment.

In 1982, the Indonesian Government promulgated Act Number 4, or the Environmental Management Act (EMA) which laid down the country's policies on environmental protection and management. It became the basis for subsequent formulation of specific laws and regulations at the national, regional and provincial levels, including the Living Natural Resources Conservation Act of 1990 which is considered a milestone legislation on nature conservation.

Thailand first passed the Enhancement and Conservation of National Environmental Quality Act in 1975 and this was recently replaced by the Enhancement and Conservation of National Environmental Quality Act (NEQA) of 1992. The latter strengthened the country's national environmental policy framework to provide better guidance and direction to environmental decisions and actions. The law empowered the Ministry of Science, Technology and Environment (MOSTE) to declare certain places in the country as "pollution control areas". These are areas with strong pollution potentials that could cause serious harm to the population and the environment. Once declared, concerned provinces are mandated to formulate a pollution control action plan for remedial and preventive measures. This area plan is then integrated into the Environmental Quality Management Action Plan for the province for which, funding is assured from both the Government budget and the Environmental Fund. The former is allocated for the implementation of projects by government agencies, while the latter is allowed only for addressing environmental problems. The Environmental Fund can be allocated as loan and/or grant to government agencies, local authorities, state enterprises or the private sector for providing wastewater treatment plants, waste disposal facilities and air pollution control systems.

The Philippine Environmental Policy (P.D. 1151) of 1977 provided for the right of all citizens to a clean environment. This right was reaffirmed in the 1987 Constitution which embodied the right of every Filipino to live in a balanced and healthy environment that is in harmony with nature. Meanwhile, the Philippine Environmental Code (P.D. 1152) of 1977 provided the framework for policy formulation and environmental management in the country. The concept of environmental protection and management embodied in earlier legislation was subsequently expanded in 1987 to the broader concept of sustainable development. Through Cabinet Resolution No. 37, the Philippine Strategy for Sustainable Development (PSSD) was adopted in 1989 to promote the country's objective of attaining economic growth without degrading environmental quality .

Drawing from the experiences of other countries, the Government of Vietnam recently promulgated the National Law on Environmental Protection (NLEP) in 1993. This law, together with its implementing regulations (Government Decree No. 175/CP) issued in 1994, identified specific environmental protection measures, and delineated environmental responsibilities among national agencies, provincial agencies, and the Ministry of Science, Technology and Environment (MOSTE).

Framework environemntal legislation in ASEAN countries contains certain common elements. One such element is the recognition of market-based instruments as a potent tool for advancing environmental protection through incentives for the private sector. Market-based instruments, such as the polluter pays principle, allow firms to decide whether to pollute the environment and pay the corresponding charge, or to reduce its output of pollution. A market-based philosophy provides the basis for innovative policies that allow business firms and government to work closely together in reducing pollution more efficiently and cost effectively.

Another common feature in most national legislation is the centralization of responsibility for the environment in a single government body. These central bodies are vested with a broad range of functions that cover policy-setting, planning, implementation, monitoring, and follow-up actions. In most cases, environmental management has shifted away from a command and control approach to a market- oriented approach.

Most national framework legislation in ASEAN has appropriately mainstreamed environment into national policy planning — thus creating countless opportunities for incorporating environmental concerns at all levels of decision-making. Malaysia's Environmental Quality Act of 1974, which laid emphasis on sustainable development, has served as an effective springboard for the subsequent enactment of several other environmental measures in the country. The broad-based Environmental Quality Council (EQC), that was created under the Act, provided guidance in the formulation of policies and strategies on environmental protection and management.

Singapore's environmental policies are incorporated in the country's development plans as well as in various sectoral legislation. In 1990, the Singapore Green Plan (SGP) was launched as the blueprint for making Singapore a model Green City in 10 years. The Plan's ultimate objective is to create "a clean and healthy environment and an environmentally conscious and responsible people, as well as to become a focal point for regional and international environmental activities". The Plan has now become the basis for planning and monitoring the country's environmental programmes.

The environmental policy objectives of Brunei Darussalam are also incorporated in its national development plans. The Sixth Plan covering the period 1991 to 1996 contains provisions for the maintenance of a healthy and clean environment through specific measures on conservation and protection, solid waste management, and water and air pollution. In 1993, the National Committee on Environment (NCE), chaired by the Minister of Development, was created to develop an integrated national policy on environmental protection and management. At the same time, the Committee was also tasked to coordinate environmental policy formulation and to oversee the implementation of various national environmental activities.

II. ENVIRONMENTAL LAWS AND REGULATIONS

Prior to the formulation of comprehensive framework legislation, the legal basis for environmental management in ASEAN consisted mostly of piecemeal rules and regulations to mitigate the degradation of natural resources. These rules usually restricted specific economic activities involving the use of water, air and land. In some cases, regulatory measures are incorporated in specific laws governing sectoral activities in mining, fisheries, port operations and others.

The evolution of environmental regulations in individual ASEAN countries largely reflected national priority concerns. Indonesia, whose economy is largely

dependent on natural resources, promulgated the Forestry Provision Act as early as 1967 because of its concern with the rapid depletion of its abundant natural resources. In Thailand, the promulgation of the Factory Act of 1969 as the first major environmental legislation reflected the strong industrial orientation of the economy. In Brunei Darussalam, contract agreements for the protection of the environment are incorporated in specific sectoral regulations. These regulatory measures gradually expanded to other areas of concern such as pollution control, nature conservation, protection of public health, and control of toxic and hazardous wastes, among others.

A. Water Pollution Control Measures

Water pollution is one of the most serious problems confronting ASEAN today. It is caused by several factors, among others: I) the generation of toxic and hazardous wastes from industry; ii) the increased application of chemicals whose residues contaminate surface and ground water; iii) expansion of human settlements along rivers and coastal areas; and iv) "natural causes" that include erosion and landslides that result in siltation. To address these stresses, ASEAN has resorted to command and control legislation that regulated the conduct of specific activities to protect the environment and ensure public safety. Among the very first laws enacted in the region were the Petroleum (Pipelines) Act of 1920 and Municipal Boards Act of 1920 in Brunei Darussalam; and the Navigation in Thai Waters Act of 1913 (Box 9.1).

It was only during the early 1970's that ASEAN countries started in earnest to enact more comprehensive regulatory measures and programmes to control water pollution (Box 9.2). These measures generally defined limits on the quality of allowable wastewater discharges expressed in terms of standard compositions of selected pollutants (see Chapter 2 on Water) and provided the applicable sanctions for any violation. In most of these regulations, standard values depended on the types or intended general uses of the receiving body of water defined in the enabling legislation.

All ASEAN countries have separate legislation for the protection of marine waters because of the critical role it plays in the economy. In some countries, certain economic sectors require special attention because of the significant pollution threats they pose on marine resources. Malaysia's special regulations on palm oil and rubber industries are cases in point. Other measures that address specific concerns are those on the classification of marine waters; ports operation; merchant shipping; protection of public health; etc.

Because of the worsening problems of water pollution, ASEAN countries began to institute programmes for the rehabilitation of major river systems. In 1977, Singapore embarked on a 10-year programme to clean up the Singapore River and Kallang Basin. Through this programme and strict implementation of existing water pollution regulations, water quality in the Singapore River and Kallang Basin has improved significantly. Similar river rehabilitation programmes are being implemented by other ASEAN countries.

Notwithstanding several regulatory measures that have been passed, water quality in ASEAN has hardly improved except for Singapore. Constraints to effective implementation include inadequate monitoring and enforcement capacities of technically qualified and motivated staff, and competing demands on limited resources, especially in cases were huge investments are required for the maintenance of water quality.

B. Air Pollution Control

The ill-effects of air pollution are mostly felt only in the highly urbanized sections of the cities on account of frequent rains and typhoons

Box 9.1
SELECTED REGULATORY MEASURES ON WATER POLLUTION CONTROL

Water pollution was one of the very first environmental problems experienced by ASEAN countries. The problem emerged as population grew along or near the rivers, waterways and coastal waters. Groundwater in certain areas became contaminated as domestic and industrial effluents percolated in the ground and found their way to aquifers. The coastal waters were similarly affected. The problem of water pollution became serious enough to generate a series of protective regulations in ASEAN countries through the years. The most important of these regulations are listed below:

Brunei Darussalam

* Petroleum (Pipelines) Act of 1920
* Municipal Boards Act of 1920 (Revised in 1984)
* Public Springs or Reservoir (Sec. 277)
* Rivers (Sec. 431)
* Water Supply Act of 1962
* Merchants Shipping Act 1984
* Port Act of 1985

Indonesia

* Act No.11 of 1974 on Water Resource Management
* Act No. 4 of 1960 on Indonesian Waters
* Provincial Regulation of DKI Jakarta on the Prevention of Air, Water and Off-Shore Pollution No.12 of 1971
* Various Provincial Regulations (Perda) on the Granting of Permits to Dispose Liquid Wastes
* The Environmental Management Act of 1982
* Act No. 5 of 1983 on the Indonesian Economic Exclusion Zone (EEZ)
* Government Regulation No. 20 of 1990 on Control of Water Pollution

Malaysia

* Environmental Quality Act (EQA) of 1974
* Environmental Quality (Licensing) Regulations of 1977
* Environmental Quality Regulations of 1978 (Prescribed Premises) (Crude Palm Oil)
* Environmental Quality Order of 1987 (Prescribed Activities) (Environmental Impact Assessment)
* Environmental Quality Regulations of 1978 (Prescribed Premises) (Raw Natural Rubber)
* Environmental Quality Regulations of 1979 (Sewage and Industrial Effluent)
* Environmental Quality Regulations of 1989 (Scheduled Wastes)
* Environmental Quality Order (Prohibition on the use of Controlled Substances in Soap, Synthetic Detergent and Other Cleaning Agents)
* Environmental Quality Regulations of 1989 (Prescribed Premises) (Scheduled Waste Treatment and Disposal Facilities)

Philippines

* Pollution Control Law (P.D. 984)
* Water Quality Management Act of 1977 (P.D.1152)
* Department Administrative Order (DAO) 34 of 1990 on water usage and classification and water quality criteria
* DAO No. 35 of 1990 on effluent quality standards
* The Water Code on Appropriation of Water Permits (P.D.1067)
* Marine Pollution Law of 1976 (P.D. 600 as revised by P.D. 979)

Singapore

* The Water Pollution Control and Drainage Act
* Trade Effluent Regulations (Limiting the Discharge of Trade Effluent)
* Amended Trade Effluent Regulations (Prescribing a Trade Effluent Tariff Scheme based on BOD and SS criteria)
* Prevention of Pollution of the Sea Act and Other Anti-Sea Pollution Regulations.
* Merchant Shipping (Oil Pollution) Act
* Environmental Public Health Act.

Thailand

* The Navigation in Thailand Waters Act of 1913 Providing for Marine Pollution Control
* The National Environmental Quality Act of 1992
* The Factory Act of 1992 Regulating the Establishment and Operation of Factories Including Pollution Control
* Ministerial Regulation No. 2 (1992) Providing Control on the quality of Effluent Discharges
* The Public Health Act of 1992 Regulating Effluent for Public Safety
* National Environment Board (NEB) Notification No. 8 of 1994 on the Classification of Surface Water and Prescribed Quality Standards
* NEB Notification No. 7 of 1994 on Regulations of Standards for Sea Water Quality

Vietnam

* The Law on Mineral Resource Exploitation of 1989
* Maritime Law of 1990
* Gas and Oil Law and Mining Code
* National Law on Protection of Environment (NLEP) of 1993
* Decree 1751CP of 1994
* Provincial Regulations

Sources: The ASEAN Environmental Improvement Project Report, 1994; Information Provided by the Governments of ASEAN Countries; World Bank, 1995

Box 9.2
REGULATORY MEASURES ON AIR POLLUTION CONTROL

ASEAN's concern for air pollution is less pressing because frequent rains and typhoons in the region have a natural cleansing effect on the atmosphere. Nevertheless, various regulatory measures have been passed by ASEAN countries to regulate air pollution, the most important of which are listed below:

Brunei Darussalam

* Petroleum (Pipelines) Act of 1920
* Municipal Boards Act 1920 (Revised 1984)
* Penal Code 1951
* Atmosphere (Sec.278)
* Petroleum Mining Act 1963

Indonesia

* Nuisance Ordinance of 1926
* Act 11 of 1962 - Hygiene of Public Enterprises
* Act 14 of 1969 - Basic Provisions on Labor Force
* Provincial Regulations in Jakarta, West Java and East Java (Perda No.12 of 1971, SK Gubernur Jabar No. 66031 of 1982 and Governor's Decree No.188 of 1988 respectively) to Control Air Pollution in their Respective Areas
* The Environmental Management Act of 1982
* Regulation No.19 of 1994 on the Management of Hazardous and Toxic Wastes

Malaysia

* Motor vehicle (Control of Smoke and Gas emissions) Rule 1977 (made under the Road Traffic Ordinance, 1958)
* Environmental Quality (Clean Air) Regulations 1978
* Environmental Quality (Compounding of Offences) Regulations 1978
* Environmental Quality (Control of Lead Concentration in Motor Gasoline) Regulations 1985
* Environmental Quality (Motor Vehicle Noise) Regulations 1987
* Environmental Quality (Prohibition on the Use of Chloroflurocarbon and Other Gases as Propellants and Blowing Agents) Order 1993

Philippines

* P.D. 984 - Pollution Control Law
* Air Quality Management (P.D. 1152) Establishing Air Quality to Protect Public Health and Damage to Living Things and Property
* Air Pollution from Motor Vehicles (P. D. 1181) Prescribing for Allowable Emission Levels for Motor Vehicles
* P.D. 1152 Establishing Standards on Noise Producing Equipment
* Memorandum Circular No.29 Prescribing Applicable Air Quality Standards for Thermal Power Plants
* DAO 14 and 14-A of 1993 on Air Quality Standards that Prescribes Allowable Emissions from Different Sources

Singapore

* Clean Air Act
* Clean Air (Standards) Regulations
* Clean Air (Standards) (Amendments) Regulations
* Clean Air (Prohibition on the Use of Open Fires) Order
* The Environmental Public Health Act

Thailand

* Ministry of Industry Notifications Nos. 2 (1993) and 4 (1971) Regulating Factory Emissions
* Minister of Science, Technology and Environment Notifications under NEQA of 1992 that Control Various Types of Emissions of Polluted Air or Pollutants
* Ministerial Regulation No. 2 under the Factory Act (FA) of 1992 that Regulates Factory Emissions Within Standard Levels
* Ministry of Science, Technology and Environment Notification under NEQA of 1992 that Establishes Vehicle Noise Standard

Vietnam

* National Law on Environmental Protection (NLEP) of 1993
* Decree 175/CP of 1994
* Provincial Regulations

Source: The ASEAN Environmental Improvement Project Report, 1994; Information Provided by the Governments of ASEAN Countries; World Bank, 1995

that wash away most of the pollutants in the atmosphere. Measurements of air pollution levels in non-urban areas, except those very near industrial facilities, show acceptable quality in terms of national standards.

Nevertheless, ASEAN countries have instituted several laws and regulations to control air pollution (Box 9.2). These regulations prescribe limits on emissions from different sources like stack gas from factories, stationary and mobile power generating plants, and others. The limits are set based on emissions of critical air pollutants such as suspended particulate, sulfur dioxide, carbon monoxide,

Box 9.3
REGULATORY AND POLICY MEASURES ON HAZARDOUS WASTES

The increasing threats posed by toxic and hazardous materials has prompted ASEAN countries to implement regulatory measures on the proper handling and management of these materials/substances. Some of these measures are as follows:

Brunei Darussalam

* The Penal Code of 1951
* Negligence re Poisonous Substances Act, Chapter 114 (Sec 284)
* Various Agreements Pertaining to Brunei Shell Petroleum Co., Sdn Bhd. (BSP) on Handling and Management of Wastes

Indonesia

* Hazardous Substances Ordinance No. 377 of 1949 Regulating the Imports and Use of Non-waste Hazardous Substances
* Government Regulation No. 7 of 1973 on the Control, Storage and Use of Pesticides
* Government Regulation No. 9 of 1969 and Nos.12 and 13 of 1975 on the Use of Radioactive Isotopes and Radiation
* Minister of Industry Decision Number 148/M/Sk/1985 on the Security of Hazardous and Toxic Substance in Industrial Companies
* Government Regulation Number 19 of 1994 on Hazardous Waste Management

Malaysia

* Environmental Quality (Scheduled Wastes) Regulation 1989
* Environmental Quality (Prescribed Pemises) (Scheduled Wastes Treatment and Disposal Facilities) Regulation 1989
* Promotion of Investments (Promoted Activities and Products) Order 1989

Philippines

* Toxic Substances and Hazardous and Nuclear Wastes Act of 1990 (R.A. 6969) Regulating the Importation, Manufacture, Processing, Sale, Use and Disposal of Hazardous Chemicals and Entry/Disposal of Nuclear Wastes
* DENR DAO No. 29 - Implementing Rules and Regulations of R.A. 6969
* DENR DAO No. 24 of July 1994 Providing for Interim Guidelines on the Importation of Recyclable Materials containing Hazardous Substances
* The Consumer Act of 1991 (R.A. No. 7394) on Hazardous Substances

Singapore

* Environmental Public Health (Toxic Industrial Waste) Regulations
* The Poisons Act and Poisons (Hazardous Substances) Rules Regulating the Import, Export, Transportation, Storage. Handling, Sale and Use of Poisons and Hazardous Substances.

