

SRI LANKA

FINAL DRAFT

STATE OF ENVIRONMENT

M. S. P. Bulankulame
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SRI LANKA

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It may be kindly noted that the views
expressed in this report are that of the
individual contributors and not that
of the Ministry.

STATE OF ENVIRONMENT IN SRI LANKA

**REPORT PREPARED FOR
SOUTH ASIA CO-OPERATIVE ENVIRONMENT PROGRAMME**

**MINISTRY OF ENVIRONMENT AND PARLIAMENTARY AFFAIRS
JULY 1994**

FOREWORD

I am informed that the South Asia Cooperative Environmental Programme (SACEP) proposes to publish in 1995 the State of Environment Report for South Asia keeping in line with United Nations Environmental Programme's Report on the State of the World Environment and Economic and Social Commission for Asia and Pacific's (ESCAP) publication for Asia and Pacific region.

In view of the above, SACEP has requested this Ministry to prepare a Country Report on the State of Environment in Sri Lanka.

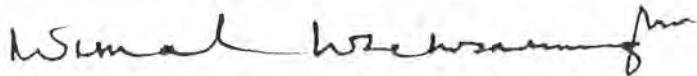
I am pleased to state that the staff of the Ministry of Environment and Parliamentary Affairs has totally prepared this Report with each chapter undertaken by the officer specialized in the particular field and in charge of the subject in this Ministry.

The chapters range from Lands, Forestry, Inland Waters, Coastal and Marine Environment, Atmosphere and Climate, Wastes-toxic and Hazardous Chemicals, Natural Disasters to Poverty, Population, Life Styles, Urbanization, Agriculture and Industry, Energy, Transport, Human Health, etc.

Further, responses regarding Environment Technology, Environment Management, Communication and Global Responses are included in this Report. There are also suggestions for follow-up of Agenda 21 and the Prospects for the 21st Century : A Regional Perspective.

I congratulate my officers and staff of the Ministry of Environment and Parliamentary Affairs for preparing this Report and forwarding it to SACEP as required.

I am sure that the contents of this Report will contribute to our understanding of the State of Our Environment in Sri Lanka and its applicability for the preparation of the State of Environment Report for South Asia.



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PART 1

ENVIRONMENTAL CONDITIONS AND TRENDS

CHAPTER 1

LAND

1.1. Introduction

Land is the most important natural resource vital for the survival of predominantly agricultural Sri Lanka. Its land cover is 6.5 million hectares in extent, and of this, only 5.5 million hectares have good soil suitable for agricultural use. With a population of 17.4 million in 1992, which is ever increasing, the total land-man ratio is about .3 ha per man, and cropped land per capita is 0.11 ha, that is the second lowest figure in South East Asia (See Table 1.1). In the face of dwindling land-man ratios, there is a sheer necessity to achieve sustained high productivity from land in the context of the national conservation strategy.

Table 1.1: Land Utilisation Ratios of Sri Lanka Compared with Selected Countries

Item (ratio)	Unit	R.Y*	SL*	BD*	IND*	PAK*	NPL*
Cropped land / total land area	%	1991	29.44	70.19	57.08	27.42	19.44
Irrigated agriculture area / total land area	%	1991	8.20	23.35	15.40	22.5	7.68
Forest and wood lands / total land area	%	1991	32.49	14.53	22.25	4.51	18.13
Cropped land per capita	Ha	1991	0.11	0.08	0.20	0.18	0.14

* R.Y.-Ref. Year; SL -Sri Lanka; BD -Bangladesh; IND -India; PAK -Pakistan; NPL -Nepal

1.2. Land Use

The major features in land use trends during the period from 1960 to 1980, are seen in the data given in Table 1.2. Those are the latest figures, because the national studies of land use changes between 1980 to 1990, conducted by Land Use and Policy Planning Division, are not completed yet.

Table 1.2: Major Land Use Changes During The Period 1960 - 1980

Land Use Category	Total % of Change	Rate of Change Per Annum %	Ha.
Open Forest	- 65	- 2	- 49868
Dense Forest	- 24	- 1	- 25254
Grassland	- 22	- 3	- 146.6
Tea	- 21	- 0.9	- 3576
Rubber	- 12	- 0.5	- 1771
Scrubland	+ 398	+ 24	+ 25096
Paddy	+ 56	+ 3	+ 18183
Sparsely used cropland	+ 22	+ 1.3	+ 14858
Homestead	+ 33	+ 2.0	+ 12185
Water Bodies	+ 41	+ 2.6	+ 5362
Forest plantation	+ 302	+ 18	+ 3888
Other croplands	+ 1329	+ 83	+ 3584
Coconut	+ 19	+ 1.1	+ 3098

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Thus the highest rates of increases during the period are seen in the land use categories of "other cropland", "scrubland", and "forest plantations". It can be deduced that the increase in scrubland, clearly indicates the degradation of vegetation cover, due to shifting cultivation and deforestation. The increased paddy extent could be attributed to the implementation of large irrigation projects, as the highest increase of 108%, is recorded in the dry zone.

The major land use trends during the period 1960 to 1980 are:

- decrease of extent by 24% and 65% respectively in the open forest and dense forest extent, at a rate of 2% and 1% per annum respectively, under open and dense forest;
- marked decrease of 22% in grassland, 233706 ha in extent; and
- notable decrease under plantation crops, namely Tea – 21%, and Rubber – 12%, while large extents coming under "other cropland" shows the highest increase (83%) per annum.

Table 1.3 gives the data on the provincial distribution of major land utilisation in Sri Lanka, according to the figures supplied by the Department of Census and Statistics in 1993 (See Fig.1.1).

Table 1.3: Provincial Distribution of Major Land Utilisations

Province	Total Land Sq. Km	Inland Waters Sq. Km	Forests Sq. Km	Major Export Ha.x100	Minor Export Ha.x100	Paddy Ha.x 100
Western	3602.6	91.5	195.4	1133.3	26.84	596.13
Southern	5398.3	161.3	932.1	748.6	132.01	971.78
Uva	8315.9	165.4	3000.5	409.5	17.38	440.81
Central	5490.1	99.6	1401.7	1128	154.09	606.04
Sabaragamuwa	4868.8	47.7	764.8	1263.5	47.06	474
North Western	7430.8	381.1	1001.5	2178	18.99	1343.63
Eastern	9157.8	634.4	3030.5	68.8	00	1466.09
North Central	9780.2	730.8	3325.8	25	00	1611.2
Northern	8291.2	593.4	3946.1	68.6	00	465.44
TOTAL	62335.7	2509.2	17598.4	6998.55	396.37	7975.12

*Major Export Crops – Tea, Rubber, Coconut

Minor Export Crops – Cocoa, Cinnamon, Cardamoms, Pepper and Cloves

1.3. Land Degradation and Soil Loss

Land degradation denotes all natural and anthropogenic processes that diminish or impair land productivity. The natural processes include climatic changes and accelerated intensity of winds and waves. Among the anthropogenic factors, over use of land and water, deforestation, excessive use of agro-chemicals, and careless disposal of wastes often degrade land. In Sri Lanka, man-induced land degradation is more significant than natural forces. It is manifested through a high rate of soil erosion and siltation, landslides, floods, emerging problems of salinization, coastal erosion, and loss of productivity of agricultural lands.

Desertification is a complex ecological process by which terrestrial eco-systems gradually lose their ability to sustain any form of life. Thus, they lose their economic value for man. Desertification is defined as land degradation in arid, semi-arid and dry sub-humid areas resulting from adverse human impact.

LAND USE

PROVINCES:

1. Western
2. Southern
3. "Uva"
4. Central
5. "Sabaragamuwa"
6. North-western
7. Eastern
8. North-central
9. Northern

LEGEND

-  Paddy
-  Tea
-  Rubber
-  Coconut
-  Garden
-  Dense Forest
-  Open forest
-  Others

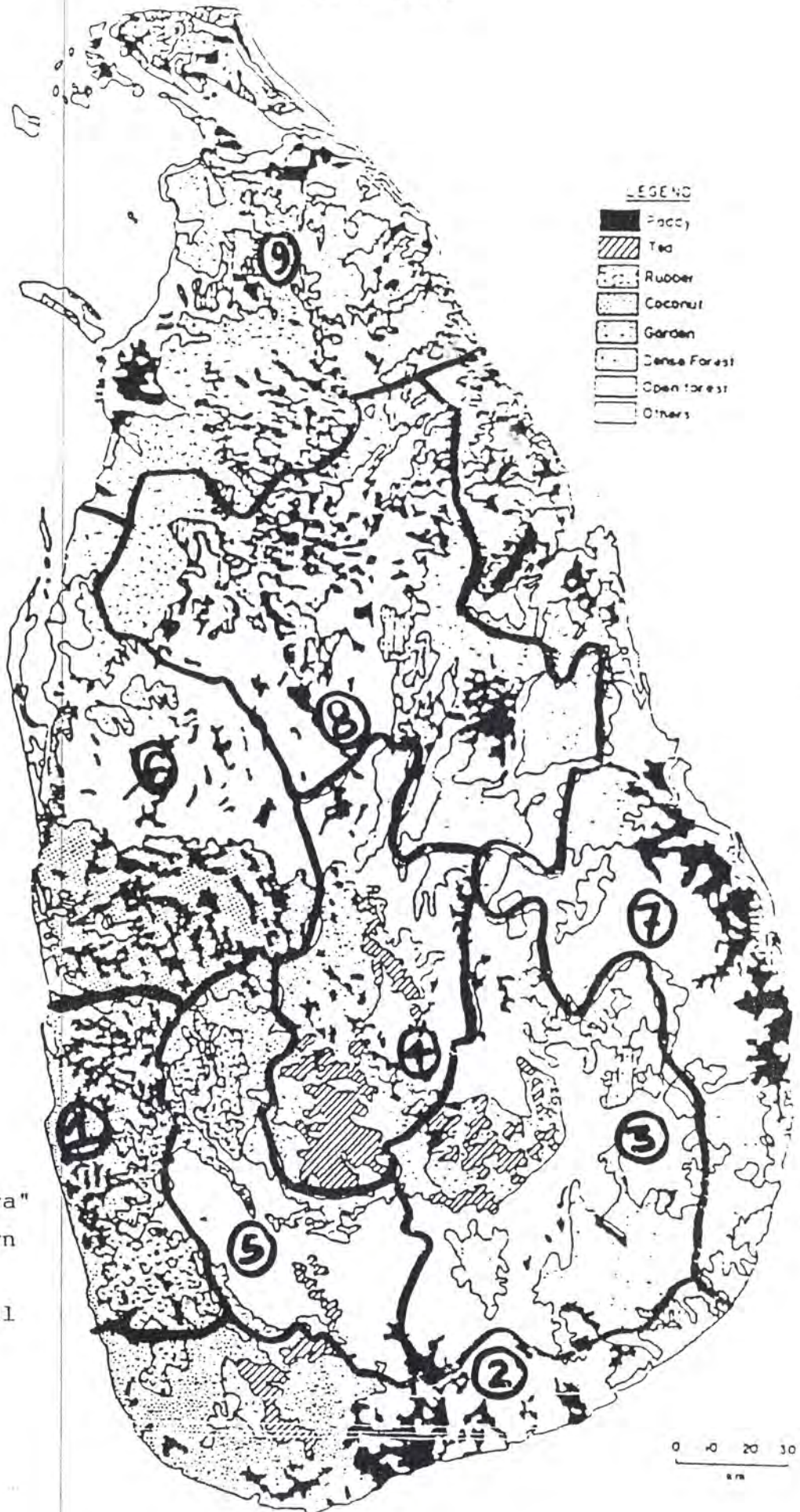


FIG 1.1 - LAND USE

Desertification is a very serious problem in many parts of the world, but it is especially so in some of the ESCAP countries. Globally 45.6 million ha. or 35 % of the area is either already affected or likely to be affected by desertification. Out of this, 17.5% is extremely desertified, 7.5% very highly desertified, 36.2% highly desertified and 38.8% moderately desertified.

The present status of land distribution of Sri Lanka based on the new definition in respect of desertification adopted in February 1990, is shown in Table 1.4.

Table 1.4: Land Classification Based on Ratio of Rainfall and Potential Evapotranspiration

Land Category	RF/POT. EVP. T*	Land Area % from total land area
Hyper-arid	<0.05	00
Arid	0.05 - 0.02	00
Semi-arid	0.21 - 0.50	12
Dry sub-humid	0.51 - 0.65	37
Moist sub-humid and humid	>0.65	51

* RF - Rain fall

POT. EVP. T - Potential evapotranspiration

Although Sri Lanka has no desert areas, the desertification process slowly takes place in the semi-arid and dry sub-humid areas, mainly due to human activities like deforestation, and unplanned tapping of ground water. If there is no Direct Action Programmes to control desertification, the programmes implemented for other objectives such as reforestation in the dry zone, provision of irrigation, conservation of bio-diversity and farmer's woodlot programmes, etc., indirectly help to control desertification.

Soil erosion rates are directly related to the topography and the land use pattern. According to the study carried out in the largest watershed area (Upper Mahaweli Catchment, it contributes 4.8% of the total land area of the country) in Sri Lanka, the replacement cost due to soil erosion in the catchment is Rs 953 million, and which is 0.67% of the GDP (in 1992 figures). The estimated replacement cost is about 3.16% of the total value of agricultural production in the country. Land use types and related soil erosion rates of the catchment are shown in Table 1.5.