Thailand

* The Notification of the Ministry of Industry No.25 1988 (BE 2531) Issued under the Factory Act 1969 (BE 2512)
* The Public Health Act of 1992 (BE 2535)
* The Hazardous Substances Act of 1992

Vietnam

* Investment Law of 1987
* Law on Labor Protection of 1991
* Code on the Protection of People's Health of 1994
* Provincial Regulations on Ambient and Workplace Standards and Inspection System of 1991

Sources: The ASEAN Environmental Improvement Project Report, 1994; Information Provided by the Governments of ASEAN Countries; World Bank, 1995

lead and others. Pollution from motor vehicles has also been the subject of special measures in most ASEAN countries. In the Philippines, for example, P.D. 1181 (Air Pollution from Motor Vehicles) was enacted to prescribe allowable emission levels for motor vehicles.

If properly implemented, air pollution control laws in ASEAN should be adequate to improve air quality. However, the lack of well-trained and highly-motivated law enforcers remains to be a constraint for most ASEAN countries. Furthermore, the social

Box 9.4
LAWS AND REGULATORY MEASURES ON CONSERVATION

In addition to the measures adopted by ASEAN countries to control pollution, other policy instruments were used to further protect the environment. These consist mostly of measures to conserve and protect the environment such as those enumerated below:

Brunei Darussalam

* Forest Code of 1951
* Land Code
* Wild Life Protection Act of 1981
* Agricultural Pests and Noxious Plants of 1971

Indonesia

* Act 5 of 1960 and Ordinance 148 of 1968 on Land Use
* Act 11 of 1967 or the Indonesian Mining Law
* Act 5 of 1967 or Basic Law on Forestry
* GR No. 33 of 1970 on Forestry Planning
* Continental Shelf Act of 1973
* Act No.11 of 1974 on Water Management
* GR No. 7 of 1973 on Pesticides
* Environmental Management Act of 1982 (EMA)
* Living Natural Resources Conservation Act of 1990 (LRCA)

Malaysia

* Land Conservation Act of 1960
* National Land Code of 1965
* The Protection of Wildlife Act (Act 76 of 1972; revised,1976)
* Environmental Quality Act of 1974
* National Parks Act of 1980
* National Forestry Act of 1984
* Fisheries Act of 1985

Philippines

* Forestry Administrative Order (FAO) No.16 and 18 of 1939 Protecting Wildlife
* Civil Code of the Philippines (R.A. 386): Provisions on Public Nuisance
* Forestry Reform Code of 1975 (PD 705) as amended by PD 1559 of 1978 and PD 1775 of 1981
* Fisheries Decree of 1975 (PD 704)
* Marine Pollution Decree of 1976 (PD 979)
* Philippine Environment Policy of 1977 (PD 1151)
* Philippine Environment Code (PD 1152)
* Department of Environment and Natural Resources (DENR) AO No. 23 of 1989 on Regulations on the Issuance of Timber Production Sharing Agreement (TPSA)
* DENR AO No. 15 of 1990 on Management of Mangrove Resources
* DENR DAO No. 8 Series of 1991 on Agricultural Land Conversion to Non-Agricultural Uses

Singapore

* Endangered Species (Import & Export) Act,1989
* Parks and Trees Act of 1985
* Fisheries Act of 1985
* Nature Reserves Act of 1985
* Sand and Granite Quarries Act of 1985
* National Parks Act of 1991
* Public Utilities Act of 1992

Thailand

* Forest Act of 1941 (as amended)
* Fishery Act of 1947 (FISHA)
* National Forest Reserves Act of 1960
* Wild Animals Protection and Reserves Act of 1961 (WAPRA)
* National Parks Act of 1961
* Minerals Act of 1967
* The Enhancement and Conservation of National Environmental Quality Act of 1992.

Source: The ASEAN Environmental Improvement Project Report, 1994; Information Provided by the Governments of ASEAN Countries; IUCN 1994

consequences of strict legal enforcement, such as closure of factories and loss of jobs, are sometimes given more importance than environmental protection. The use of less-polluting processing technologies has been limited by the lack of capital, especially on the part of small and medium enterprises.

C. Control Measures for Toxic and Hazardous Substances

In recent years, ASEAN countries have become increasingly concerned with the effects of toxic and hazardous wastes on the environment and on the health of the population. With rapid industrial expansion, most of these substances have become more sophisticated and complex to handle, rendering olds laws inadequate to cope with their ill-effects. Thus, a more responsive set of laws on hazardous substances evolved (Box 9.3). These laws provide for the monitoring of all toxic and hazardous substances; designation of appropriate regulatory institutions to control the handling, treatment and disposal of these materials; and provide restrictions on the entry of toxic and hazardous wastes. Some of these regulatory measures have just been recently promulgated and their implementing guidelines are still evolving.

D. Conservation Measures

Environmental protection and natural resources conservation is embodied in laws and regulations covering forest protection and preservation, soil management, fisheries conservation, land management, wildlife protection and conservation, and marine resources management, among others (Box 9.4). They provide the legal basis for ASEAN countries to pursue different conservation measures which include: i) the preservation of all biological species especially those that are endemic and endangered; ii) creation and maintenance of gene banks as a conservation strategy; iii) protection of habitat of threatened biological species; iv) conservation of vegetation cover and forest resources; v) conservation of soil and sound management of watersheds; vi) preservation of cultural heritage; vii) environmentally compatible land use planning and implementation; and other conservation measures.

III. ENVIRONMENTAL INSTITUTIONS

A. Policy Formulation

Through the years, various ASEAN institutions were established to formulate policy and enforce laws and regulations on the environment. Policy formulation is lodged at the highest level of decision-making in Government, usually at the ministry level (Table 9.1). Except for Brunei Drussalam, ASEAN countries have designated a single ministry to be responsible for the environment . The ministry is generally equipped with in-house capabilities for planning, research, and project development that feed into the policy process together with inputs from other agencies.

Policy implementation and rule enforcement are carried out by different government institutions. Private sector participation in the work of environmental institutions is generally encouraged in all ASEAN countries, and in some cases, mandated by law. Important policy legislation in ASEAN requires extensive public hearings to ensure that the views of the different sectors, especially the non-government interest groups, are heard and taken into consideration.

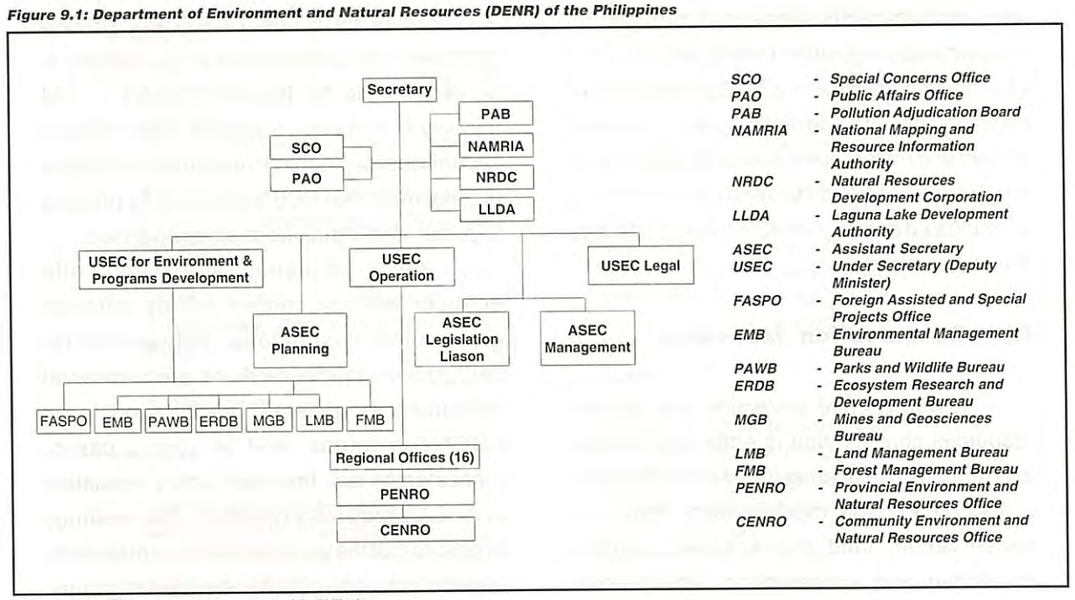
A typical organization structure of an environment ministry is reflected by the Department of Environment and Natural Resources (DENR) of the Philippines (Figure 9.1) and the Ministry of Science, Technology and Environment (MOSTE) of Vietnam (Figure

Table 9.1: Environmental Decision Making and Policy Formulation Institutions in ASEAN

Country	Institution	Level
Brunei Darussalam	National Committee on Environment (NCE)	Chaired by Minister for Development with Permanent Secretaries of other Ministries as members
Indonesia	State Ministry of Environment	Ministry
Malaysia	Ministry of Science, Technology and the Environment (MOSTE) Environmental Quality Council (EQC)	Ministry Multi-sectoral Advisory Body
Philippines	Department of Environment and Natural Resources (DENR)	Ministry
Singapore	Ministry of the Environment (ENV)	Ministry
Thailand	National Environmental Board (NEB) Ministry of Science, Technology and Environment (MOSTE)	Chaired by the Prime Minister with the Permanent Secretary of MOSTE as secretary Ministry
Vietnam	Ministry of Science, Technology and Environment (MOSTE)	Ministry

Source: The ASEAN Environmental Improvement Project Report, 1994; Information Provided by the Governments of ASEAN Countries; World Bank, 1995.

Figure 9.1: Department of Environment and Natural Resources (DENR) of the Philippines

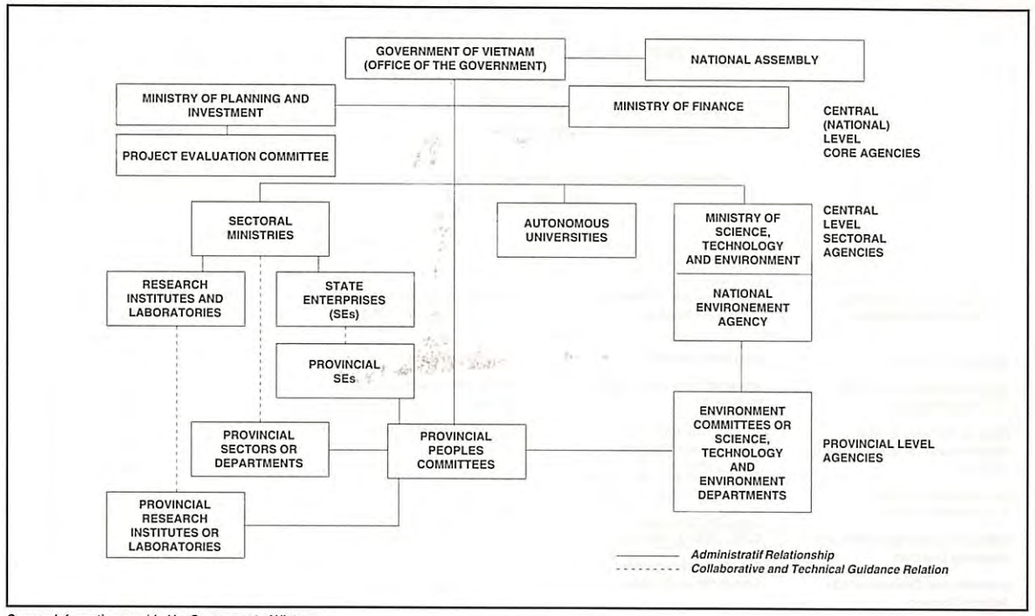


Source: Information provided by Government of the Philippines

9.2). DENR was created by Executive Order 192 and given overall responsibility for the protection and management of the environment. The Environmental Management Bureau (EMB) within the DENR provides most of the inputs for policy formulation, in coordination with other government departments.

The MOSTE of Vietnam was created by virtue of the National Law on Environmental

Figure 9.2: Environmental Management Organization of Vietnam



Source: Information provided by Government of Vietnam

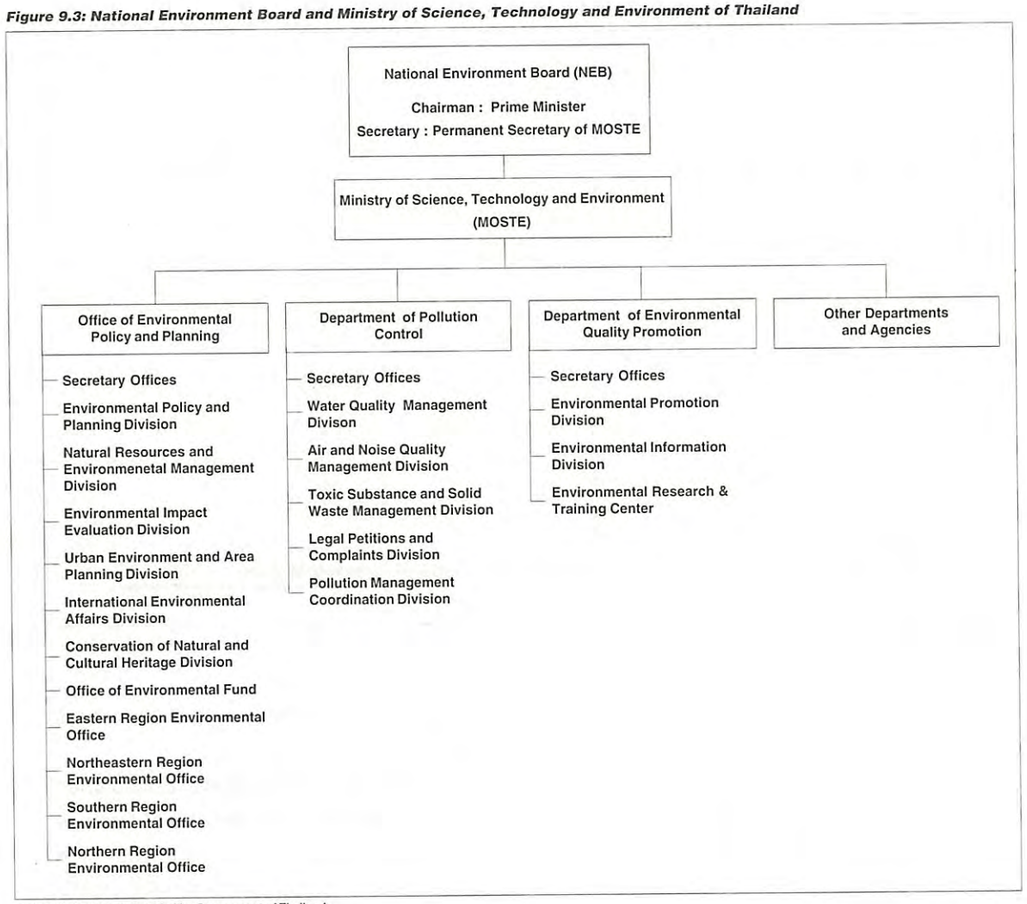
Protection (NLEP) and its implementing regulation, Decree 175/CP. MOSTE is mandated to promote the sustainable development of Vietnam's natural resources; control pollution in urban and industrial centers; and balance the growth of the economy with environmental protection (World Bank, 1995).

In Brunei Darussalam, the National Committee on Environment (NCE) has overall responsibility for environmental matters. The members of this high-level multi-sectoral committee are the Minister of Development (as chair), Permanent Secretaries of different concerned Ministries, Directors of relevant Bureaus, other important Government officials, and leaders in the private sector. The NCE coordinates all the environment-related functions of the different agencies of Government and oversees the obligations and responsibilities of the private sector. To function more effectively, it has been vested with the authority to create working groups to prepare and implement environmental plans and programmes for the country. Working Groups on Water Resource Management, Solid Waste Management and Environmental Education and Communication have been established so far.

Under the 1992 National Environment Quality Act (NEQA), the Ministry of Science, Technology and Environment (MOSTE) of Thailand is responsible for the development of environmental legislation and the formulation and management of environmental policies. The MOSTE carries out its functions through three environmental departments, namely; the Office of Environmental Policy and Planning, the Department of Pollution Control, and the Department of Environmental Quality Promotion (Figure 9.3).

The NEQA also provided for the reorganization of the Office of the National Environment Board (ONEB), that was first created under the 1975 National Environmental Preservation and Promotion Act, into the National Environment Board (NEB). The present high-level structure is chaired by the Prime Minister, who is assisted by a Deputy Prime Minister, and the Minister of MOSTE as first and second Vice Chairman, respectively. Other ministers and high level Government officials and representatives from the private

Figure 9.3: National Environment Board and Ministry of Science, Technology and Environment of Thailand



Source: Information provided by Government of Thailand

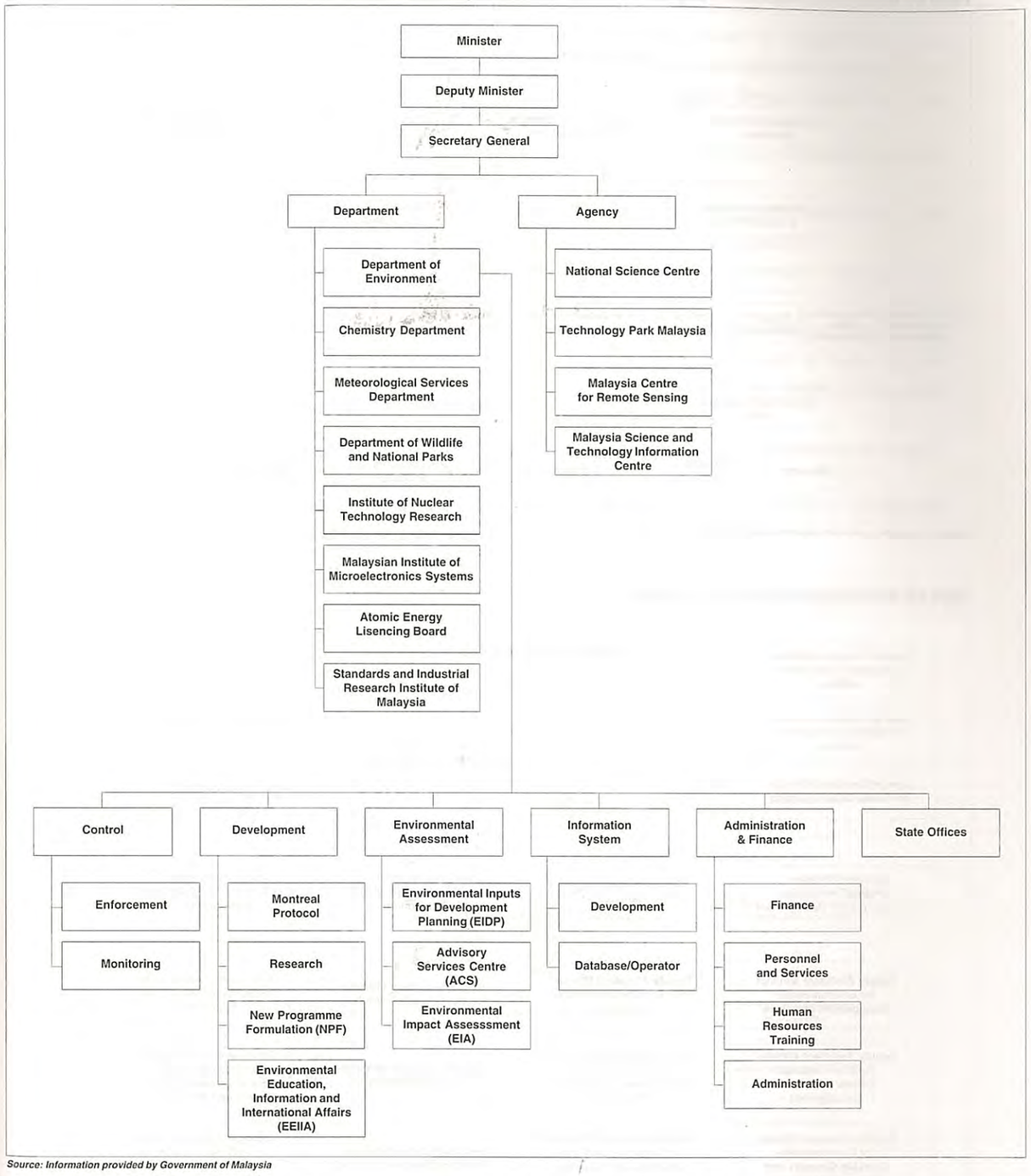
sector participate in the Board as members. Among the functions of NEB are the formulation of environmental policies and plans, the establishment of environmental quality standards, and the preparation of national environmental quality reports .

The Department of Environment (DOE) is the principal agency in the Malaysian Government responsible for the formulation and implementation of environmental policies. Operating under the supervision of the Ministry of Science, Technology and the Environment, the DOE has six operating arms to carry out its functions (Figure 9.4). It serves as the technical secretariat to the Environment Quality Council (EQC) — the highest multi-sectoral body on the environment established by the Environmental Quality Act of 1974.

The EQC is composed of members from the federal and state governments, academic institutions, industry associations and other private environmental organizations. Because of its broad-based representation, it functions effectively in the coordination of Cabinet decisions, promulgations of different government committees and agencies, and ministeral and administrative directives. The Council also provides guidance and direction to the DOE in the formulation of environmental policies and strategies.

Set up in 1972, the Singapore's Ministry of the Environment undertakes the task of protecting public health and enhancing the environment (Figure 9.5). The Ministry has since developed and implemented comprehensive environmental protection and public health

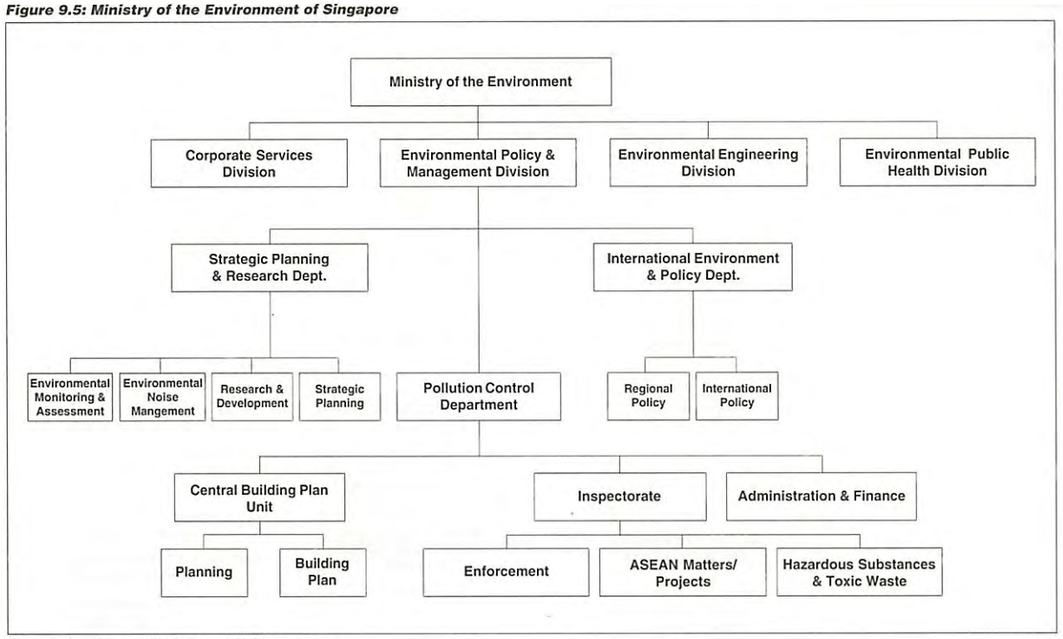
Figure 9.4: Ministry of Science, Technology and the Environment of Malaysia



Source: Information provided by Government of Malaysia

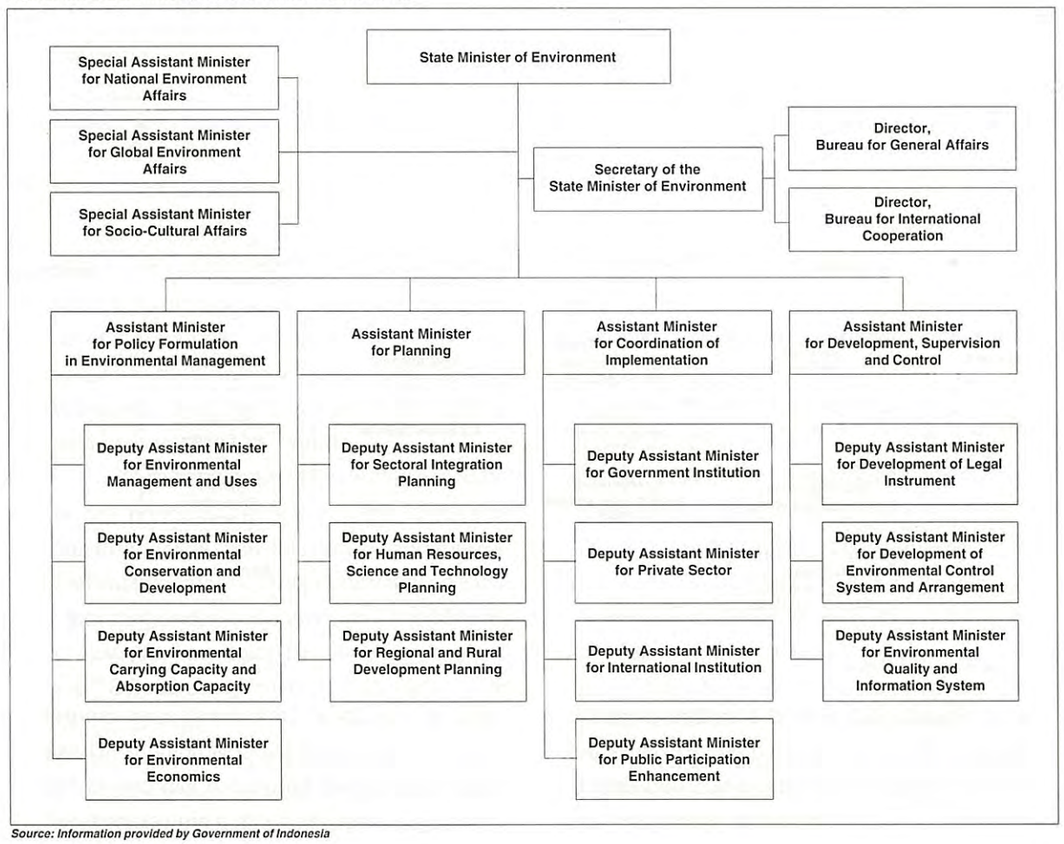
programmes with a high standard of public health. These include putting in place the environmental infrastructure such as drains, sewers, sewage treatment works, refuse incineration plants and transfer stations, as well as the legal framework and control measures to protect the environment. These have transformed Singapore into one of the world's cleanest cities with a high standard of public health.

Figure 9.5: Ministry of the Environment of Singapore



Source: Information provided by Government of Singapore

Figure 9.6: State Ministry of Environment of Indonesia



Source: Information provided by Government of Indonesia

The State Ministry of Environment of the Republic of Indonesia was established through the President of Republic Indonesia's Decreee Number 44, 1993.

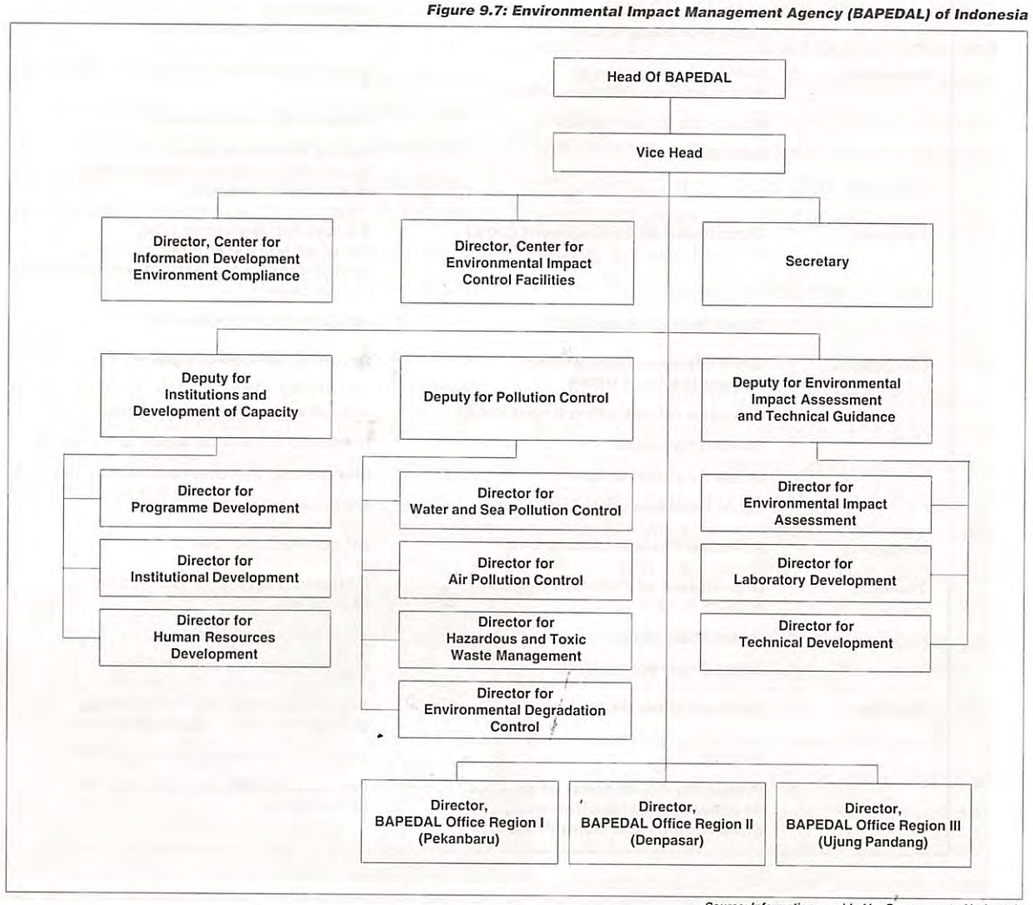
The Government of Indonesia has previously established the State Ministry for Development Supervision and the Environment in 1978. In 1983, in line with its new approach and mandate, the name of the Ministry changed to the State Ministry for Population and the Environment. This Ministry remained until 1993 when the Government split it into two Ministries namely, the State Ministry for Population and the State Ministry of Environment.

The State Ministry of Environment is the highest government institution responsible for environmental management at the national level (Figure 9.6). This institution is reponsible for the coordination of environmental management which is implemented by government sectoral agencies, provincial and local governments, private sector and the public.

The State Ministry of Environment has six functions as follows:

- formulation of government policies on environment management;
- planning of environment management programmes;
- coordination of activities carried out by government agencies in light of the implementation of the entire government programmes;
- increase public participation in environment management;
- coordination of BAPEDAL's operational activities;

Figure 9.7: Environmental Impact Management Agency (BAPEDAL) of Indonesia



Source: Information provided by Government of Indonesia

- making reports, recommendations to and preparing materials for the President.

In his daily activities the State Minister of Environment is assisted by a Secretary of the Ministry responsible for administrative matters, four Assistant Ministers responsible for technical matters, and three Special Assistant Ministers responsible for specific assignments.

The Environmental Impact Management Agency (BAPEDAL) is a non-departmental government agency directly responsbile to the President. It was established in 1990 through Presidential Decree No.23, 1990 and further improved through Presidential Decree No.77, 1994 (Figure 9.7). Its role is to assist the President in environmental impact control which includes the prevention and control of environmental pollution, environmental deterioration, and the rehabilitation of environmental quality, in accordance with the prevailing statutes and regulations. The State Minister of Environment is the Head of BAPEDAL.

B. Pollution Control

Pollution control laws in ASEAN are administered by various agencies responsible for particular sectors or particular sites (Table 9.2). In certain cases, specific agencies are

Table 9.2: Institutions Enforcing Pollution Control Regulations

Country	Institutions	Functions
Brunei Darussalam	* National Committee on Environment (NCE)	* Coordination; advise
	* Sectoral Departments Local Municipal Boards	* Enforcement * Monitoring; enforcement
Indonesia	* Different ministries on mining/energy, industry, etc.	* Issues and withdraws permits to operate
	* Provincial Governments	* Monitoring; enforcement
	* BAPEDAL	* Issues permits of waste treatment facilities; management of hazardous wastes
Malaysia	* Department of Environment (DOE)	* Administers/enforces EQA * Reviews and formulates environmental regulations and standards * Coordination
	* Other Federal Agencies	* Monitoring; enforcement
Philippines	* Environmental Management Bureau (EMB) of DENR	* Coordination and assistance
	* Pollution Adjudication Board (PAB)	* Adjudication of pollution cases
	* Special Agencies	* In charge of special areas or functions
	* DENR Regional Offices	* Monitoring; enforcement, issues permits
	* Local Government Units	* Enforcement
Singapore	* Pollution Control Department	* All control functions
Thailand	* Department of Pollution Control, MOSTE	* National monitoring and setting standards
	* Other Ministries	* Enforcement of laws
	* Local Government Units	* Monitoring and enforcement
Vietnam	* Sectoral Ministries	* Implementation and enforcement of regulations in respective sectors
	* MOSTE	* National monitoring and coordination
	* Provincial Department of Science, Technology and Environment or Environmental Committees	* Implementation and Enforcement at local level

Sources: The ASEAN Environmental Improvement Project, Draft Report, 1994; Information Provided by the Governments of ASEAN Countries; World Bank, 1995

mandated by law to be responsible for environmental matters. This was the case for Laguna Lake in the Philippines that was managed by the Laguna Lake Development Authority under the Office of the President until 1993 when the Authority was finally placed under the general supervision of the DENR. The enforcement of pollution control regulations in coastal waters in the Philippines is handled also by a specialized agency — the Philippine Coast Guard — which is under the Philippine Navy of the Department of National Defense.

Although the institutions to enforce anti-pollution measures in ASEAN have sufficient legal basis, most of them are experiencing difficulties in enforcement primarily due to the lack of well-trained manpower to police potential violators. There is also scope for streamlining organizational links and procedures to make enforcement more effective.

Over the years, increasing awareness of environmental issues and concerns has motivated the ASEAN population to participate voluntarily in several environmental activities. Recognizing this trend, ASEAN countries have specially provided for the promotion and support of NGO participation in environmental affairs in more recent legislation. As more NGO's were organized at the national and local levels, they have become effective partners of Government in monitoring pollution and other environmental activities in their local areas of operation.



ASEAN Environmental Publications

IV. ENVIRONMENTAL IMPACT STATEMENT (EIS) SYSTEM

The practice of conducting Environmental Impact Assessments (EIA) helps improve policy analysis by tracing the impacts of decisions at various levels — at the project, sectoral and macroeconomic levels. As a tool for policy analysis, EIAs should be done in parallel with the different stages of the planning, programming and project development cycles to take into account the bio-physical and social dimensions of development interventions.