Table 1.5: Land Use Types and Related Soil Erosion Rates

Land Use Type	Soil loss tons/ha/yr (estimated)
Dense forests	1.0
Degraded forests	25.0
Degraded grasslands	30.0
Poorly managed seedling tea	52.0
Well managed seedling tea	15.0
Paddy and mixed garden	1.0
Chena and Tobacco	70.0
Market garden (vegetable)	25.0

The studies carried out by NEDECO (1984), in collaboration with the Irrigation Department, indicated an average of 15 million tons of sediment, for the period 1952-1982, removed in the Upper Mahaweli Watershed, and about 70% of this load trapped in the Polgolla reservoir, constructed in the Mahaweli river.

Other estimates of soil loss due to erosion have been reported from different parts of the country. USAID (1980) reports soil losses in the Maha Oya catchment (mid-country), in lands under tobacco, on slopes ranging from 45% to 60%. The estimated range of soil loss is from 388 to 913 t/ha/yr. More recent studies of sediment transport estimates for major rivers in Sri Lanka are given in Table 1.6.

Table 1.6: Sediment Load

River Basin	Drainage area sq. km	Annual sediment yield	
		t/km ²	m ³ /km ²
Kelani Ganga	1809	875	442
Mahaweli Ganga	1166	417	156
Walawe Ganga	337	470	237
Kirindi Oya	912	68	34

In the coastal peneplain of the wet zone, there are about 50,000 ha. of Bog and Half Bog soils, and about 24,000 ha. of alluvial soils that are water logged. Out of this land, about 25,000 ha. lie close to the sea and in depressions at or below sea level. They suffer from salinity as a result of sea water intrusion. It has been recorded that the influx of the sea water upstream due to sand extraction in the Kelani river is causing salinity problems.

About 500,000 ha. Low Humic Clay soils in the inland dry zone is seasonally water-logged for a period of 3-5 months from October to February, and for a shorter period from March to May. These soils have a high base saturation. Transient salinity can develop if precautions are not taken during land development and land management. At any given time, the extent of salt affected land does not exceed 5% of the total extent estimated.

An additional extent of about 400,000 ha. of alluvial soils occur along valley bottoms and coastal plains. They suffer water-logging and frequent flooding. The cause of the problem is low relief. About 5% of this soil can suffer from salinity, especially those close to the coast.

Misuse of irrigation water, lack of drainage and salt water intrusion can lead to a rise in the ground water table, accumulation of salts and sodification of soils. Some of the major soil groups of Sri Lanka, such as Reddish Brown Earth, Low Humic Clay Soils, Non Calcic Brown Soils, Grumusols and alluvial soil are susceptible to rising water table and salt build-up caused by poor water management practices.

In the extreme northern area of the country (Jaffna peninsula), the heavy dressing of nitrogenous fertilizer and organic manure have been applied to irrigated cash crops. The shallow ground water from which both irrigation and drinking water are drawn, has been accumulating nitrate, which in some places has reached toxic levels.

Vegetable farmers in the montane areas located in Nuwara Eliya and Badulla districts apply large doses of fertilizer. It is feared that this practice is harmful to soil, but has not been well investigated. Frequent application of pesticides, fungicides and weedicides could lead to accumulation

of toxic residues in the soils, ground water and surface water bodies. This aspect has not been adequately studied in Sri Lanka, and needs urgent attention in the interest of conserving soil in a good state.

1.4. Underground Land Resources

Sri Lanka, for its size, is reasonably well endowed with mineral resources (see figure 1.2), and mineral exports account for about 5% of the national export earnings. Mining and quarrying contribute 3.5% of the GDP, and account for one-tenth of total employment. The Table 1.5 shows the export values of gem and mineral sands.

Table 1.5: Export Values of Gem and Mineral Sands (Rs. million)

Underground Land Resources	1985	1986	1987	1988
Gems	317.8	431.5	797.6	978.7
Mineral sands	172.6	198.6	156.9	302.2

Mining activities include extraction of ceramic and cement raw materials, graphite, mineral sands, mica, rock phosphate, precious stones, marble dolomite, coral, rock and sand for building and road construction, and clay for brick and tile manufacture. Mining activities destroy the lands by the very nature of the enterprise, and this is very extensive in the case of ceramic and cement raw materials, clay and gem mining. The latter mentioned mining activities are largely confined to paddy lands. Gemming activities carried in river beds, banks and upland areas leads directly to soil erosion through soil disturbances and by washing of gravel directly into streams or directly to drainage channels. Inland coral mining in certain areas, especially in the south-west coastal belt has affected paddy cultivation in those areas. Area coverage is not known in any of the above mining activities.

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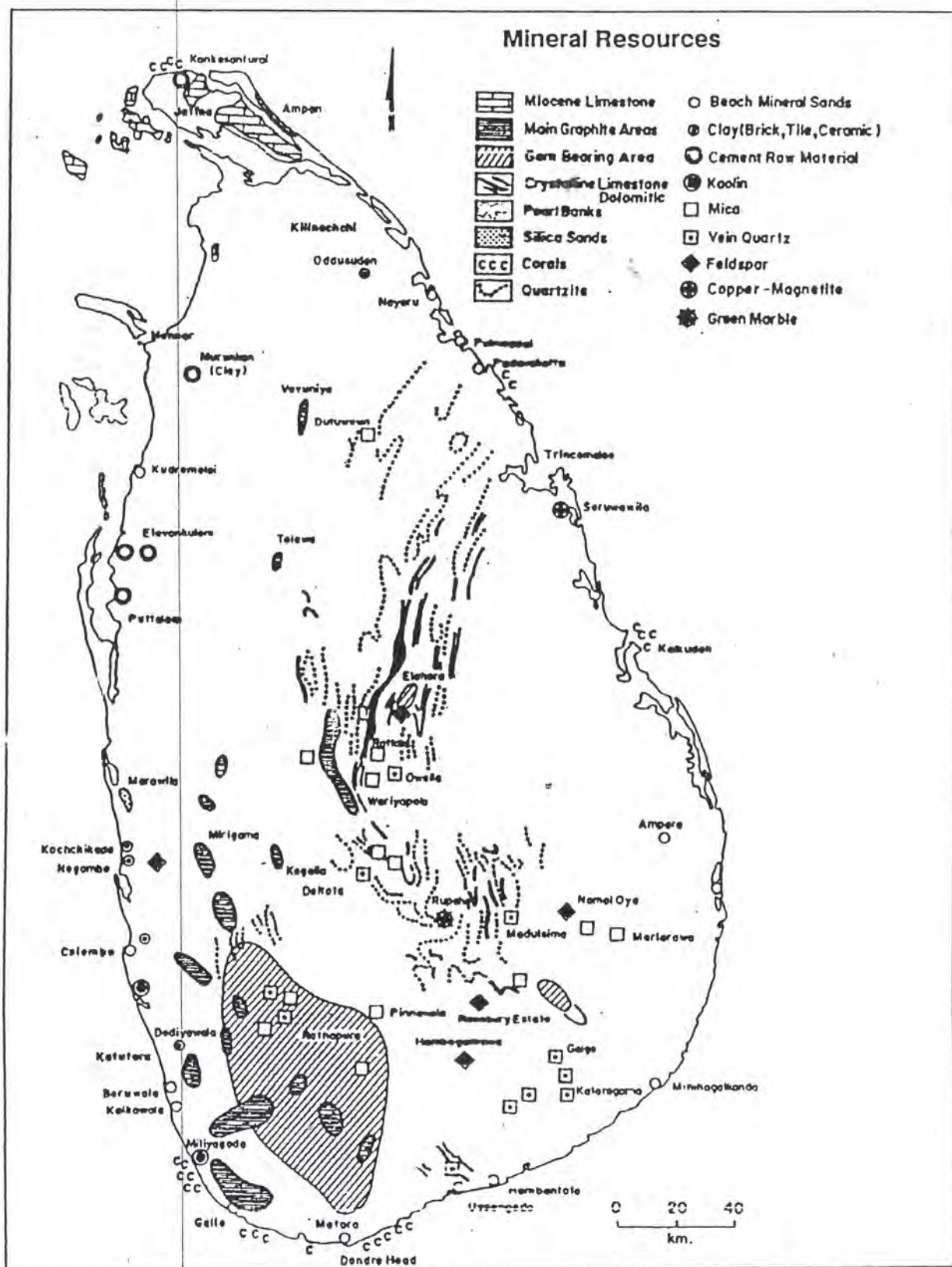