A. EIS Implementation in ASEAN

In ASEAN countries, EIAs are widely used at the level of major programmes and projects. They are applied mostly to critical projects that have major potential effects on the environment (Table 9.3). In the case of the Philippines, the EIA is also required for all projects that will be sited in environmentally critical areas (Box 9.5).

The Environmental Impact Statement (EIS) system is designed to serve as a planning tool and to provide inputs during the different stages of planning and implementation of major development projects. The EIS cycle also includes follow-up activities such as environmental compliance and verification of predicted impacts. In a number of ASEAN countries, public participation in assessment and monitoring are encouraged in an effort to build consensus among the stakeholders.

Indonesia, Malaysia, the Philippines, and Thailand have formal EIS systems in place as provided by their national legislations (Table 9.4). Singapore does not have a formal EIS system although many aspects of impact assessment are

Table 9.3: Selected Environmentally Critical Projects in ASEAN

Type	Malaysia	Philippines	Thailand
Petrochemicals	All sizes	All sizes	100 tonnes/day or more
Non-ferrous smelting	All sizes (Aluminum and Copper)	All sizes	50 tonnes/day or more
Iron and Steel Industry	100 tonnes/day (Iron Ore as raw material) 200 tonnes/day (scrap iron as raw material)	30,000 tonnes/year or more	100,000 tonnes/ day or more
Cement	30 tonnes/hr. or more	Not available	All sizes
Pulp and paper	50 tonnes/day or more	not available	50 tonnes/day or more
Thermal Power Plant	10 MW or more	10 MW or more	10 MW or more
Water Dams	200 Hectare area or more	Storage Vol. of 20 mil. cu. m. or more	100,000,000 cu. m. storage vol. or more
Fishpond	Not available	25 has. area or more	Not available
Pipeline Construction	50 km. or more	Not available	Not available
Pesticide Industry	100 tonnes/day	All sizes	All sizes
Housing Development	50 has. or more	not available	16 has or more
Airport	Air strip of 2500 m Airstrip in State and National Parks	All sizes	All sizes

Source: Information provided by Governments of ASEAN Countries

incorporated in their review process for major programmes and projects. Brunei Darussalam is considering to institute an EIS system.

Although the EIS system is increasingly being used by ASEAN countries in programme and project planning, its full and regular application is still hampered by a number of difficulties at the operating level. These difficulties include: i)the inability of firms, especially small and medium enterprises, to absorb the costs involved in environmental assessments; ii) the absence of guidelines for certain industries; iii) inadequate local institutional capabilities to conduct the assessments;

Box 9.5
ENVIRONMENTALLY CRITICAL AREAS IN THE PHILIPPINES

Presidential Proclamation 2146 (1981) that was issued pursuant to P.D. 1151 and P.D. 1586, classified actions and undertakings as environmentally-critical projects (ECP) and/or located in environmentally-critical areas (ECA). Projects located in the ECAs require impact assessments, the processing of which is vested on the DENR Regional Offices (DAO No. 21, series of 1992). Areas classified as ECAs are as follows:

1. All areas declared by law as national parks, watershed reserves, wildlife preserves and sanctuaries;
2. Areas set aside as aesthetic and potential tourist spots;
3. Areas that serve as habitat for any endangered or threatened species of indigenous Philippine wildlife;
4. Areas of unique historic, archaeological, or scientific interests;
5. Areas that are traditionally occupied by cultural communities or tribes;
6. Areas frequently visited or hard-hit by natural calamities
7. Areas with critical slope
8. Areas classified as prime agricultural lands
9. Recharged areas of agricultural lands
10. Water bodies
11. Mangrove areas
12. Coral reefs

Source: Information provided by DENR

Table 9.4: Enabling Legislation of the EIS System

Indonesia	Malaysia	Philippines	Thailand	Vietnam
Regulation no.29 (1986)	The Environmental Quality (Prescribed Activities)	Philippine Environmental Policy of 1977 (P.D. 1151)	The National Environmental Quality Act of 1992 (BE2535)	Environmental Protection Law, 1993
Revision by Regulation No. 51 (1993)	(Environmental Impact Assessment) Order 1987	Environmental Impact Statement system of 1978 (P.D. 1586)	Notification of MOSTE under NEQA 1992	Decree No. 175 on Implementation of EPL

Sources: The ASEAN Environmental Improvement Project Report, 1994; Information Provided by the Governments of ASEAN Countries

iv) inadequate bio-physical and socio-economic data; v) the long processing time involved in the conduct of the assessment; vi) difficulty in monitoring and supervision of compliance with the conditionalities of the project permit; and vii) weak sanctions for non-compliance.

On the whole, the EIS system in ASEAN is still evolving. Several ASEAN countries are in the process of refining their systems and building the institutional capabilities required for conducting and administering the assessments. EIA processes are also being streamlined to avoid unnecessary delays in project implementation. In Malaysia, for example, the processing time for EIS was successfully reduced from 6.2 months in 1991 to less than 3 months in 1994. The Philippines is presently working on the application of the EIAs at the programmeme level where a consoliderated EIS could be approved for say, the establishment of an industrial estate, rather than individual projects locating in it.

B. EIS Administration

The EIS systems of most ASEAN countries are administered by the ministries responsible for the environment, or more specifically, by certain departments within the ministry (Table 9.5). Technical expertise required to review the EIS is normally drawn from a pool of experts accredited by the ministry. Meanwhile, the enforcement of compliance with conditionalities in the EIS permits has been decentralized and delegated to local government units or local offices of the ministry. Continuing improvements are being undertaken to streamline the EIS process, refine guidelines and parameters, and build staff capabilities to implement the system more effectively.

The structure of EIS administration in Indonesia deserves special mention because of its unique structure. The Indonesian EIS system, known as AMDAL, is implemented by 14 central government departments and 27 provincial governments. They develop the implementing procedures and guidelines consistent with the basic guidelines issued by the State Ministry of Environment. Each implementing entity also establishes an Environmental Review Commission that approves the EIS submitted for its consideration. Overall coordination of the EIS process is done by the Environmental Impact Management Agency or BAPEDAL.

Since Brunei Darussalam is still in the process of establishing a formal EIS system, the environmental aspects of planned projects are being handled by the specific agencies in

Table 9.5: Institutions that Administer the EIS System

Country	Institution
Brunei	None
Indonesia	EIA Commission; BAPEDAL
Malaysia	Department of Environment, MOSTE
Philippines	Environmental Management Bureau, DENR; Regional Offices of DENR
Singapore	(EIA Incorporated in planning process)
Thailand	Office of Environmental Policy and Planning, MOSTE
Vietnam	Sectoral Line Agencies

Source: The ASEAN Environmental Improvement Project Report, 1994; Information Provided by the Governments of ASEAN Countries; World Bank, 1995.

charge of the approval process, in consultation with the National Committee on Environment. In Vietnam, impact assessment is being administered by the concerned line ministry with technical assistance provided by MOSTE. This set-up is currently undergoing review and may be revised subsequently as more experience is accumulated.

V. REGIONAL COOPERATION

ASEAN Member Countries have a long history of cooperation on environmental issues and concerns. This stems from the realization that environmental problems, especially those that require long-term and difficult solutions, could be better addressed by collaborative efforts through the sharing of knowledge and the pooling of resources. Unified positions on international environmental issues of common interest have also allowed ASEAN to be heard more effectively and to enhance their negotiating positions in the international fora. Lastly, ASEAN has long understood that the nature of environmental problems necessarily transcends national borders and would therefore require joint efforts to address.

A milestone in environmental cooperation was achieved by ASEAN in July, 1985, when the Foreign Ministers of the Member Countries signed the ASEAN Agreement on the Conservation of Nature and Natural Resources in Kuala Lumpur, Malaysia. The agreement expressed ASEAN's resolve to make environmental conservation an integral part of development planning as a means to ensure that ecological factors are accorded equal importance with economic and social factors. The agreement is comprehensive in scope, covering all aspects of conservation relevant to the interests of all the Member Countries. The spirit of the agreement pervaded subsequent initiatives to enact new or to strengthen existing national legislation related to conservation of natural resources and the environment. The Agreement also provideed a framework for the development of major environmental programmes and projects in the region (IUCN 1994).

The evolution of ASEAN cooperation on environment could be gleaned from the several Joint Declarations that have been issued by the ministers responsible for the environment through the years (Box 9.6). The Manila Declaration of 1981 and the Bangkok Declaration of 1984 highlighted ASEAN's primary concern at that time for continued economic growth and a better quality of life for the people. In pursuing these goals, the two Declarations recognized the importance of mitigating the environmental impact of development activities through environmental protection and natural resource conservation. However, it was not until the Jakarta Resolution of 1987 that sustainable development, as a principle, was first adopted and called for the establishment of a regional body on the environment to focus cooperative efforts in the pursuit of this goal.

The Kuala Lumpur Accord on Environment and Development of 1990

Box 9.6
MAJOR ASEAN STATEMENTS ON THE ENVIRONMENT

ASEAN Ministers for the Environment have issued seven major statements on the environment, namely:

1. **The Manila Declaration on the ASEAN Environment (30 April 1981)**
2. **ASEAN Declaration on Heritage Parks and Reserves (29 November 1984)**
3. **Bangkok Declaration on the ASEAN Environment (29 November 1984)**
4. **Jakarta Resolution on Sustainable Development (30 October 1987)**
5. **Kuala Lumpur Accord on Environment and Development (19 June 1990)**
6. **Singapore Resolution on Environment and Development (18 February 1992)**
7. **Bandar Seri Begawan Resolution on Environment and Development (26 April 1994)**

Source: ASEAN Secretariat



A Recent ASEAN Ministerial Meeting on the Environment

provided specific policy measures on sustainable management of environmental and natural resources. These measures included: I) harmonization of approaches to environmental assessment; ii) the setting of harmonized environmental quality standards; iii) the formulation of an ASEAN common strategy for sustainable development; iv) the harmonization of transboundary pollution prevention and abatement practices; and v) the development of harmonized procedures to incorporate environmental resources in the system of national accounts. The formulation of a common ASEAN position in the 1992 United Nations Conference on Environment and Development (UNCED) was also adopted.

The Singapore Resolution on Environment and Development of 1992 further clarified the different policies and strategies that should be adopted to pursue sustainable development initiatives. It called for the promotion of regional cooperation towards sustainable development in different areas including policy formulation, information exchange, institutional development, technology cooperation, public awareness and specific environmental programmes. The Declaration also adopted a common ASEAN position in support of important international efforts to protect the global environment.

The Bandar Seri Begawan Resolution on Environment and Development of 1994 reaffirmed earlier directions and themes of ASEAN cooperation on the environment which was translated into the ASEAN Strategic Plan of Action on the Environment. The Resolution included the adoption of the Plan, declaration of 1995 as the ASEAN Environment Year and the adoption of a set of Harmonized Environmental Quality Standards for ambient air and river water quality.

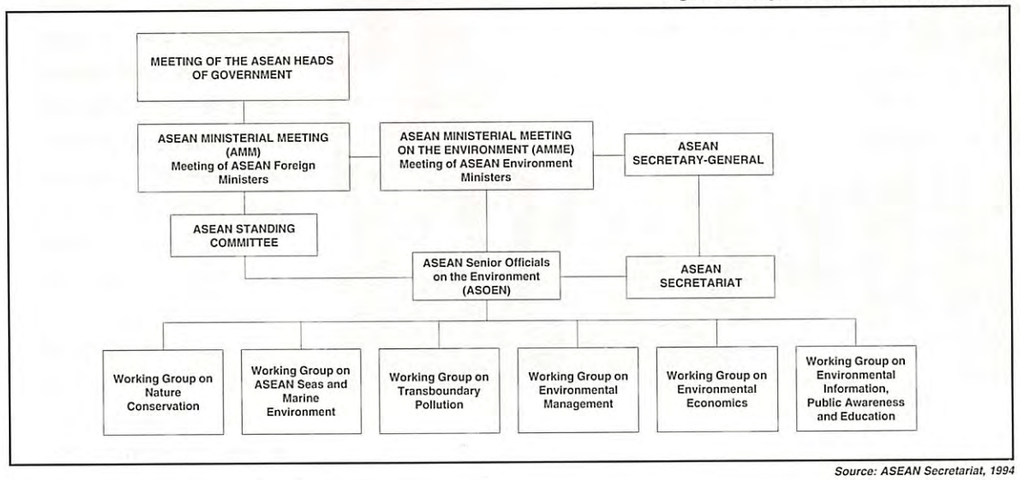
In addition, a position paper entitled "Post-UNCED Issues: ASEAN's Priorities and Responses" was also adopted.

In recognition of the increasing periodicity and worsening impact of transboundary pollution in the ASEAN region and recognizing the complexity of the problem, an ASEAN Cooperation Plan on Transboundary Pollution was adopted in June 1995. This Plan consists of three programme areas, namely; Transboundary Atmospheric Pollution, Transboundary Movement of Hazardous Wastes and Transboundary Shipborne Pollution.

In response to the above-mentioned Cooperation Plan, a Haze Technical Task Force was established to operationalize and implement the measures recommended in the Plan relating to transboundary atmospheric pollution. The Task Force is chaired by Inodnesia and comprise of concerned officials from Brunei Darussalam, Indonesia, Malaysia and Singapore. The Task Force met for the first time on 16-17 October 1995 and again on 11 August 1997 in Jakarta, Indonesia.

ASEAN commitment to strengthen environmental cooperation was demonstrated when the ASEAN Experts Group on the Environment (AEGE) was upgraded in 1989 into what is now the ASEAN Senior Officials on

Figure 9.7: Organizational Structure of ASOEN



Source: ASEAN Secretariat, 1994

the Environment (ASOEN). Composed of members at the level of Permanent Secretaries, the ASOEN has been vested with the responsibility to formulate plans and programmemes for ASEAN cooperation on the environment. These members serve as national ASOEN chairs and focal points for all regional cooperation on the environment.

To carry out its functions more effectively, ASOEN has created six working groups (Figure 9.7) in the following areas:

- Nature Conservation
- ASEAN Seas and Marine Environment
- Transboundary Pollution
- Environmental Management
- Environmental Economics
- Environmental Information, Public Awareness and Education

These working groups plan, implement, and coordinate joint activities in their respective areas, and solicit regional and/or international support for them. At present ASOEN, through its working groups, is coordinating various projects in the different priority programme areas as identified in the ASEAN Strategic Plan of Action on the Environment (Table 9.6) that are mostly funded with the support of ASEAN's Dialogue Partners. ASEAN and the working groups coordinate closely with the ASEAN Secretariat, specifically the Functional Cooperation Bureau, in the conduct of their activities.

Table 9.6: Priority Programme Areas of the ASOEN Working Groups

	Actions
ASEAN Seas and Marine Environment	**Improve regional marine and coastal environmental coordination.** **Develop a framework for the integrated management of regioanl coastal zones.**
Nature Conservation	**Promote the development of a framework for the protection and conservation of heritage areas and endangered species.** **Strengthen capacities for R&D to enhance biodiversity conservation in the region.**
Transboundary Pollution	**Establish regional guidelines for assessing highly pollutive industries and safe handling of potentially harmful chemicals entering the ASEAN region** **Strengthen the information network on the transboundary movement of toxic chemicals and hazardous wastes.**
Environmental Management	**Pursue the establishment of basic environmental quality standards leading to the setting up of harmonized quality standards for the region.** **Identify centers of excellence for environmental R&D and eventually build them as focal points of environmental networks.**
Environmental Economics	**Initiate activities that will make use of natural resources and environmental accounting studies and approaches.** **Initiate studies on development of environmental and trade policies which are supportive to the principle of sustainable development.**
Environmental Information, Public Awareness and Education	**Strengthen regional information network and promote exchange of expertise on environmental education programmes** **Establish a mechanism for the preparation of periodic reports on state of the region's environment.**

Source: ASEAN Secretariat, 1994

VI. INTERNATIONAL TREATIES AND AGREEMENTS

ASEAN countries share many of the environmental concerns of the global community. Their commitment to international cooperation for the protection and enhancement of the environment was spelled out in the various ministerial statements and action plans that have been adopted and through the ratification of and accession to various international agreements (Table 9.7). However, the interests and priorities of individual Member Countries differ depending on its own national environmental concerns.

Most ASEAN countries actively participated in the 1992 UN Conference on Environment and Development (or the Earth Summit). They all subscribed to the Declaration of Principles of the Summit and contributed to the finalization of Agenda 21. ASEAN Member Countries were among the first to obtain the national ratification of Agenda 21 and have formulated their national responses to it

Table 9.7: Action of ASEAN Countries on Selected International and Regional Environmental Agreements

Convention	Brunei	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam
International Plant Protection Convention	na	Dec. 1957(S) June 1977 (R)	May 1991 (A)	June 1951 (S) Dec. 1953 (R)	na	Dec. 1951 (S)	na
Convention on Fishing and Conservation of the Living Resources of the High Seas	na	May 1958 (S)	Dec. 1960 (A)	na	na	Apr. 1958 (S) July 1968 (R)	na
Convention on the Continental Shelf	na	May 1958 (S)	Dec. 1960 (A)	na	na	Apr. 1958 (S) July 1968 (R)	na
Convention on the High Seas	na	May 1958 (S) Aug. 1961 (R)	Dec. 1960 (A)	na	na	April 1958 (S) July 1968 (R)	na
International Convention on Civil Liability for Oil Pollution Damage	Sept. 1992 (A)	Nov. 1969 (S) Sept. 1978 (R)	na	na	Sept. 1981 (A)	na	na
International Convention for the Prevention of Pollution from Ships (modified by the Protocol of 1978)	Oct. 1986 (A)	Oct. 1986 (A)	na	na	Nov. 1990	na	May 1991 (A)
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	May 1990 (R)	Dec. 1978 (R)	Oct. 1997 (R)	Mar. 1973 (S) Aug. 1981 (R)	Nov. 1986 (R)	Mar. 1973 Jan. 1983 (R)	Mar. 1973 (S) Jan. 1994 (R)
ASEAN Agreement on the Conservation of Nature and Natural Resources	July 1985 (S)	July 1985 (S) July 1986 (R)	July 1985 (S)	July 1985 (S) Sept. 1986 (R)	July 1985 (S) (S)	July 1985 (S) May 1986 (R)	na
Convention Concerning the Protection of the World Cultural and Natural Heitage	na	July 1989 (Acceptance)	Dec. 1988 (R)	Sept. 1985 (R)	na	Sept. 1987 'Oct. 1987 (Acceptance)	(Acceptance)
Convention on Biological Diversity	na	June 1992 (S)	June 1992 (S)	June 1992 (S) Oct. 1993 (R)	Mar. 1993 (S)	June 1992 (S)	May 1993 (S)
Convention on Wetlands of International Importance	na	Aug. 1992 (A)	Mar. 1996	Nov. 1994 (A)	na	na	Jan. 1989 (A)
International Tropical Timber Agreement	na	June 1984 (S) Oct. 1984 (R)	Dec. 1984 (S) Dec. 1984 (A)	Mar. 1985 (S) Mar. 1985 (R)	na	Oct. 1985 (A)	na
Convention for the Jan. 1994 (A) Protection of the Ozone Layer	July 1990 (A)	June 1992 (A)	Aug. 1989 (A)	July 1991 (A)	Jan. 1989 (A)	July 1989	Jan. 1994 (A)
Protocol on Substances that Deplete the Ozone Layer	May 1993 (A)	July 1988 (S) June 1992 (R)	Aug. 1989 (A)	Sept. 1988 (S) July 1989 (R)	Jan. 1989 (A)	Sept. 1988 (A) July 1989 (R)	Jan. 1994 (A)
Amendment to the MontrealProtocol on Substances that Deplete the Ozone Layer	na	June 1992 (R)	June 1993 (A)	Aug. 1993 (R)	Mar. 1993 (A)	June 1992 (R)	Jan. 1994 (A)
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	na	Sept. 1993 (A)	Oct. 1993 (A)	Mar. 1898 (S) Oct. 1993 (R)	Jan. 1996 (A)	na	March 1995 (R)
Framework Convention on Climate Change	na	August 1994 (R)	July 1994 (R)	August 1994 (R)	na	Dec. 1994 (R)	Nov. 1994 (R)

Source: CIESIN, 1995.
Note: na — data not available or no action by country. S — signature; R — ratification; A — accession

References

ASEAN Secretariat. 1994. *ASEAN Strategic Plan of Action on the Environment.*

ASEAN Environmental Improvement Project. 1994. *Draft Report on "Environmental Policy, Regulations, Programmes and Institutions of the ASEAN Member Countries".* December 1994.

CIESIN Policy Instruments Database (pidb@ciesin.org). 1995.

ESCAP. 1995. *State of the Environment in Asia and the Pacific.*

IUCN. 1994. *Legislation for Implementaion of the ASEAN Agreement on the Conservation of Nature and Natural Resources.*

World Bank. 1995. *Environmental Programme and Policy Priorities for a Socialist Economy in Transition.*

Chapter 10
Towards Sustainable Development

This ASEAN State of the Environment Report (SoER) is the first of its kind in ASEAN's history. It has been compiled to provide focus and impetus to ASEAN's present collective efforts towards sustainable development. By presenting a regional perspective on issues that are generally perceived on a national plane, the Report is able to identify opportunities for common approaches to the problems of environmental management.

The ASEAN SoER presents a portrait of the natural resources and environmental conditions in the region and also stands as a record of what ASEAN nations have achieved so far in protecting the environment. It is a record that could be shared with other developing countries, especially those which have looked to ASEAN as a successful example of development. These countries can derive useful lessons from ASEAN in the common effort towards sustainable development.

The earlier chapters of the SoER have extensively discussed the nature and intensity of the various environmental pressures faced by ASEAN today. The Report concludes that these problems converge in two main areas, namely, natural resource depletion and environmental degradation with all its consequences — confirming previous perceptions that these two elements together constitute the core issues in environmental management throughout the world. The Report underscores the magnitude of these problems — their causes, as well as their implications for ASEAN.

Within the context of various ASEAN plans and programmes on the environment, the SoER represents an effort to appraise and verify perceptions on the state of the environment in ASEAN and to gauge the intensity and effectiveness of national and regional efforts. In this manner, the conclusions derived from the SoER could augment, modify or even redirect the strategic thrusts of ASEAN cooperation on the environment.

I. PRESSURES ON THE ASEAN ENVIRONMENT

The economic strategies adopted by ASEAN influenced, in varying degrees, land use patterns, demographic dynamics, and cultural and social values. Industrialization has severely affected the resource base and has significantly altered production and consumption patterns. Land, forest, water, air and coastal areas have been seriously affected as the ASEAN economies developed rapidly in the past two decades.

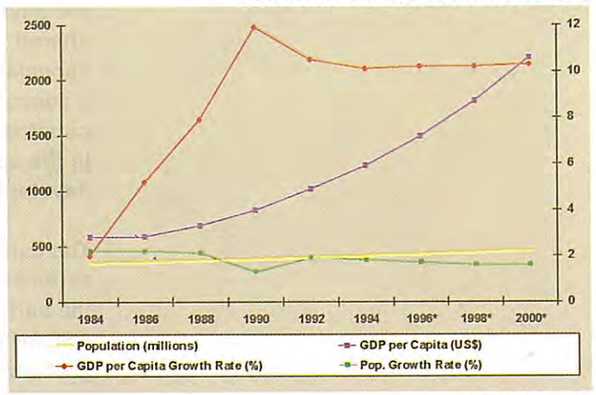
A. Socio-Economic Conditions and Trends

On the whole, ASEAN presents a record of remarkable economic growth in the developing world. For the past three decades, most ASEAN countries have attained an average economic growth rate of 10% or higher. Available projections indicate that ASEAN's economic dynamism will likely continue in the immediate future. In recent years, international business has gravitated towards the region as a result of liberalization policies that have enhanced the competitiveness of ASEAN markets. An outward-oriented and market-driven economic development strategy has successfully diversified the ASEAN economies and fostered rapid industrialization.

The demand for natural raw materials and energy increased significantly as a natural consequence of industrialization. This is especially true for ASEAN industries that are still largely resource-based and require increased exploitation and processing of natural resources. The rapid rates of energy and resource consumption that accompanied industrialization have transformed some ASEAN countries from resource-rich to resource-deficient countries. Rapid industrialization has also accelerated environmental pollution and waste accumulation.

The ASEAN population has been expanding very rapidly, almost doubling every 30 years. Improvements in health and nutrition have prolonged the average life span and have reduced the death rate dramatically. During the last 10 to 20 years, fertility rate reduction was able to taper off the net increase in population. From 2.2% in the early 1980s, population growth declined to 1.8% in 1994 and is expected to decline further to 1.6% by 2000 (Figure10.1). Nevertheless, the increase in population will continue and by the turn of the century, ASEAN's population is estimated to reach 457 million.

Figure 10.1: Population and Relative Affluence



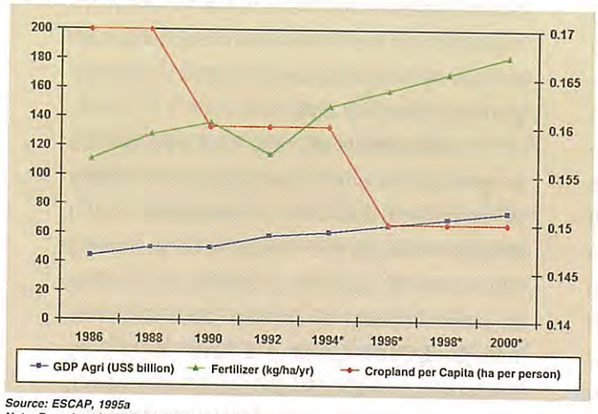
Source: ESCAP, 1995a
*Note: * Projection of the trend*

The increase in population will be felt mostly in the urban areas. Urban population is projected to grow by 3.5%, outpacing the average growth in total population estimated at 1.6%. Meanwhile, rural population in some Member Countries remained stagnant or even declined in recent years. Migration to the cities will continue as the disparity in living conditions and economic opportunities persist between urban and rural areas. The concentration of population in the cities will thus remain and even intensify, further aggravating pollution and other environmental stresses.

National output will continue to surpass population growth, causing per capita incomes to increase by about 10% annually (year 2000). As improvements in the level of affluence increase consumption, agricultural and industrial production will inevitably adjust to meet changing demand. Shifts to higher levels of productivity would imply greater resource use and increased pressures on the environment.

Notwithstanding improvements in per capita incomes, poverty will persist, especially in the less dynamic ASEAN economies. Poverty alleviation ranks high in the agenda of most ASEAN countries and has focused attention on core issues such as access to resources and basic services, productive employment, and empowerment of the poor and disadvantaged groups.

Figure 10.2: Trends in Agriculture



Source: ESCAP, 1995a
*Note: Brunei not included; * projected values*

Increased food production will be a major challenge of rapid population growth. ASEAN countries have addressed this concern through intensified agricultural production that has resulted in land conversions, use of fertilizers and chemicals, mechanization, and the expansion of fisheries and aquaculture. Agriculture's contribution to GDP will increase modestly, from US$44.2 billion in 1986 to US$75 billion in 2000 (Figure 10.2). Because of the limited availability of land for conversion to cropland, most ASEAN countries have resorted to intensive agricultural production techniques involving the application of agri-chemicals. Although ASEAN countries continue to import many of their food requirements including cereals, volumes as a percentage of total imports have been decreasing. On the whole, food security conditions in ASEAN will continue to improve as a near term scenario.

B. Resource Use

The natural endowments of the region continue to be subjected to pressures from population and development activities. Rapid rates of deforestation have occurred due to commercial logging, slash and burn agriculture, and collection of fuel wood for domestic use. A direct consequence of deforestation is loss in biodiversity and, over a longer period, simplification of the biota. The loss of forest has contributed to land degradation such as soil erosion and other deleterious effects, among them, flooding of the lowlands, reduction in cropland productivity, and siltation of the different waterways.

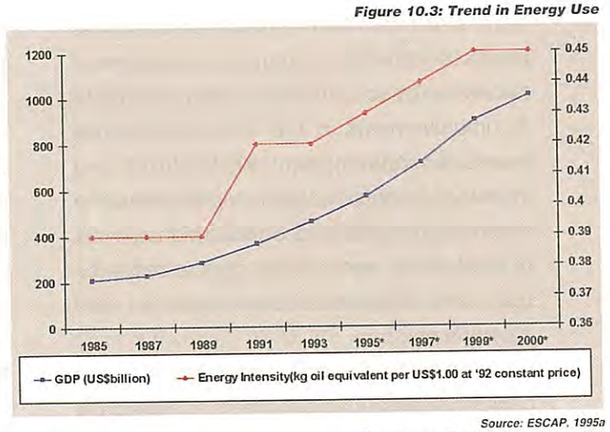
ASEAN waters are also being subjected to different pressures from sedimentation, contamination from various pollution sources, and unsustainable withdrawal rates from certain surface waterbodies and aquifers. Lastly, overexploitation and pollution from various sources continue to threaten marine resources in the region.

The use of raw materials such as wood, metals, and minerals for the production of consumer products, whether for domestic consumption or exports, will imply continuing exploitation of natural resources. Over the short term, the extraction of raw materials will continue to pose a threat to the environment unless mitigated by measures to regulate the extraction industry. Progress in science and technology may also be able to develop suitable

substitutes to natural resource-based raw materials.

Industrialization has resulted in significant increases in energy use. Energy use is one of the major sources of pollution and may continue to be so in the future. A disturbing trend is the continuing increase in energy intensity as indicated by energy consumption per unit of GDP increase (Figure 10.3). The rapid pace of development in ASEAN would imply a parallel development of energy systems and a possible continuation of this trend.

Figure 10.3: Trend in Energy Use



Source: ESCAP, 1995a
*Note: Brunei not included; * projected values*

The effects of increased energy consumption on pollution have been described in Chapter 7. The impact of energy use can extend to both local and global environments. The burning of fossil fuels can affect climate change, while the burning of wood, which is prevalent in the region, can result in localized air pollution problems. The world wide transport of oil imposes a high risk on marine waters through oil spill accidents and offshore pollution.

The policy issues on energy concern the balancing of the energy mix in order to ensure security and at the same time mitigate adverse impacts on the environment at all levels - national , regional and global. These would require critical choices in determining energy supply sources and the technological processes for energy conversion. Another challenge to the ASEAN governments is the incorporation of the cost to the environment from energy generation and distribution in the pricing mechanism.

II. ASEAN ENVIRONMENTAL MANAGEMENT

A. National Regulatory Framework

Prospects for sustainable development in ASEAN depend largely on national capacities to control the deterioration in environmental quality resulting from increased demands of economic growth. National efforts aimed at promoting sustainable development have taken various forms — ranging from command and control approaches to market-based incentives. Most ASEAN countries have promulgated comprehensive framework legislation on the environment alongside with various other specific laws directed to regulate particular sectoral activities.

Early efforts of most ASEAN countries to manage the environment consisted largely of command and control measures (CAC) brought about by the objective of protecting public health against pollution and other negative impacts of sectoral developmental activities. Subsequently, different regulatory measures and specific programmes evolved, directed at specific sectoral activities. Among these are: clean river programmes; resettlement programmes; and anti-smoke belching drives. Although many of these initiatives were reactive and difficult to sustain, they served as important precursors to later efforts towards comprehensive environmental management and sustainable development.

At the core of the CAC measures was the enactment of various national environmental standards. Although most ASEAN countries made use of both ambient and performance standards, technology and product standards were also adopted in a few

cases. Later efforts to enforce ambient standards took into account the relative conditions of certain areas. Some were designated priority areas for environmental action, while others that are less critical and less densely populated were allowed less stringent standards. In general, however, ambient standards of national application are set in ASEAN countries and these are updated periodically (see for example Chapter 3).

Performance standards in ASEAN are based on more flexible emission/effluent standards for commonly encountered pollutants. These are set based on the best available technology (BAT) in the country. Additional flexibility is imputed by setting different performance levels for existing and old facilities, new ones, or those planned to be established. Also, stricter standards are often set in areas considered environmentally critical or where existing or planned activities may be sensitive to environmental degradation. In Thailand, for instance, popular tourist areas such as Pattaya, Phuket and Hat-Yai have been designated as special pollution control areas.

In a few cases, ASEAN countries make use of technology standards. Although this approach limits flexibility through the specification of pollution control technology and/or other inputs, compliance is assured and monitoring is not too costly. Examples of technology standards adopted by some ASEAN countries are: i) mandatory use of electrostatic precipitators to control dust in cement plants; ii) limits on sulfur contents of fuel used for power generation; iii) designation of protected areas where no developmental activities are allowed; and iv) limits on lead content of petrol.

Through the years, several laws and regulatory measures were instituted by ASEAN countries to set restrictions on human activities considered detrimental to ecological balance and natural resource conservation (see Chapter 9). Early laws on the environment essentially focused on national priority concerns of ASEAN countries, e.g., forestry in the case of Indonesia, manufacturing in the case of Thailand, and petroleum exploration and production in the case of Brunei Darussalam. Later regulatory measures expanded to other areas of concern such as pollution control, nature conservation, protection of public health, and control of toxic and hazardous wastes, among others.

In recent years, most ASEAN countries have consolidated different concerns on environmental protection and conservation into comprehensive framework legislation. This framework legislation has served as a centerpiece for articulating national policies and objectives on the environment. It has served as the basis for the updating existing laws, the development of subsequent environmental regulations, and the establishment of environmental institutions. The institutional framework for environmental management in ASEAN is now fairly well-established.

The establishment of various levels of institutions responsible for the environment reflects the high priority accorded by ASEAN Governments to environmental protection. Their responsibilities invariably include policy formulation, coordination and implementation; planning; programme and project development, and research. Participation by the non-government sector in the formulation and implementation of environmental policies is encouraged by all ASEAN countries. ASEAN's decision to establish a regional entity to foster cooperation in environmental efforts has enhanced the role of these institutions in the task of environmental management beyond national boundaries.

ASEAN has taken a major step in institutionalizing the integration of environmental considerations into the planning process. In ASEAN countries, environmental impact assessments are widely used at the level of major programmes and projects to

take into account the bio-physical and social dimensions of development interventions. The assessment of the environmental impacts are undertaken at various stages of the programme and project development cycle to serve as inputs in the planning and design of activities. Participation by non-government and community-based organizations in assessment and monitoring are encouraged in an effort to build consensus among stakeholders.

B. Regional Cooperation

The formulation of a framework for ASEAN cooperation on the environment was initiated within the first few years of the establishment of ASEAN itself. An early step was the preparation of an ASEAN Sub-Regional Environmental Programme (ASEP) in 1977 with the assistance of the United Nations Environment Programme (UNEP). In the following year, the newly established ASEAN Experts Group on the Environment (AEGE) drafted and adopted the first of what became a series of ASEPs. ASEP I was endorsed by the First ASEAN Ministerial Meeting on the Environment in 1981. Subsequent Ministerial Meetings later endorsed ASEP II and ASEP III.