FIG. 1.2 - MINERAL RESOURCES OF SRI LANKA

CHAPTER 2

FORESTS AND WILDLIFE

2.1. Introduction

"Forests" can be defined as vegetation types dominated by diverse kinds of species of trees, of different size and age. All forests found in Sri Lanka are Tropical forests. Tropical forests are one of the earth's valuable resources. Their service to man are innumerable. Indeed, man may not be able to survive for long, if there were no forest life on earth.

Wildlife has been defined as the sum total of animals and plants, excluding domesticated or captive animals and cultivated plants, grown for human purposes. An important link which cannot be ignored when dealing with forests, is their link with wildlife. Forests, especially tropical forests, provide the habitat for wildlife, and once forests are destroyed, their habitat too gets destroyed.

The development of organised forestry and protected area management in Sri Lanka has a long history. One of the first wildlife sanctuaries was established in Sri Lanka, in the Third Century B.C., during the reign of King Devanampiyatissa. Religious philosophy and the associated ethics, through the centuries have also instilled a deep respect for all living beings, including trees, amongst Sri Lankans, thus paving the way for the protection of forests.

2.2. Forests

- The Role of Forests

Forestry which covers only unprocessed wood, contributed 1.7% to the Gross Domestic Product (GDP), or 1.9 billion, in 1983. However, the official statistics underestimate the real contribution. If the value of freely and illegally collected wood, and of the wood available from non-forest resources is added, the total value of wood production, harvesting and transport is Rs. 4.7 billion per year. The industrial production of wood commodities, contributes an additional Rs. 520 million, and of paper and paper products, Rs. 900 million. The forestry and forest industries employ about 170,000 people, including the collection and transport of fuelwood.

The role of Sri Lanka's forest in respect of supplying, industrial wood, small wood for rural needs, fuelwood, and numerous other products such as cane, bamboo, honey, medicinal plants, etc., is significant. Inevitably, the forest plantation in Sri Lanka, with their high level of productivity, will have to play an increasingly important role in providing the industrial wood needs of the country.

In Sri Lanka, which has a large rural population, forests play a significant role in the supply of energy for the rural people. In fact, in some parts of the country, the removal of wood is mainly for meeting the fuelwood requirements. The high forests of Sri Lanka provide 20-25% of the total household biomass fuel. Natural forests and forest plantations have contributed, at the rate of 13%, to the total fuelwood demand of industries.

The forests, in Sri Lanka, are environmentally and biologically indispensable, as they maintain the hydrological balance, curb erosion, and provide a habitat for a wide variety of fauna and flora. The importance of forests with regard to wildlife cannot be over-emphasized, because they are the only natural abode that wildlife has. The forests also play an important role, as the repository of the country's indigenous, terrestrial genetic resources. Sri Lanka, despite its relatively small size, has a high degree of plant and animal diversity, and a high degree of endemism.

– Extent, Diversity, Types, Distribution and Rates of Changes

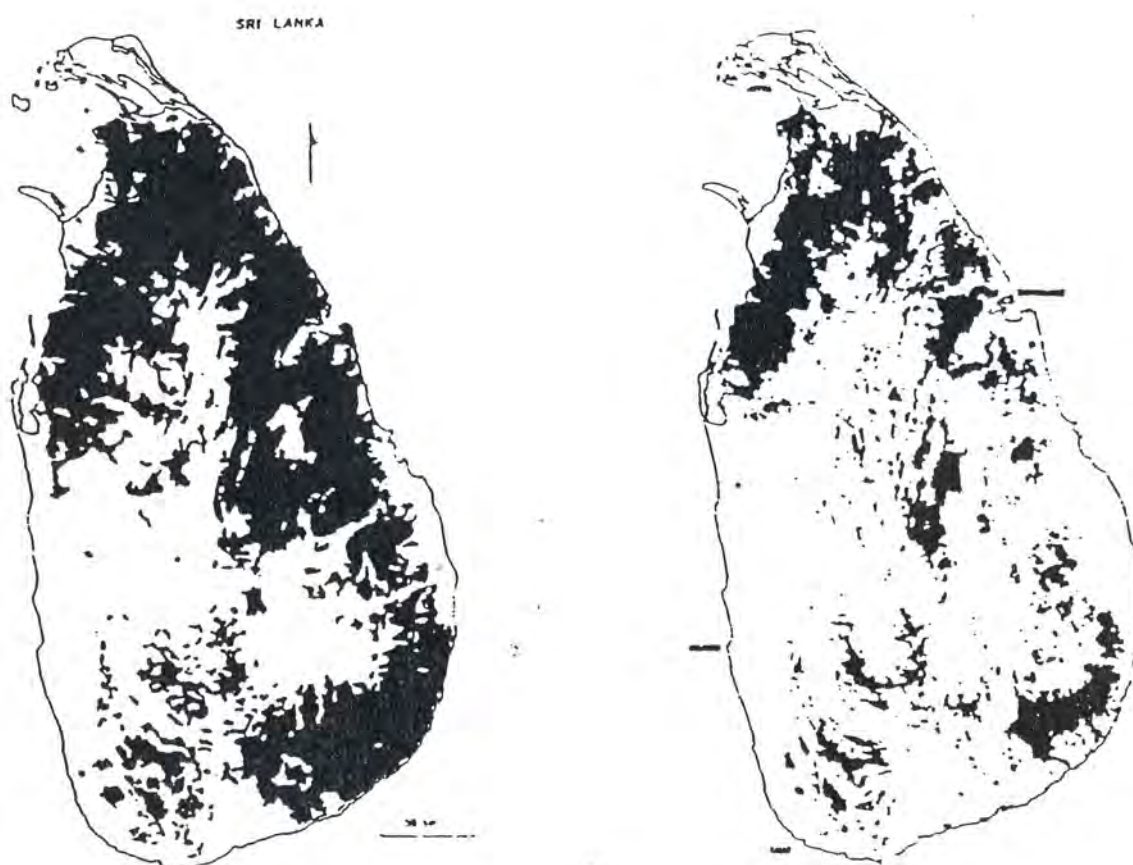
The statistics on the forest cover of Sri Lanka are shown in Table 2.1. The area of closed canopy natural forest, 1.33 million hectares, or 20.3% of the total area of the country, can be compared with a 1956 value of 2.9 million hectares, or 44%. These figures suggest that the average annual rate of deforestation during the past decade, both planned and unplanned (illegal felling and encroachment), has been about 54,000 hectares (see Figure 2.1). The total area of established forest plantation up to 1992, is 112,131 hectares.