In July 1985, ASEAN Member Countries signed the Agreement on the Conservation of Nature and Natural Resources. This comprehensive and progressive regional conservation instrument has greatly influenced environmental initiatives of Member Countries up to the present. A recent review has shown how various elements of the Agreement have been adopted and incorporated in the different national legislation of ASEAN Member Countries (IUCN, 1994).

The Agreement contains several important features that include: i) the integration of ecological factors in the development process and according them equal importance as the conventional economic and social

Box 10.1
ASEAN STRATEGIC PLAN OF ACTION ON THE ENVIRONMENT, 1994-1998

Strategy 1:

Support the development of a regional framework for integrating environment and development concerns in the decision making process.

Actions:
- 1.1 Continue support in the documentation of regional EIA experiences leading towards the harmonization of procedures.
- 1.2 Initiate activities that will make use of natural resource and environmental accounting studies and approaches.
- 1.3 Establish procedures that would initiate the integration of environmental concerns in the various ASEAN programmes and activities.

Strategy 2:

Promote government-private sector interactions that lead towards the development of policies that mutually support the thrust of each sector.

Actions:
- 2.1 Initiate studies on development of environmental and trade policies which are supportive to the principles of sustainable development
- 2.2 Establish mechanisms that encourage government and private sector to adopt appropriate environmental standards backed up by sufficient economic incentives.
- 2.3 Set up government-private sector information linkages/networks to include information on technology, expertise and facilities for environmental management.

Strategy 3:

Strengthen the knowledge and information data base on environmental matters.

Actions:
- 3.1 Pursue the establishment of basic environmental quality standards leading to the setting up of harmonized quality standards in the region.
- 3.2 Identify centers of excellence for environmental R & D and eventually build them as focal points of environmental networks.
- 3.3 Establish mechanisms for the preparation of periodic reports on the state of the region's environment.

Strategy 4:

Strengthen institutional and legal capacities to implement international agreement on environment.

Actions:
- 4.1 Undertake a comparative study on the institutional structure and legislation for environmental management.
- 4.2 Establish capacities to support regional efforts to implement international agreements and participate effectively in negotiation of new or revised agreements.
- 4.3 Enhance collaboration with international bodies overseeing the implementation of international agreements and cooperation.

Strategy 5:

Establish a regional framework on biodiversity conservation and sustainable utilisation of its components.

Actions:
- 5.1 Promote the development of a framework for the protection and conservation of heritage areas and endangered species.
- 5.2 Strengthen capacities for R &D to enhance biodiversity conservation in the region.

Strategy 6:

Promote the protection and management of coastal zones and marine resources.

Actions:
- 6.1 Improve regional marine and coastal environmental coordination.
- 6.2 Develop a framework for the integrated management of regional coastal zones.

Strategy 7:

Promote environmentally sound management of toxic chemicals and hazardous wastes, and control of transboundary movement of hazardous wastes.

Actions:
- 7.1 Establish regional guidelines for assessing highly pollutive industries and safe handling of potentially harmful chemicals entering the ASEAN region.
- 7.2 Strengthen the information network on the transboundary movement of toxic chemicals and hazardous waste.

Strategy 8:

Develop a system for the promotion of environmentally sound technologies.

Actions:
- 8.1 Establish linkages with existing clearing houses on environmentally sound technologies.
- 8.2 Establish mechanisms that identify end users of R & D results and encourage the participation of private sector.
- 8.3 Strengthen linkage and coordination with other ASEAN committees such as COST doing related R & D work on the environment.
- 8.4 Support the promotion of indigenous technology or technologies that have been adapted to regional needs.

Strategy 9:

Promote regional activities that strengthen the rate of major groups in sustainable development.

Actions:
- 9.1 Support the publication of a regional environmental magazine and newsletters.
- 9.2 Strengthen regional information network and promote exchange of expertise on environmental education programmes.
- 9.3 Develop strategic programmes of action that will strengthen the role and participation of major groups on environmental management and decision making.

Strategy 10:

Strengthen the coordinative mechanism for the implementation and management of regional environment programmes.

Actions:
- 10.1 Establish an operational system at the ASEAN Secretariat for planning, monitoring and facilitation of implementation of environmental projects.
- 10.2 Source and match funding requirements for proposed projects.

Source: ASEAN Secretariat, 1994

factors; ii) providing legal basis to the preservation of all species; iii) guidelines for the establishment, operation and use of gene banks; iv) providing a legal regime for the sound management of harvested species, protection of habitat of endangered species, conservation of soil, and management of forest resources; v) providing a legal framework for the conservation of soil and protection of the watersheds; vi) providing a mechanism for promoting environmentally sound agriculture; and vii) a guiding principle that assigns the responsibility for prevention and rehabilitation to those responsible for environmental impacts. The Agreement also embodies principles to be adopted in the selection, establishment and management of protected areas and the formulation of multilateral agreements on transboundary effects and shared natural resources.

The focus on sustainable development was further strengthened in 1987 when the World Commission on Environment and Development (WCED, also known as the Brundtland Commission) completed its report entitled "Our Common Future". In that year, ASEAN adopted the Jakarta Resolution on Sustainable Development which highlighted sustainable development as a common objective. The Jakarta Resolution also stated the need to integrate environmental considerations into the development process.

In June 1990, the principle of sustainable development was reaffirmed by the Kuala Lumpur Accord on Environment and Development. Subsequent ASEAN meetings further brought the principle of sustainable development into central position in ASEAN environmental cooperation. In 1992, ASEAN adopted the Singapore Resolution on Environment and Development which set the tone for ASEAN's participation in the Earth Summit held later that year.

ASEAN reached another milestone when the ASEAN Ministers for the Environment agreed to adopt and implement the ASEAN Strategic Plan of Action on the Environment covering the period 1994 to 1998 (Box 10.1). Largely based on the experience of earlier ASEAN Environment Programmes (ASEP I, II, III), the Plan underscores many similar concerns contained in these Programmes and translates them into specific actions based on agreed strategies. These strategies largely pertain to various problems and concerns that could be more effectively addressed through regional collaboration. At the same time, they also reflect the gaps and constraints affecting the successful implementation of environmental management programmes. These include problems involving institutional capacities, access to funding and technology, and levels of environmental awareness and environmental education, among others.

The ASEAN Ministers for the Environment also adopted the ASEAN Cooperation Plan on Transboundary Pollution in June 1995. The Plan consists of three programme areas, namely: Transboundary Atmospheric Pollution, Transboundary Shipborne Pollution and Transboundary Movement of Hazardous Wastes. In each programme area, the objectives, strategies, activities and institutional arrangements are further elaborated. The Plan of Cooperation also contains a section on resources and extra regional support which describes the various sources of technical expertise and financial assistance that are available or can be mobilised to support ASEAN's efforts in implementing the Plan. The Plan further includes a section on implementation and evaluation which outlines the steps required to implement the Plan and evaluate the progress made.

In this connection, a Haze Technical Task Force, chaired by Indonesia and comprising of other representatives from Brunei Darussalam, Malaysia and Singapore, was established in September 1995 to operationalize the measures recommended

in the Plan relating to transboundary atmospheric pollution.

The task of promoting cooperation on sustainable development was assigned to the ASEAN Senior Officials on the Environment (ASOEN), which succeeded the AEGE. It has also been given the responsibility for implementing the ASEAN Strategic Plan of Action on the Environment and the ASEAN Cooperation Plan on Transboundary Pollution. The resource requirements for implementing these Plans are enormous and would have to be contributed by Dialogue Partners and ASEAN Member Countries through cost-sharing schemes. Ultimately, the management of ASEAN environmental cooperation itself will enhance national capacities for sustainable development.

C. International Cooperation

ASEAN shares the world's vision for sustainable development. Their commitment to international cooperation for the protection and enhancement of the environment was embodied in the Singapore Resolution on Environment and Development adopted in February 1992. Among others, ASEAN has supported international initiatives on the protection of the ozone layer, biological diversity, and climate change.

ASEAN commitment to international environmental agreements is essentially the sum of individual countries' commitments. ASEAN's specific mandate, does not make it possible for Member Countries to collectively accede to international conventions. ASEAN Member Countries, however, have always consulted with one another before they accede to international conventions. This practice dates back to the First ASEAN Ministerial Meeting on the Environment in 1981 where it was agreed that no member country should hamper any other member country in meeting its obligations under an international environmental convention to which it is a signatory.

ASEAN countries have also cooperated closely among themselves to arrive at common positions on various international issues, and in so doing, exercise some influence in directing the course of international negotiations. ASEAN countries consolidated their positions on the agenda of the UN Conference on Environment and Development, or the Earth Summit, held in Rio de Janeiro, Brazil in 1992. They all subscribed to the declaration of Principles in the Summit and contributed to the finalization of Agenda 21 — the blueprint for global action adopted at the Earth Summit. ASEAN Member Countries were among the first to obtain national ratification of Agenda 21 and have drafted their national responses to it.

The ASEAN Strategic Plan of Action on the Environment emphasizes the need to strengthen capacities in ASEAN to actively participate in negotiations of international agreements and to effectively implement their commitments under these agreements. In this regard, the Plan also called for enhanced collaboration with international bodies overseeing the implementation of such international agreements and cooperation.

III. CHALLENGES TO SUSTAINABLE DEVELOPMENT

A. National Capacities

1. Integration of Environmental Considerations in Development Planning

The challenges faced by ASEAN in coping with environmental problems are formidable and complex. The cut across various sectors are within the interfaces of the development cycle, and are among the different

tiers of the institutional machinery. At the policy level, the most important challenge is the integration of environmental and social conditions into development planning. Since environmental problems are brought about by the pace and pattern of development, ASEAN Governments will have to be more sensitive and aware of the environmental implications, not only of sectoral programmes and projects, but of macroeconomic policies as well. Fiscal policies, resource allocation, trade and investment policies, infrastructure and skilled workers availability, and technological advancement all have environmental consequences that must be deliberately considered in policy making. The underlying challenge is to incorporate environmental costs in the decisions of producers and consumers in order to reflect the scarcity value of resources used for development. This would require the development of appropriate economic instruments and procedures for the valuation of resources in the national accounting system.

Sectoral planning must take into account linkage effects on other sectors. Planning for energy systems, for example, will have to consider both resource use and production technology and the requirements of transport, agriculture and industry. Policies on agricultural productivity will have implications on land use and food security. On the whole, comprehensive analytical techniques must be developed and applied to enable simultaneous analysis of impacts of policy decisions at the macro, sectoral and project levels.

Although environmental impact assessment systems are in place in most ASEAN countries, their application can be further improved and expanded. Several problems remain at the operating level, among others: i) the inability of small and medium enterprises to absorb the costs involved in environmental assessments; ii) the absence of guidelines for certain industries; iii) inadequate institutional capabilities to conduct assessments; iv) difficulties in monitoring and supervision; and v) weak sanctions for compliance. ASEAN countries are continuing the process of refining their systems and building the national capacities to be able to implement them more effectively.

2. Inadequate Institutional Capacities

Most ASEAN countries lack the skilled manpower to implement environmental management policies and programmes. The dominance of the command and control approach in environmental regulation requires a fairly large number of skilled manpower for enforcing and monitoring compliance. These enforcers must have a comprehensive understanding of environmental issues and their implications. They must be sufficient in number to ensure national coverage so as not to compromise enforcement. Equally important is the availability of data to monitor compliance and to feed the process of policy and programme formulation.

Gross estimates indicate that the manpower required to enforce environmental laws in ASEAN is inadequate. In Thailand, for example, the Department of Industrial Works (DIW) which is responsible for the monitoring and enforcement of environmental standards in more than 51,500 industrial plants has around 700 staff, of which only 143 are directly responsible for the said function (O'Connor, 1994). This means that only 0.3 person-year is available to inspect 100 factories, meaning that each staff must inspect two factories each day to cover all polluting plants. The lack of adequate and trained manpower in ASEAN is compounded by the lack of resources to engage them in the task of environmental management on a full time basis. In most ASEAN countries, government personnel are assigned multiple tasks and are sometimes seconded to other posts.

Continuous training of environmental personnel is necessary to keep them abreast with emerging problems and issues and new

environmental technologies. In many ASEAN countries, frequent training and skills upgrading are required because of the high turn-over rate of environmental personnel. The low compensation in government in most ASEAN countries makes them susceptible to transfer to better-paying jobs in industry or international organizations. Because of this, training has to be conducted continuously and expanded to include other government personnel as well as the private sector. This strategy is applied in Indonesia where training programmes are offered to a variety of audiences in all sectors of society. (O'Connor, 1994). The resource implications of a continuing and comprehensive manpower training programme would require a rethinking of the command and control approach to environmental management in favor of market-based instruments.

3. Financial Requirements

The cost of pursuing sustainable development involves substantial resources that could pose additional burden especially to countries that are already experiencing difficulties in meeting the requirements of economic growth. Still, the goals of sustainable development make it imperative to maintain the productivity of existing natural resource assets for future generations and to arrest and restore damages resulting from past development endeavors. Resource requirements for sustainable development would thus include investments in environmental infrastructure required to maintain the productivity of existing assets for the future.

The financing of sustainable development activities involves incremental resources on top of those needed to sustain economic growth. Estimates of additional costs for some ASEAN countries to attain a level of progress in environmental protection using best practices of OECD countries are shown in Table 10.1. For the energy sector alone, it is estimated that Indonesia, Malaysia, the Philippines and Thailand would have to invest an additional US$5.4 billion for environmentally sound power generation systems on top of the US$124 billion using conventional technology and without the added cost of environmental protection (ADB, 1994). For all the sectors, and assuming that ASEAN countries will be able to adopt about 25% of best available technologies (BAT) by the year 2000, additional investments of US$72 billion (net present value discounted at 5%) would be required for clean technologies for the period 1991 to 2000.

The long-term consequences of making these additional investments can be advantageous. Investment in low-pollution technology in the industry sector is expected to reduce the pollution index from 236 (without the investment) to 173 by the year 2000 (Table 10.2). Similarly, in the transport sector, an

Table 10.1: Net Present Value (at 5 percent rate) of Estimated Additional Investment Cost 1991-2000 with Progress in Environmental Protection (US$ million)

	Water Supply	Sani-tation	Electric Power	Trans-portation	Industry Waste	Agri-culture	Forestry	Popu-lation	Edu-cation	Acid Rain	Global Climate	Bio-diversity	Total
Indonesia	3,959	1,931	1,175	1,829	1,525	1,206	5,038	2,333	11,657	224	713	319	31,909
Malaysia	570	300	938	830	952	520	736	239	1,426	97	244	32	6,884
Philippines	1,901	1,007	471	445	1,004	560	639	811	4,270	218	229	4	11,559
Singapore	90	57	0	0	757	2	0	35	174	84	0	0	1,199
Thailand	1,125	508	2,799	2,571	1,853	699	411	737	2,081	380	346	90	13,700
Viet Nam	1,186	347	0	0	0	0	491	862	3,874	61	125	12	6,958
ASEAN*	8,831	4,150	5,383	5,675	6,191	2,987	7,315	5,017	23,482	1,064	1,657	457	72,209

Source: ADB, 1994
*Note: Progress in Environmental Protection means best practices by OECD countries adopted fully by the year 2030; * Brunei not included in ASEAN aggregate*

*Table 10.2: Forecast on BAT Environmental Investment in Industry Sector for ASEAN**

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Manufacturing Output (US$ million)	67,608	74,415	81,908	90,161	99,247	109,252	120,269	132,402	145,762	160,476	1,081,500
Pollution Index without Investment on the Environment (percentage of 1991 level)	100	110	-	133	146	161	177	194	214	236	
Additional Investment in Low Pollution Tachnology (US$ million)	0	34	107	226	396	625	922	1,296	1,759	2,322	7,687
Pollution with Environmental Investment (percentage of 1991 level)	100	109	-	127	136	144	152	160	166	173	

Source: ADB, 1994
*Note: * Aggregate includes Indonesia, Malaysia, Philippines and Thailand; All are forecast figures*

additional investment of US$8.0 billion in low-polluting vehicle technologies would cause a reduction in the pollution index from 260 to 117 by 2000 (Table 10.3). Thus, if the additional investments were not made, pollution levels would be expected to triple and environmental improvements from other initiatives would have been lost.

Mobilization of additional investment funds for environmental protection would be a major challenge for ASEAN countries in the future. With competing priorities for limited public funds, Governments will have to increasingly rely on market-based instruments to share the cost of environmental protection with private enterprises. External funding support through official development assistance and debt conversion schemes, could also augment domestic resources available to governments. As policy makers realize that addressing environmental damage could be extremely expensive, anticipatory and preventive policies, rather than reactive ones, will increasingly become important.

ASEAN countries have accessed the Global Environment Facility (GEF) to finance some of their projects. The GEF provides financial grants to developing countries in four transboundary environmental issues—climate change, destruction of biodiversity, pollution

*Table 10.3: Forecast on BAT Environmental Investment in the Transport Sector for ASEAN**

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
Forecast Demand for Vehicular Fuels (thousand tons of oil equivalent)	33,244	36,703	40,548	44,822	49,573	54,859	60,742	67,293	74,592	82,724	
Pollution Index without Investment on the Environment (percentage of 1991 level)	100	110	122	136	148	167	186	205	232	260	
Additional Investment in Low Pollution Technology (US$ million)	0	48	143	283	472	708	998	1,341	1,746	2,219	7,958
Pollution with Environmental Investment (percentage of 1991 level)	100	108	114	119	122	125	126	125	122	117	

Source: ADB, 1994
*Note: * Aggregate includes Indonesia, Malaysia, Philippines and Thailand; All are forecast figures*

of international waters, and depletion of stratospheric ozone. During the pilot implementation of the facility, ASEAN countries participated minimally, availing itself of US$36.7 million for three projects (Table 10.4). In October 1994 the size of the GEF was increased from US$750 million to US$2.0 billion. ASEAN should actively consider this resource in financing some of its projects.