Table 2.1 – Areas of Natural Forest Categories, 1992

Category	Area (Ha)	Percentage of total forest cover
Dwarf Montane	1280	0.1
Sub Montane	66530	4.99
Lowland Rain Forest	120320	9.04
Moist Monsoon Forest	524910	39.45
Dry Monsoon Forest	572630	43.04
Dry Zone Riverain Forest	37930	2.85
Mangroves	6980	0.52

The forest cover is largely concentrated in the dry zone (see figure 2.1). The lowland rain forest, the forest eco-system with by far the highest level of biodiversity, occupies less than 10% of the forest area.

Figure 2.1 – Sri Lanka's Forest Cover in 1956 (left) and 1992



The natural vegetation types of Sri Lanka have been described in various ways by foresters, plant geographers, and ecologists. The Table 2.2. gives a widely accepted classification of the natural forest types, in the different bioclimatic zones

Table 2.2 – Classification of the Natural Forest Types

Bioclimatic Zone	Forest Formation
Lowland mid-country wet zone	Tropical rain forest / Wet evergreen forest
Montane wet zone	Tropical montane forest
Low and mid-elevation intermediate zone	Intermediate evergreen forest
Montane intermediate zone	-----
Dry Zone	Dry mixed evergreen forest
Arid zone	Semi-evergreen, thorn forest

The classification into bioclimatic zones and forest types as given in the Table 2.2, should not be taken to imply uniformity in the general composition of the forest within each zone, for such is not the case. It is common to find sharp changes in the habitat conditions, within short distances in a climatic zone.

The dominant species in the wet evergreen forests are –

- The Dipterocarpus community dominated by Dipterocarpus zeylanicus, or rarely by D. hispidus. The other associated tree species are Vitex altissima, Chaetocarpus castenocarpus, Dillenia retusa, Wormia triquetra, Myristica dactyloides, Semicarpus gardneri, and Doona trapezifolia. This community is confined to the low and mid elevation.
- Mesua-Doona-Shorea community is found at mid elevation. All tree dominants as well as well as Dipterocarpus, which also occurs frequently in this community, belong to the Dipterocarpaceae. The common associates in this community are, Palaquium petiolare, Chaetocarpus castanocarpus, Magnifera zeylanica, Callophyllum tomentosum, Vitex altissima, and Myristica Dactyloides.
- Camptosperma zeylanica, other species community. This is found in the forests of the Adam's Peak range, at mid elevation.
- Vitex-Wormia- Chaetonocarpus-Anisophyllea community. This occurs at low elevation.

In the montane wet zone, the Syzygium-Calophyllum-Godonia-Michelia association is perhaps the best known.

The dry mixed evergreen forest, which is the forest type found in the dry zone, is the most extensively developed formation in Sri Lanka. As expected, there is variation in species composition. The Manilkara-Drypetes-Chloroxylon community is the most common association.

In the low and mid-country intermediate zone, now containing very little natural forest, the climax formation is, in physiognomy and species composition, somewhere between the wet evergreen forest, and the dry mixed evergreen forest.

In the arid zone, the formation consists of a low, open, thorny scrub, with isolated trees or patches of forest containing Manilkara hexandra, Salvadora persica, Dichrostachys cinerea, Acacia spp., and shrubs of Carissa spinarum, and Zizypus spp.

- Causes and Consequences of Forest Changes

The reasons for the reduction of forest cover, or deforestation are many – the population explosion and thereby increasing the need for land for shelter as well as for agriculture, fuelwood, timber extraction for local consumption, as also as a means of earning badly needed foreign exchange, illicit logging and poverty itself. The major causes of forest degradation in Sri Lanka, have been identified as:

- a. settled agriculture and shifting cultivation;
- b. introduction of cash crops and expansion of plantations;
- c. urbanisation and extensive agriculture;
- d. timber felling;
- e, gem mining;
- f. expansion of tourism; and
- g. encroachment.

The average annual rate of deforestation during the past decade is 54,000 hectares. The reduction of forest cover during the last 100 years is shown in Table 2.3. The total area of established forest plantations up to 1992 is 112,131 hectares, and this figure is not significant, compared to the figure of deforestation.

Table 2.3 – Reduction of Forest Cover (Ha)

Year	Total land area	Forest cover	Forest cover % from total land area
1880	6,525,000	5,546,000	85
1900	6,525,000	4,567,500	70
1950	6,525,000	3,300,000	50
1956	6,525,000	2,871,000	44
1982	6,525,000	1,750,000	26.6
1985	6,525,000	1,566,000	24
1992	6,525,000	1,324,575	20.3

The consequences of deforestation has become painful in recent years all over the world, and particularly in the developing countries. Flooding, soil erosion, siltation of rivers and reservoirs, scarcity of water and fuelwood, are only a few examples of the consequences. Loss of genetic resources is another major problem, although, not many have fully understood the implications.

Scientists are now concerned that tropical deforestation, especially setting fire to forests, will affect climate on the global level, by increasing carbon dioxide levels in the atmosphere, and thereby contributing to the greenhouse effect.

An extreme result of deforestation is desertification, i.e., the destruction of the biological potential of land, which can ultimately lead to desert-like conditions. It is an aspect of the widespread deterioration of eco-systems and diminishes or destroys plant and animal production, thus leading to numerous social and economic problems.

- Trade in Forest Products

The supply of sawn timber, sawn logs, and other wood products in 1992, and the future demand for 1995 to 2016, are shown in Table 2.4. Out of .54 million m³ of sawn timber, 864 m³ were imported in 1992.

Table 2.4 – Supply and Demand for Sawn Timber, Sawn Logs and Other Wood Products

Year	Sawn Timber (mil. m ³)	Sawn Logs (mil. m ³)	Panels (m ³)	Poles (mil.)	Fuelwood (m ³ x000)
1992	0.52	1.42	21,077	0.87	-
1995			22,844		12,460
1996	0.60	1.59		0.98	
2010			34,166		12,560
2011	0.68	1.79		1.10	
2015			39,072		12,500
2016	0.70	1.85		1.13	

The supply of sawn logs from forest plantations during 1994–2017, is forecasted to be around 30% of the total demand. In the case of fuelwood, forest plantations contribute less than 6% of the total demand, and the rest of the demand will be met from non-forest wood resources.