Table 10.4: GEF Availment by ASEAN Countries

Country	Project	GEF Grant Funding US$ million	Management Approval Date
Fiscal Year 1994			
Indonesia	Biodiversity Collection	7.2	June 1994
Philippines	Conservation of Priority Protected Area	20.0	May 1994
Prior to 1994			
Thailand	Promotion of Electrical Energy Efficiency	9.5	April 1993

Source: World Bank, 1994

4. Technological Capacities

Environment-friendly technologies will pose an important challenge for industries as consumers, both in the domestic and international markets, become more attuned to clean technologies and processes. Technologies for the safe disposal of hazardous and toxic wastes will be required in increasing amounts as environmental standards become more stringent. The growing demand for agricultural produces that are free of toxic chemicals will likewise present itself as a challenge in the midst of efforts to increase agricultural productivity and ensure food security in the region.

Transfer of technology from the developed to the developing countries as envisaged in Agenda 21 and other conventions will face serious difficulties under the Intellectual Property Rights provisions of the GATT agreement (ESCAP, 1995b). Nevertheless, this could provide the opportunity for ASEAN countries to develop clean technologies within the region. They could also collaborate on initiatives to access environmental technologies through technical assistance provided by international organizations.

B. Regional Cooperation

The expansion in ASEAN membership brought about by the recent admission of Vietnam, Lao PDR and Myanmar, and prospectively of Cambodia, has put into sharper focus the heterogeneity of the ASEAN Member Countries in terms of land size and population, natural resources, population, culture, national wealth, and stage of development, among others. The economies of these new and potential members are much more dependent on agriculture and natural resource exploitation than other Member Countries. If Vietnam and Cambodia embark on a similar export-led economic growth path, stresses on natural resources could intensify, with the attendant consequences on the bio-physical environment. Differences in the levels of development among ASEAN Member Countries could induce a relocation of lower value added industries to those economies that are in the earlier stages of development. The wood-processing industry, for instance, could be gradually shifted to Vietnam and/or Cambodia which, if not handled properly, could accelerate the depletion of forest resources in these two countries.

Notwithstanding the heterogeneity among ASEAN members, there are numerous areas that offer possibilities for cooperation on environmental matters. Direct and indirect assistance can be provided to less advanced countries in developing sustainable modes of

natural resource utilization and other aspects of environmental management. Vietnam has, in fact, adopted some of the sound environmental practices of other ASEAN countries in the field of integrated pest management, watershed management, and forest-fire prevention. ASEAN countries have also cooperated in the field of training and manpower development for the environment.

A major challenge facing ASEAN Member Countries is the need to harmonize their national environmental standards and databases for monitoring. This is made difficult because of the pronounced differences in development objectives and strategies and environmental goals among Member Countries. Nevertheless, ASEAN Governments have accepted the need for harmonization because of shared environmental commons, and the recognition that many environmental programmes have regional implications.

ASEAN has still to establish a region-wide mechanism for systematically collecting data and information to support effective environmental management. For instance, there is still no regional system for regularly collecting data on rates of depletion and degradation of natural resources, as well as information on available techniques and technologies for an environmentally sound exploitation of these resources. This information gap could hamper the formulation of options and informed policy choices that bear on both development and the environment. At the same time, this gap could open the possibilities for ASEAN collaboration on a system of monitoring that could generate regionally comparable data. The periodic publication of the SoER is a step in this direction.

The implementation of AFTA, and ASEAN's participation in the APEC process, will greatly influence the pace of trade liberalization in the region, and consequently, the intensity of its environmental impacts. Although trade and environment are mutually supportive and together could help bring about sustainable development, causes and effects have not yet been fully sorted out (ESCAP, 1995b). The challenge that ASEAN faces in this respect is to come to a fuller understanding of the trade-environment nexus through collaborative studies and research. The environmental impact of trade however, will tend to vary among Member Countries because of wide differences in their development goals and status. On a pragmatic plane, the challenge for ASEAN countries is to maintain their competitiveness in the face of increasing trade restrictions that are justified, legitimately or illegitimately, by environmental arguments.

C. International Pressures

The continuing international debate on the linkages between trade and the environment will require ASEAN to be fully attuned to the related issues of technology transfer, ecolabelling, and intellectual property rights. Increased demand for products using clean technologies will require ASEAN industries to adjust their production processes without losing their competitiveness in the global market. Some ASEAN countries have started to adopt measures that would project environment-friendly products and services. These include the use of sustainable processes, use of non-Ozone Depleting Substances (ODS) in the manufacture of certain products, and ecolabelling. In view of the Uruguay Round agreement for the gradual phase-out of pollution control subsidies, some ASEAN countries have encouraged the clean-up of industrial waste and effluent through schemes applying the polluter pays principle in order to promote the internalization of environmental costs. To the extent that ASEAN countries are still in the early stages of industrialization, they could be in an advantageous position to select the best available technology and still remain competitive in the world market.

Appropriate labeling of natural resourced-based products will require extensive research on target commodities such as timber, agricultural products and foods. Apart from complying with international requirements, the practice of ecolabelling can help promote sustainable practices in natural resource exploitation. It would benefit ASEAN to coordinate ecolabelling efforts to consolidate their position in the international marketplace.

IV. ASEAN COMMITMENT TO SUSTAINABLE DEVELOPMENT

Sustainable development is the major theme that weaves together the various chapters of the SoER. Two interrelated themes are dominant in the Report. The first is that economic growth inevitably exerts pressure on natural resources and leads to environmental quality loss. The second is that both development and environmental conservation efforts converge in the goal of improving the quality of life. These dimensions consistently underpin various ASEAN environmental programmes that have evolved through the years, and although priorities have been reformulated, the thrusts of the region's efforts have not drastically changed.

The confluence of regional and global developments in recent years has created a conducive environment for promoting the agenda of sustainable development. In individual ASEAN countries, bold and innovative schemes have been initiated, reflecting the political will to effectively address the challenges of environmental regeneration. Collectively, ASEAN has strengthened regional cooperation on environmental concerns. This momentum must be sustained for sustainable development to fully flourish and to become a reality.

A. Integrated Approach to Development Planning

While a global consensus has been reached at the Earth Summit on the imperatives of integrating environmental considerations into development planning, there is a continuing debate on how such integration can be effectively achieved. Considerable progress has been achieved in recent years in developing concepts that trace the environmental costs of development activities. Although these concepts are continuing to undergo refinements, they represent an encouraging step towards the formulation of new strategies for sustainable development. Most ASEAN countries have begun the process of familiarizing themselves with and testing some of these tools.

Environmental Impact Assessments (EIA) are increasingly being used in ASEAN countries to trace the environmental impact of policy decisions at the macroeconomic, sectoral and project levels. As a policy tool, EIAs provide information on how a development plan should be implemented at the least cost, taking into account environmental costs. The EIA integrates environmental factors in a plan to identify appropriate project location/relocation, necessary mitigation measures such as pollution control, and accompanying programmes to improve the social acceptability of the project. In some cases, EIAs have formed the basis for stopping the implementation of projects that are found to have excessive environmental costs. Other ASEAN countries integrate environmental considerations into the project evaluation and approval processes, in lieu of the EIA.

ASEAN countries are continuing to improve the EIA process by reducing the cost and time of conducting such assessments, and expanding its coverage. However, inadequate manpower and difficulties in monitoring compliance with conditionalities

have limited the effectiveness of the EIA. To overcome these constraints, most ASEAN countries employ university-affiliated experts to conduct the review of environmental impact statements. By availing themselves of expertise in universities, concerned government agencies are able to save on costs. For the actual conduct of the EIA, private consulting groups are often used by the project proponents. The involvement of non-government personnel in the conduct of EIAs has allowed ASEAN countries to develop a wider pool of expertise at lesser cost.

Other improvements in the EIA process include the establishment of support mechanisms to ensure the viability of intended results. This includes the setting up of an environmental guarantee fund that can be used to finance environmental enhancement efforts, the monitoring of project implementation, and more importantly, payments for future damages to property and human welfare attributable to the project. Most EIAs also require the setting up of a multi-sectoral monitoring team that includes project stakeholders to monitor the implementation of and compliance with environmental standards.

Public participation is encouraged in the conduct of EIAs. Non-government and community-based organizations, as well as local government units, are consulted at different stages of project planning and development. This process enables the consideration of consumer preferences and promotes ownership of the project among stakeholders. The involvement of community-based organizations is particularly important because they know their locality best — its resources, culture, traditional practices and technologies, and the norms of social interaction. Viewed in a wider context, community participation is part of a long process of building grassroots capabilities for sustainable development.

An integrated approach to development planning that takes into account environmental concerns lies at the core of any sustainable development strategy. Beyond the EIA process, there is a need for planners, policy-makers and all members of the government machinery to internalize environmental considerations in the performance of their respective functions. Ministries responsible for energy, for instance, should be able to plan for energy systems that favor cleaner fuels and set pricing policies that incorporate environmental costs. On-going efforts to provide highly-specialized training for government personnel on various aspects of environmental management are contributing to increased awareness and sensitivity to sustainable development issues. Over the long-term, this internalization process should be made part of the larger educational system. Environmental education could be made part of the civil service curriculum, as practiced in Indonesia, or part of the general education programme, as practiced in several ASEAN countries.

B. Market-Based Instruments (MBIs)

ASEAN's command and control approach to environmental regulation continues to face a number of difficulties. Aside from weaknesses that are inherent in regulatory schemes, their enforcement has proven to be difficult and costly. In recent years, some ASEAN countries have begun to use market-based incentives, as well as disincentives, as means to modify attitudes and behavior on related environment matters. The use of incentives and disincentives to complement regulatory measures can serve as potent instruments for internalizing environmental values, and can engender more active involvement on the part of the business sector and the general public in environmental affairs.

Market-based instruments (MBI) are generally based on the "polluter pays principle"

that specifies the condition that all environmental costs — both direct and indirect — should be internalized in the total cost of a product. Some examples of MBI are: i) pollution charges based on the amount of pollution generated; ii) pollution quotas for specific areas that could be traded among companies; iii) subsidies and incentives on pollution abatement; iv) product charges levied on highly polluting products; and v) resource depletion allowance. Although several ASEAN countries have begun to experiment with MBIs, the shift away from the command and control orientation has not been easy. Many of the concepts and principles underlying MBIs have not been fully understood. In addition, the "free" access and use of environmental resources is still a dominant view in many ASEAN societies. At the same time, the internalization of environmental costs in product prices could affect the competitiveness of ASEAN goods and services in the world market.

Several ASEAN countries are currently employing MBIs in their environmental programs. Pollution charges are now common in the operation of many industrial estates through the use of a centralized treatment facility. This is also applied for toxic and hazardous wastes in countries with common treatment facilities. In Thailand, a deposit-refund scheme has been adopted to further improve the effectiveness of the instrument. (O'Connor, 1994) Each waste generator enters into a contract with the government to deliver a specified amount of hazardous waste per year for treatment and disposal. The company pays a fee at twice the estimated cost to treat the waste but after the delivery of the contracted amount of waste, half the fee paid is refunded with interest. Government audits help ensure that companies are contracting all the estimated wastes they will be generating. In a strict sense, however, the scheme is only a modified MBI since the charges levied are not high enough to discourage pollution but are equal only to the cost of treatment and disposal.

Another scheme used in some ASEAN countries is the granting of incentives for the use of pollution abatement systems. Exemption from taxes and duties are allowed on the importation of equipment and instruments. In some cases, low-cost financing is provided to cover part of the project cost. Grants are also made available to cover the cost of technical studies for projects that support the government's thrusts on environmental protection.

The global trend on green consumerism has made ASEAN countries more aware of the need to accredit certain products and processes as environmentally friendly. Singapore was the first ASEAN country to implement ecolabelling. Started in 1992 by the Ministry of the Environment, the ecolabelling system has now listed 14 product categories (Table 10.5). Other countries of ASEAN are also in the process of initiating their own ecolabelling schemes.

ASEAN countries have also adopted various strategies in setting environmental standards to facilitate compliance and make monitoring less costly. One method that is commonly applied is the use of differentiated standards based on the type of industry, age of the plant, and location of the facility. Older plants are initially subjected to less stringent standards and are given more time to comply

Table 10.5: Product Categories under Singapore Green Labelling Scheme

Launched in 1992	Launched in 1993
Stationary Paper	Alkaline Battery
Hygiene Paper	Integral Compact Fluorescent Lamp
Printing Paper	Modular Compact Fluorescent Lamp
Office Automation Paper	Laundry/Powder Detergent (Standard)
Carbon-Zinc Battery	Laundry/Powder Detergent (Concentrated)
	Laundry/Liquid Detergent
	Dish Washing Detergent
	Floor Cleaner
	Washing Machine

Source: Ministry of the Environment, Singapore, 1994

relative to those applied to newer plants. Stricter standards are also applied to critical areas or places reserved for some special purpose (tourist areas or archeologically significant places), heavily populated zones, and areas that are more vulnerable to pollution stresses.

Because MBIs work through the price mechanism, they are self-regulating and work best in conditions where no significant market distortions exist. The effectiveness of MBIs depends largely on prevailing conditions that must be carefully assessed to arrive at a judicious selection of the appropriate instrument. For instance, the use of pollution charges for small scale industries may be as difficult to enforce as compliance with discharge standards, and hence, no advantage can be gained by shifting to an MBI. Proper selection of MBIs requires careful study of prevailing conditions, simulation, and pilot testing to allow for adjustments and to ensure intended results.

ASEAN's environmental management regime in the medium-term will most likely see a combination of CAC and MBI approaches. ASEAN will adopt MBIs found suitable to domestic conditions and acceptable to concerned parties. CAC will be applied to address certain environmental problems where more direct interventions are more effective. Technology standards will be used increasingly instead of discharge standards as the former is more cost effective to enforce and monitor.

C. Community Involvement

ASEAN countries have encouraged public participation in different aspects of environmental management. Non-government organizations (NGOs), local governments, and other forms of community-based groups have been mobilized to foster increased participation in environmental activities, especially at the local level. Given the complexity of environmental problems, the role of NGOs and community-based groups have gone beyond advocacy into more direct forms of participation in community projects. Participation ranges from monitoring environmental conditions; implementation of development programmes and projects; regulatory enforcement; and in some cases, policy formulation, drafting of standards and setting strategies for sustainable development. In some ASEAN countries, community participation is mandated by law or specified in certain environmental measures.

Community participation allows local expertise and knowledge to be harnessed in identifying and solving problems, incorporating preferences of beneficiaries and affected parties, and enhancing decision-making processes through consensus building among the concerned sectors. A community-driven approach to sustainability however, rests on the more fundamental claim for empowerment at the grassroots. This requires promoting grassroots mechanisms to foster interaction among communities, giving them a large measure of participation in the management of natural resources, and, more importantly, respecting the cultural integrity and the rights of indigenous people and their communities.

In Thailand, for example, the development and involvement of NGOs in community affairs are remarkable. To date, there are more than 130 NGOs and other private groups which take part in environmental protection and conservation, particularly the 49 associations registered with MOSTE. Some excellent examples of these organizations are the Green World Foundation, Think Earth, Wildlife Fund Thailand, and the Environmental Engineers Association of Thailand.

D. Environmental Education

The success of sustainable development will depend in large measure on the level of environmental consciousness of the citizenry. A citizenry that is sensitive to the environment will be motivated to act positively

to protect the environment and if necessary, change their own lifestyle and consumption habits. Environmental education will play an important role in fostering this consciousness.

ASEAN countries are currently promoting environmental education through various approaches. Singapore has integrated environmental education in the formal education system at all levels. Outside of the formal school system, continuing education is carried through participation in environmental programmes. Environmental education is made a lifelong process and is carried out both inside the classrooms and in the fields and surroundings.

In Indonesia, the promotion of environmental consciousness is handled by 52 Environmental Study Centres (locally named PSLs) in both the state and private university systems (ODA/IIED, 1994). PSLs are engaged in research, education and public service. They also publish educational materials, provide expert assistance to provincial planners and administrators, and assist non-government organizations and the private sector.

Malaysia, through the Department of Environment promotes environmental awareness through environmental publications; information dissemination campaigns through the Query-Response Services and the Enviro-Library Services; environmental lectures and exhibitions; and the celebration of the World Environment Day and Malaysian Environment Week (Malaysia MOSTE, 1994).

The passage of the Philippine Environment Code (PD No. 1152) provided the legal basis for environmental education in the country. The law mandated the Department of Education and Culture to integrate subjects on environmental education in the school curricula at all levels. It also provides for the conduct of special community education that emphasizes the relationship of man and nature (Government of the Philippines, 1992). The

Box 10.2
THE NGO MOVEMENT IN THE PHILIPPINES

NGOs in the Philippines started as private civic organizations involved in providing assistance to victims of natural calamities such as typhoons, earthquakes, volcanic eruptions, as well as to victims of social inequities and political persecutions. During the 1960s and 1970s, NGOs expanded to the corporate sector with the involvement of big business in socially-oriented projects. The Philippine Business for Social Progress (PBSP) was established to coordinate corporate involvement in social and civic endeavors. More recently, NGOs were formed to influence policy choices and to advocate for alternative models of development. Among these types were NGOs that challenge development policies and programmes in terms of their compatibility with environmental objectives. A number of these NGOs have international counterparts and supporters.