- The Protection and Management of Forests

With the increase in forest plantations created by the extensive afforestation programme in Sri Lanka, the problem of forest fires has been mounting steadily in recent years. According to the statistics available at the Forest Department, the estimated fire damage is around 20–25% of the annual planting area. If these figures are applied to the whole country, the annual burnt area would be between 1500 and 2000 ha. The establishment of fire fighting groups in Forest divisions, and the good maintenance of the fire lines within the plantations, are major actions already taken to combat forest fires.

Illegal logging in the State forests are widespread in Sri Lanka. The recorded forest offences were 5848 cases in 1981, and 3700 in 1984. The Forest Department has 9 protection squads operating in the different parts of the country. Combined operations with the Police, Divisional Secretariats, and the Army, have proved to be successful. The enforcement of Emergency (Forest) regulations and the establishment of mobile timber checking units, are the new developments for the protection of forests, from illegal logging and transportation.

2.2. Wildlife

- The Importance and Value of Wildlife

The wildlife conservation, and protected area management represent, in Sri Lanka, an important sector of natural resources development. Performance in this sector has a direct influence on the Sri Lanka Government's ability to conserve the country's biological diversity, and manage its wildlife and protected area resources, in a sustainable manner. The potential for developing tourism in protected areas has been recognized. Species and eco-systems provide the basis for human civilization. Human beings could not possibly survive, without the crucial services that are provided by nature, including a stabilizing climate, protecting watershed, essential cycling of elements, etc.,

– Conditions and Trends

Sri Lanka has greater biodiversity per unit area than any other country in Asia. It is one of the eleven areas in the tropics, identified by the Committee on Research Priorities in Tropical Biology, as demanding special attention because of its high level of biological diversity, endemism, and its vulnerability to habitat destruction. The flora of Sri Lanka, has over 3,100 species of vascular plants. About 28.5% of them are endemic, 65% are of Indian and Himalayan affinity, while the balance of 6.5% come from the Malaysian, African and Australian regions.

Sri Lanka's fauna which has been influenced by the climatic, topographic, and zoogeographic history of the country, shows a high degree of diversity and several other features of interest. Table 2.5 shows the faunistic diversity, endemism, and geographical distribution in Sri Lanka.

Table 2.5 – Faunistic Diversity, Endemism, and Distribution

Faunistic category	No. of Species	Endemic Species	LCWZ *	HC *	LCDZ *	Islandwide
Fishes	64	16 (27%)	15	04	03	02
Amphibian	39	19 (51%)	09	12	03	--
Reptiles	139	72 (51%)	51	30	32	02
Birds	237	21 (08%)	13	14	04	03
Mammals	85	12 (14%)	06	09	03	02

* LCWZ – Low Country Wet Zone; HC – Hill Country; LCDZ – Low Country Dry Zone

Sri Lanka currently has a fairly extensive system of protected areas, covering nearly 14% of its total land area. Sri Lanka is only one of five countries in the world, that has over 12% of the land area allocated exclusively for strict conservation. The bulk of the protected areas, is under the administration of the Department of Wildlife Conservation (DWLC), while the rest falls under the Forest Department (FD). Within the Forestry Sector, at present, over 45% of the existing natural forests have been allocated as protected areas, entirely for protection and conservation purposes. The different categories and extent of the protected areas are given in Table 2.6.

Table 2.6 – The Categories and Extent of the Protected Areas

Category	Managed by	Number	Extent (Ha)
National Parks	DWLC	12	466,286
Strict Nature Reserves (SNR)	DWLC	03	31,574
Nature Reserve	DWLC	03	33,372
Jungle Corridors	DWLC	--	--
Sanctuaries	DWLC	50	249,020
SUB TOTAL	DWLC		780,252
MAB Reserves	FD	42	106,810
Sinharaja	FD	01	11,330
Knuckles	FD	01	16,000
Wet Zone Forests	FD	13	24,038
SUB TOTAL	FD		158,178
GRAND TOTAL	DWLC+FD		938,430

The distribution of protected areas under DWLC, show very clearly (see figure 2.2.) a heavy representation of dry zone habitats, and a relatively minor representation of wet zone habitat types.

- The Impact of Human Activities

The destruction of the habitat, is now recognized as a single most important cause of loss of wildlife, through extinction of the species, because most species have a narrow range of habitat tolerance. Habitat destruction comes in two forms. The direct habitat destruction occurs when forests are cleared completely for shifting cultivation, settlements, roadways, dams, reservoirs, mining, urban centres, industrial sites, etc. This destruction, of course entails total loss of wildlife. Wildlife in Sri Lanka, has been adversely affected by heavy deforestation over the past few decades, i.e., about 54,000 ha, per year. Although logging is less drastic, it also results in much loss of wildlife.

Indirect destruction of the habitat occurs in the form of pollution by chemicals, solid waste, and siltation. Pollution by chemicals can include a number of different biocides (i.e., insecticides, fungicides, herbicides etc). In fact, the indiscriminate use of biocides has affected bird life in the agricultural areas in the country. In the Southern and Western parts of the island, mangroves (and marshlands), have been used as garbage dumps, and as a consequence, mangrove wildlife had suffered. Especially in Sri Lanka, most of the birds of migration, live in this habitat. The heavy use of fertilizers, can also cause considerable problems to aquatic flora and fauna, through a change in the chemical composition of the eco-systems.

Hunting for food is the main activity of a large part of the rural population, especially those living in the vicinity of forests. They hunt to supplement their protein supply. Hunting by traditional methods is not a problem, because the hunting is often limited.

An indirect form of collection (or capture of animals) that results in very high casualties is the "incidental take". Common in fishery, incidental take is simply the collection of non-target species in the course of harvesting others. Incidental take, such as light course fishing, using gelignite explosion etc., accounts for a very toll of marine species. The destruction of smaller trees, while felling a valuable timber tree, is the forestry version of incidental take.

- Policies and Programmes for Wildlife Management and Conservation of Biodiversity

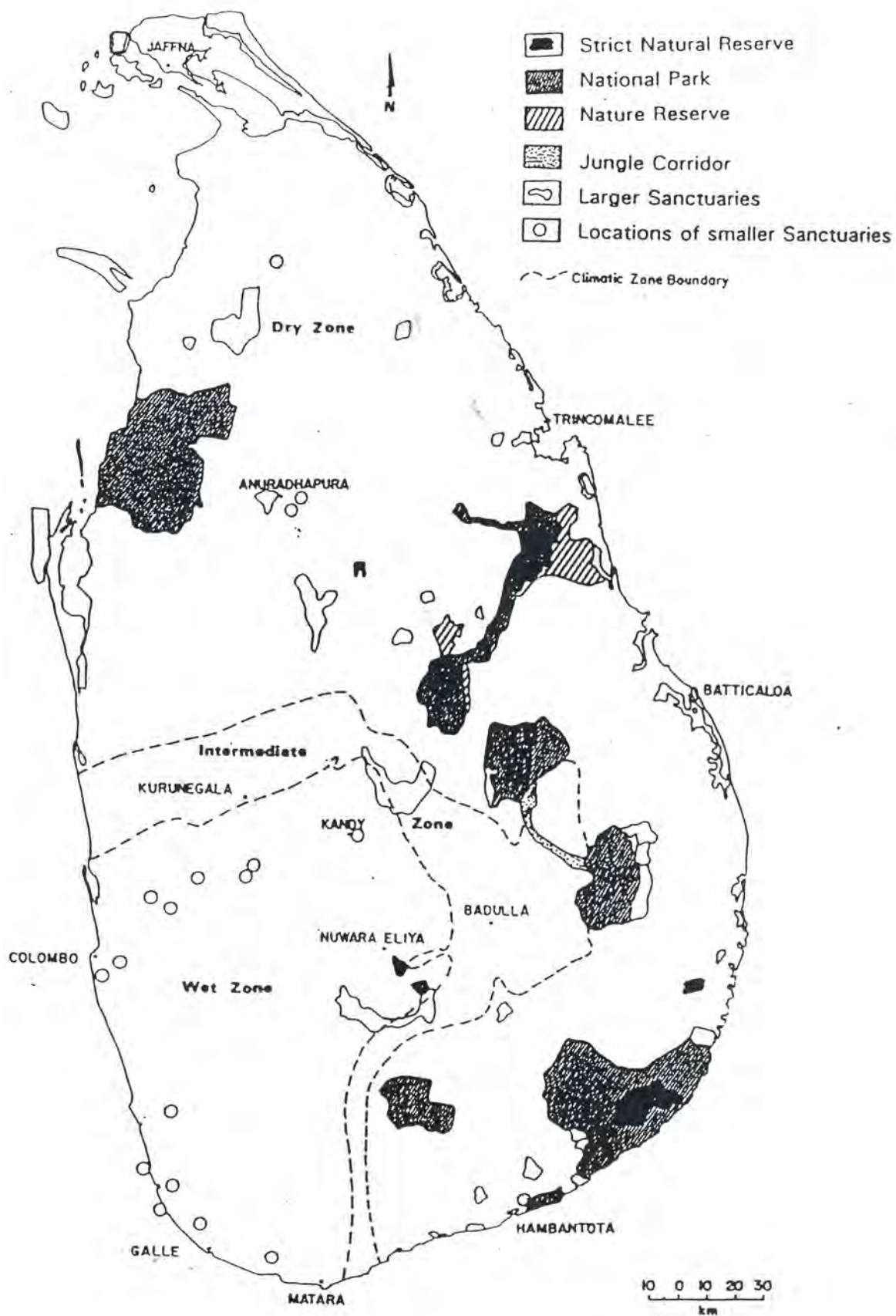
The policy document for wildlife conservation, was prepared by the DWLC, in 1989, in accordance with the following objectives of the Sri Lanka National Conservation Strategy,

- to maintain the ecological process and life sustaining system;
- to preserve genetic diversity, especially the bio; and
- to ensure the sustainable utilization of species and eco-systems.

This policy emphasizes the need for the conservation of fauna and flora, and the importance of soil and water conservation. Both institutions, the FD and DWLC, manage protected areas under the provisions of different legislation, such as the Fauna and Flora Protection Ordinance, the Forest Ordinance, and the National Heritage and Wilderness Areas Act. The lack of a National Land Use Policy, and lack of consideration given to biodiversity and environmental values in economic development and planning, are the major barriers for wildlife conservation.

The Five-Year Development Plan for the Wildlife Conservation and Protected Area Management Sector in Sri Lanka, prepared in 1990, with UNDP (GEF) assistance, is directed at the conservation of the biological diversity in Sri Lanka. It is an institutional project, designed to raise the technical and management capabilities of the DWLC and establish a representative and functional National Protected Area Network. The Wetland Conservation Project, and the National Conservation Review, for all the forest area of the island, under the Forest Sector Development Project, are the major on-going projects of wildlife conservation.

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Protected Areas under the Department of Wildlife Conservation, according to available records.

CHAPTER 3

INLAND WATERS

3.1. Introduction

Being a tropical island located in the Indian Ocean, a few miles off the Southern tip of the Indian sub-continent, Sri Lanka is endowed with an abundant supply of water, through monsoon rainfall. The monsoons constitute the ecology of the island. There are two major monsoons, that bring rain at different times of the year, to different regions of the island, namely, the North-East and the South-West monsoons. The North-East monsoon sets in by the middle of November, and lasts till about the end of February, bringing rain to the whole island. The South-West monsoon brings rain in June and July, but it is limited to the South-West sector and central highlands. During this period a severe drought prevails, in the other parts. The inter-monsoonal period brings occasional rains in March, April and May. On the basis of rainfall, the island is divided into 3 major zones: the wet zone, the dry zone, and the arid zone. Geographers sometimes speak of an intermediate zone between the wet and the dry zones (please see Figure 1).

3.2. State and Uses of Inland Waters

- Rivers and Lakes

The location of the central hill country receiving a heavy rainfall, has led to the development of a radial drainage pattern, with the stream sources in the high elevation water-sheds. One hundred and three distinct natural river basins, covering a good portion of the land area of the island can be recognised. The river basins that originate in the water pots of the hill country are perennial, while many of those in the dry zone are seasonal. Only a few river basins such as the Mahaweli River, which covers 16% of the total land area of the island, carry water from the wet to the dry zone (please see Figure 2).

- Man-made Reservoirs and their multiple use

In Sri Lanka, the heritage of our ancient civilisation is known to have depended on an irrigation system that had achieved a multipurpose objective, comprising, irrigation, drainage, flood control, and conservation. The modern irrigation and multipurpose development projects tend to concentrate on irrigation, flood control and hydro-power production, with only secondary emphasis on drainage, and an almost compelling absence of attention to conservation. Large scale development of water resources for irrigation and hydro-power, progressed rapidly during the last fifty years. Today, largely because of dams on the Mahaweli river, hydro-power provides 90% of Sri Lanka's electric energy. The large reservoirs, which irrigate over 500,000 hectares of land, have an aggregate installed capacity of 938 Megawatts (1983). The Irrigation Department, established at the turn of the century, assumed control over most of the water resource programmes. The renovation of derelict ancient irrigation works, and new land settlements around them, became major concerns in the 1930s, and continued virtually unchanged after National Independence.

About 12,000 small village tanks now irrigate some 269,000 hectares, mainly in the dry zone. Since ancient times they have been recognized as valuable sources of fish. Inland reservoirs now provide about 2 % of Sri Lanka's fish production.