NGOs concerned with the environment are generally involved in promoting public awareness of environmental issues, and instilling vigilance in local communities in safeguarding their environment. In many cases, they cooperate with the Government in the enforcement of environmental laws and serve as monitors for violators. Some of their notable achievements in the area of environmental protection are the following:

- Prevention or postponement of seaweed farming operations in Palawan that could endanger more than 300 species of corals and 379 species of fish and other marine life in a pristine coastal area.
- Prevention of further logging operations in several provinces in the country.
- Protest actions that prevented the intrusion of foreign fishing boats into Lamon Bay in Quezon province.
- Prevention of open dumping of mining wastes (145 millions tonnes of tailings had already been dumped) by a multi-national mining firm into Calancan Bay in Marinduque Province.

NGOs are presently moving towards assisting communities chart their own development strategies in ways that are compatible with the objectives of sustainable development.

Source: Government of the Philippines, 1992

growth and expansion of different environmental NGOs in the country is an indication of the increasing level of environmental consciousness (Box 10.2).

In Thailand, the Department of Environmental Quality Promotion is mandated to promote public awareness of the environment and encourage participation in environmental activities. Among their major environment-related activities are environmental education, publications, exhibitions, and promotional campaigns.

Increased environmental awareness implies that ASEAN governments will increasingly rely on NGOs in the task of managing the environment. To enhance this role, continuing environmental education through formal and informal mechanisms will have to be strengthened and improved. In the long-run, more informed and technically knowledgeable citizens themselves will drive the process of sustainable development. Environmental activism could spur increased production efficiency; sustainable use of natural resources; less wasteful consumption; use of clean technology; and the preservation of ecological balance.

V. PROSPECTS FOR SUSTAINABLE DEVELOPMENT

ASEAN's record of economic dynamism in the last two decades has raised the concern for sustainable development into a higher plane. Although countries in the region have been taking measures to protect the environment and to control the rate of exploitation of resources, they continue to face difficulties in the wake of institutional limitations, inadequate manpower and technological capacities, and financial constraints. Prospects for sustainable development in the wake of continued economic growth will depend on the ability of ASEAN countries to overcome these constraints and respond to the challenges of sound environmental management.

The pursuit of sustainable development as a shared commitment of ASEAN, is clearly expressed in the present ASEAN Strategic Plan of Action on the Environment. The Plan, which has served as a springboard for the formulation of joint or national environmental programmes, is supplemented by the present SoER. The major issues that have been presented in the SoER suggests a review of the Plan of Action to bring its thrusts into sharper focus and to compel a process of prioritization based on key issues. Targeted efforts on a collaborative basis can generate greater region-wide impact and could increase the efficiency of resources generated by individual Member Countries.

The various issues raised in the SoER can be classified into three sets of problems. The first set involves substantive problems related to natural resource depletion and environmental degradation and their causes. The second involves the complex interrelationship between the causes and effects of environmental problems and the role played by development policies in addressing them. The third set involves problems associated with institutionalizing the pursuit of sustainable development. Although these problems are experienced by all ASEAN countries, the Report presents specific configurations of these problems as they occur in particular social, economic, political and administrative settings.

While programmes to address specific environment problems will continue, it would seem that the most formidable challenge for sustainable development lies in the formulation of a responsive integrated policy framework that weaves together demographic dynamics, economic growth, natural resource use, and social welfare. Measures to integrate environmental concerns into development

planning is a step in this direction. In many ASEAN countries, notable progress has been achieved in applying concepts pertaining to the interaction between development and the environment.

Because environment and development both converge in the goal of improving the quality of life, sustainable development would therefore also have to address questions regarding equity and income distribution. While progress has been achieved in developing concepts pertinent to the interface between economic development and the environment, progress has been slower in developing concepts pertinent to social and demographic factors. Ignoring social dimensions could lead to tensions that might ultimately negate the benefits of development.

ASEAN countries are continuing to cope with the challenge of balancing environmental concerns with the imperatives of development. Environmental degradation continues to disturb the region, i.e. deforestation, loss of biodiversity, degradation of land and water, pollution, adulteration of cultural heritage and social values, and many others. But while environmental conditions continue to deteriorate, the socio-political setting in ASEAN countries has become more conducive in accommodating bold and innovative approaches to environmental management. Once environmental problems are recognized, ASEAN countries have acted in earnest to institute preventive and corrective measures to address them as a matter of priority.

References

ASEAN Secretariat. 1994. *ASEAN Strategic Plan of Action on the Environment.*

ADB. 1994. *Financing Environmetally Sound Development.*

ESCAP. 1995a. *Statistical Yearbook for Asia and Pacific Region,* 1994.

ESCAP. 1995b. *The State of the Environment in Asia and the Pacific.*

Government of the Philippines. 1992. *A Report on the Philippine Environment and Development for the United Nations Conference on Development.* Manila.

IUCN. 1994. *Legislation for the Implementation of the ASEAN Agreement on the Conservation of Nature and Natural Resources.*

Malaysia MOSTE. 1994. *Environment Quality Report. 1993.*

Ministry of the Environment, Singapore. 1994. *Annual Report, 1993.* Singapore.

ODA/IIED. 1994. *Environment Quality Report. 1993.*

O'Connor, D. 1994. *Managing the Environment with Rapid Industrialization.* OECD.

The World Bank. 1994. *Making Development Sustainable.*

Appendix 1
Acronyms

A

ADB	Asian Development Bank
AEGE	ASEAN Experts Group on the Environment
AEEMTRC	ASEAN - EC Energy Management, Training and Research Center
AEM	ASEAN Economic Ministers
AFTA	ASEAN Free Trade Area
APEC	Asia Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
ASEP	ASEAN Sub-regional Environmental Programme
ASMC	ASEAN Specialised Meteorological Centre
ASNEM	ASEAN Network on Environmental Monitoring
ASPEN	ASEAN Plan of Action on the Environment
ASOEN	ASEAN Senior Officials on the Environment

B

BAT	Best Available Technology
BAPEDAL	Environmental Impact Management Agency of Indonesia
BCSDM	Business Council for Sustainable Development, Malaysia
BMR	Bangkok Metropolitan Region
BOD	Biological Oxygen Demand
BOT	Build, Operate and Transfer

C

CAC	Command And Control
CEPT	Common Effective Preferential Tariff
CETEC	Centre for Environmental Technologies
CETDEM	Centre for Environment, Technology and Development
CFC	chlorofluorocarbons
CH_4	atmospheric methane
CHOGM	Commonwealth Heads of Government Meeting
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO_2	carbon dioxide
COREMAP	Coral Reefs Rehabilitation and Management Project
COST	ASEAN Committee on Science and Technology
cu m	cubic meter
CZM	Coastal Zone Management

D

DIW	Department of Industrial Works of Thailand
DENR	Department of Environment and Natural Resources of the Philippines
DOE	Department of Environment of Malaysia
DSM	Demand Side Management

E

EAGA	East ASEAN Growth Area
EAP	Economically Active Population
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessments
EIS	Environmental Impact Statement
EMA	Environmental Management Act of Indonesia
EMB	Environmental Management Bureau of the Philippines
ENSEARCH	Environmental Management and Research Association of Malaysia

EO	Executive Order
EQC	Environmental Quality Council of Malaysia
ERTC	Environmental Research and Training Center of Thailand
ESCAP	Economic and Social Commission for Asia and the Pacific of the United Nations

F

FA	Factory Act of Thailand
FAO	Food and Agricultural Organization
FDI	Foreign Direct Investment

G

GATT	General Agreement on Tariff and Trade
GAW	Global Atmosphere Watch
GDP	Gross Domestic Product
GEF	Global Environment Facility
GESMAP	Group of Experts on the Scientific Aspects of Marine Pollution
Gj	Gigajoules
GNP	Gross National Product
Gwh	Gigawatt hour

H

ha	hectare
HDI	Human Development Index

I

ICZM	Integrated Coastal Zone Management
IEA	International Energy Agency
IIED	International Institute for Environment and Development
IMO	International Maritime Organization
IMT-GT	the Indonesia-Malaysia-Thailand Growth Triangle
IPCC	Inter-governmental Panel on Climate Change
IPM	Integrated Pest Management
IRRI	International Rice Research Institute
IUCN	International Union for the Conservation of Nature and Natural Resources

K

KOE	Kilograms Oil Equivalent

L

LADA	the Langkawi Development Authority
LCR	ASEAN-Australia Living Coastal Resources Project
LLDA	Laguna Lake Development Authority, Philippines
LNG	Liquified Natural Gas
LRT	Light Rapid Transit

M

MBI	Market-Based Instruments
MEAP	Marine Emergency Action Procedure
MFA	Multi Fibre Agreement
MICCI	Malaysia International Chamber of Commerce and Industry
MNS	Malaysian Nature Society
MOSTE	Ministry of Science, Technology and Environment (of Malaysia, Thailand or Vietnam)
MREP	Marine Resources Evaluation and Planning Project
MRT	Mass Rapid Transit

N

NAFTA	North American Free Trade Agreement
NCE	National Committee on Environment of Brunei Darussalam
NEB	National Environment Board of Thailand
NEQA	National Environmental Quality Act of Thailand
NGO	Non-Government Organization
NIEs	Newly Industrialized Economies
NLEP	National Law on Environmental Protection of Vietnam
NO_2	nitrogen dioxide
NOx	nitrogen oxide

O

ODA	Overseas Development Administration
ODS	Ozone Depleting Substances
OECC	Overseas Environmental Cooperation Center
OECD	Organization for Economic Co-operation and Development
ONEB	Office of the National Environment Board of Thailand
OSPAR	Oil Spill Preparedness and Response Project

P

PBSP	Philippine Business for Social Progress
PNOC	Philippine National Oil Corporation
PPCP	Polystyrene Packaging Council of the Philippines
PPP	Polluter Pays Principle
PPP	Purchasing Power Parity
PROKASIH	The Clean River Programme in Indonesia
PSA	Port of Singapore Authority
PSI	Pollutant Standards Index
PSSD	Philippine Strategy for Sustainable Development

R

R&D	Research and Development

S

SAM	Sahabat Alam Malaysia
SEM	Single European Market
SGP	Singapore Green Plan
SIJORI	Singapore-Johore-Riau Growth Triangle
SMEs	Small and Medium Enterprises
SoER	State of Environment Report
SO_2	sulphur dioxide

T

TDRI	Thailand Development Research Institute
TEI	Thailand Environment Institute
TFAP	Tropical Forestry Action Plan
TOE	Tons of Oil Equivalent
TPRM	Trade Policy Review Mechanism
TRIMs	Trade-Related Investment Measures
TRIPs	Trade-Related Intellectual Property Rights

U

UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	US Agency for International Development

W

WAPRA	Wild Animals Protection and Reserves Act of Thailand
WCED	World Commission on Environment and Development
WHO	World Health Organization
WMO	World Meteorological Organization
WTO	World Trade Organization
WWF	World Wildlife Fund
WRI	World Resources Institute

Appendix 2
List of Consultation Meetings, ASOEN Meetings and Reviewers

Consultation Meetings

Experts Group Meeting on the ASEAN State of the Environment Report
4-6 July 1995
Manila, the Philippines

ASEAN

Brunei Darussalam	Mr. Ak. Shamhary Pg. Dato Paduka Hj Mustapha Environment Officer Environment Unit Ministry of Development
Indonesia	Mr. Harry Harsono Amir Deputy Assistant Minister State Ministry of Environment
Malaysia	Ms. Roshadah Hashim Environment Control Officer Department of Environment
Philippines	Dr. Amelia D. Supretan Chief-Environmental Education and Information Division Environmental Management Bureau Department of Environment and Natural Resources
Singapore	Mr. Chia Mia Chiang Head, Strategic Planning & Research Department Ministry of the Environment
	Mr. Eng Wee Hua Chief Engineer International Environment & Policy Department Ministry of the Environment
Thailand	Dr. Wanee Samphantharak Director, Environmental Policy and Planning Division Office of Environmental Policy and Planning
ASEAN Secretariat	Dr. Filemon A. Uriarte, Jr. Director Functional Cooperation Bureau ASEAN Secretariat
	Mr. Dhannanjaya V. Sunoto Assistant Director Functional Cooperation Bureau ASEAN Secretariat

UNEP

Kenya	Dr. Daniel Van R. Claasen Coordinator UNEP/EAD/ENRIN UNEP Environmental Assessment Division
Thailand	Dr. Surendra Shrestha Regional Coordinator Asian Institute of Technology
	Ms. Elizabeth Solidum Programme Specialist Asian Institute of Technology

Consultants

Indonesia	Mr. M.S. Kismadi Indonesian Foundation for Sustainable Development
Malaysia	Ms. Lily Hor Yin Heng Centre for Environment Technologies (CETEC)
Philippines	Dr. Rufino C. Lirag, Jr. University of the Philippines-Diliman Campus
	Dr. Ramon Abracosa
Thailand	Dr. Vute Wangwacharakul Thailand Environment Institute (TEI)

Adhoc Working Group Meeting on the ASEAN State of the Environment Report
18-19 September 1995
Bali, Indonesia

Brunei Darussalam	Mr. Ak. Shamhary Pg. Dato Paduka Hj Mustapha Environmental Officer Environment Unit Ministry of Development
Indonesia	Ms. Retno L.P. Marsudi Directorate of Multilateral & Economic Cooperation Department of Foreign Affairs
Malaysia	Mr. Nadzri Yahaya Assistant Director Conservation and Environment Division Ministry of Science, Technology and the Environment
Philippines	Dr. Delfin J. Ganapin, Jr. (Chair) ASOEN Chairman-Philippines Undersecretary Department of Environment and Natural Resources
Singapore	Mr. Chia Mia Chiang Head, Strategic Planning & Research Department Ministry of the Environment
Thailand	Dr. Wanee Samphantharak Director, Environment Planning and Policy Division Office of Environmental Policy and Planning
Other Participants	Mr. Dhannanjaya V. Sunoto Assistant Director, Science, Technology and Environment ASEAN Secretariat

	Dr. Surendra Shrestha Regional Coordination UNEP
	Dr. Rufino C. Lirag, Jr. Consultant

Editorial Meeting to Review the Draft ASEAN State of the Environment Report
13-15 February 1996
Manila, the Philippines

ASOEN Chairman	Dr. Delfin J. Ganapin, Jr.
ASEAN Secretariat	Dr. Filemon A. Uriarte, Jr. Mr. Dhannanjaya V. Sunoto
Consultant	Dr. Rufino C. Lirag, Jr.
Editor	Dr. Carolina S. Guina

ASEAN Senior Officials on the Environment (ASOEN)

Sixth Meeting of ASOEN
20-22 September 1995
Bali, Indonesia

Brunei Darussalam	Dato Paduka Hj Othman B Hj Yaakub - *Head of Delegation* Permanent Secretary Ministry of Development
Indonesia	Dr. Surna T. Djajadiningrat - *Head of Delegation* Assistant Minister for Environmental Coordination The State Ministry of Environment
Malaysia	Mr. V. Danabalan - *Head of Delegation* Secretary General Ministry of Science, Technology and the Environment
Philippines	Dr. Delfin J. Ganapin, Jr - *Head of Delegation* Under Secretary for Environment and Programs Development Department of Environment and Natural Resources
Singapore	Mr. Tan Gee Paw - *Head of Delegation* Permanent Secretary Ministry of the Environment
Thailand	Mr. Kasem Snidvongs - *Head of Delegation* Permanent Secretary Ministry of Science Technology and Environment
Vietnam	Mr. Mai Huu Dua - *Head of Delegation* Deputy Director General National Environment Agency
ASEAN Secretariat	Mr. Dhannanjaya V. Sunoto - *Head of Delegation* Assistant Director Science, Technology and Environment

Seventh Meeting of ASOEN
9-11 September 1996
Langkawi, Malaysia

Brunei Darussalam	Dato Paduka Hj Othman B Hj Yaakub - *Head of Delegation* Permanent Secretary Ministry of Development
Indonesia	Dr. Surna T. Djajadiningrat - *Head of Delegation* Assistant Minister for Environmental Coordination The State Ministry of Environment
Malaysia	Dato' V. Danabalan - *Head of Delegation* Secretary General Ministry of Science, Technology and the Environment
Philippines	Dr. Delfin J. Ganapin, Jr - *Head of Delegation* Undersecretary for Environment and Programs Development Department of Environment and Natural Resources
Singapore	Mr. Tan Gee Paw - *Head of Delegation* Permanent Secretary Ministry of the Environment
Thailand	Mr. Kasem Snidvongs - *Head of Delegation* Permanent Secretary Ministry of Science, Technology and the Environment
Vietnam	Prof. Chu Tuan Nha - *Head of Delegation* Vice Minister Ministry of Science, Technology and Environment
ASEAN Secretariat	Dr. Filemon A. Uriarte, Jr - *Head of Delegation* Director Functional Cooperation

Reviewers

Institutions	Ministry of Development, Brunei Darussalam State Ministry for the Environment, Indonesia Ministry of Science, Technology and the Environment, Malaysia Department of Environment and Natural Resources, Philippines Ministry of the Environment, Singapore Ministry of Science, Technology and Environment, Thailand Ministry of Science, Technology and Environment, Vietnam
ASEAN Secretariat	Dr. Filemon A. Uriarte, Jr. Mr. Dhannanjaya V. Sunoto Mr. Apichai Sunchindah Dr. Somsak Pipoppinyo Dr. Donald Tambunan Ms. Maria S. Macesar Ms. Nunki L. Gardjito Ms. Zullia Saida
UNEP	Mr. Surendra Shrestha Mr. Chondhury Rudra Charan Mohanty