- Water Uses and Demand: Consumptive uses

Less than 25% of the Sri Lanka households have access to pipe-borne water. The large majority of the population, still depends on water from wells, while about 7% draw water from rivers and reservoirs, for their domestic use. The Government of Sri Lanka, is a signatory to the New Delhi Statement, adopted by 115 countries, at the global consultation on "Safe Water and Sanitation in 2000", held in New Delhi, in 1990. The right to use, manage, and control the water,

of any public lake, or public stream, is vested in the State, and is subject to a few restrictions.

The average annual run-off water volume was estimated by an IRDB Mission, at 4.04 million hectare/metres (ham). A considerable proportion of this water, is now utilised in the irrigation and hydro-power projects, and what escapes to the sea, is less than 3.3 million ham. It must be noted, however, that over 60% of the water escaping to the sea, is from the wet zone, where it often causes flooding, and water-logging, in many low-lying areas. In the dry zone, in 1972, over 50% of the total run-off, had been utilised.

3.3 Quality of Water and Pollution Sources

In Sri Lanka, with small cities and industries, and plentiful water to dilute wastes, the water pollution problems are not insurmountable, although they are increasing rapidly.

- Water Quality, State and Trends

The non-point pollution, more difficult to identify and manage, includes urban, agricultural or any other land run-off. The urban run-off into lakes, streams or canals, includes nearly every pollutant nutrients, toxic oils, bacteria, and sediments. The agricultural run-off into streams, and rivers, usually includes pesticides, dissolved soils, nutrients from fertilizers, organic material and pathogens. The run-off from forestry, road construction or other land clearing, introduces high levels of solids and various oxygen demanding loads, as with the run-off from mines and sediment, acids and heavy metal pollution.

About 21.5% of Sri Lanka's total population live in officially designated urban areas, which cover 0.5% of Sri Lanka's 65,610 sq. kms. The disposal of urban wastes, which includes - sewage, liquid waste from industrial processors, sewage water from kitchens and laundries, garbage, industrial solid wastes, and urban storm water run-off, contribute to the water pollution problems in Sri Lanka. The Colombo Municipal Council area, with its estimated population of 625,000, is the only municipality with piped sewage. In 1986, it was connected to serve 60% of the inhabitants. 50% of the population belongs to the low-income category, which occupy marginal lands, and their sewage and garbage are dumped into the surface water, particularly, where they occupy stream and canal reservations. Organic pollution from sewage accounts for at least 50-60% of the total waste load discharged into the canal network in Colombo.

The large urban centres face rising problems in disposing of urban solid waste, both domestic and industrial.

- Industrial Waste

Industrial waste undergo little or no treatment before discharge. The liquid effluents are discharged directly into the surface drainage network, or on to land, from whence they reach the closest water-body. Thus, textile dyeing and printing industries, have caused widespread water pollution, in Ratmalana and Moratuwa. However, Sri Lanka has relatively few sewage pollution problems, from chemical industries.

- Pathogens and Organic Matters

The sanitation figures show that 44% of the rural population use pit and bucket latrines, while 36.5% have no latrine facilities whatsoever. Only 5% of the rural population had access to piped water, 85% used wells, and the rest depend on streams and rivers. As a result, a high proportion of the population is exposed to health risks, associated with faecally contaminated water. According to one study, "the poor water supply and excreta disposal systems, have resulted in

40% of the Sri Lankan population being affected by typhoid, gastroenteritis, amoebic and bacillary dysentery, infectious hepatitis, colitis, and worm infections (Hydrogeochemical Atlas of Sri Lanka).

- Heavy Metals, Toxic Chemicals and Silt

The fertilizer application rates for the country in general show an upward trend, and fertilizer pollution has become a potential hazard. In several districts (Nuwara Eliya, Jaffna), Monaragala Fertilizer has caused pollution of the ground and surface water, by nitrates. The use of pesticides has also risen steadily. Unfortunately, no systematic studies have been undertaken, and little or no published data on monitoring, are available on pesticides and fertilizer levels, in the run-off from cultivated land.

A consequence of certain agricultural practices on high terrain, is that silt is carried through run-off. The sand and gem mining, as also land clearing, causes bank erosion, de-regulation of water flows, and siltation, which in turn contributes to sedimentation, and destabilized seasonal water flows in rivers.

3.4. Environmental Impacts of Water Resources Uses

- Ground Water Utilization

The estimated ground water potential for the country is 780,000 hectare/metres per annum. Sri Lanka's largest most studied aquifers lie in the North and North-West. In the Vanathavillu basin, which spreads over some 40 sq. kms, the confined aquifer creates artesian conditions. The estimates of ground water resources available in the Vanathavillu basin vary between 5-20 million cubic metres per year. The deep well technology has developed over the past 15 years, to supply water for irrigation and domestic use, under the programmes of the water supply authorities. In many areas the tube wells yield water of reasonable quality, occasionally affected by excessive salinity, hardness or fluoride content (Dissanayake et al, 1986). The average yields from tube wells in the North and North-West, range from 75-35 litres per second (l/sec). The estimates of well yields, outside the North and North-West, illustrate the modest ground water potential. For example -

District	Well Yield
Colombo	3.5 l/sec
Hambantota	0.4 l/sec
Anuradhapura	0.5 l/sec

Source: Foster et al, 1977

In the regions devoid of large aquifers, ground water resources depend on local long-term recharge from rainfall infiltration and irrigation. The lack of hydrogeological data makes it difficult to formulate a national policy on ground water development, for the metamorphic regions (which concerns 90% of the island) of Sri Lanka. Temporal data for analysis of ground water resources trends are altogether lacking, and the increased exploitation of ground water for domestic use through a large number of tube wells, in the hard rock areas of the Dry zone, requires careful monitoring to determine the impact on adjacent shallow wells and other surface waters.

Ground water is increasingly used for potable water, especially in the small towns and rural areas. The ten year plan launched in 1980, envisaged drilling 20,000 deep wells, and constructing or rehabilitating 25,000 dug wells. By this means, 50% coverage for the rural population, was to be achieved by 1990, although this target has not been reached.

The most serious threats to ground water come from nitrate and bacterial (faecal) contamination. Nitrate pollution is due as much to extensive use of agrochemicals, and bacterial contamination is caused by the disposal of sewage effluent from pit latrine soakaways.

The leaking of pesticides into the ground water may also occur in agricultural areas, but no analyses have been carried out, due to lack of facilities and funding for monitoring. The river and canal pollution also affects ground water, and this problem is critical in urban areas, where ground water provides most of the potable water. The unregulated ground water use, has led to salinity intrusion in certain districts, and in some instances, rainwashed dissolved solids have caused salt water intrusion into the ground water.

3.5. Wetlands

Sri Lanka is blessed with a large number of wetland eco-systems, many of which are of national or international importance. To sustain this important heritage, on the 22nd June 1990, Sri Lanka signed the International Convention of Wetlands of International Importance, known as the RAMSAR Convention. Therewith, the country committed itself to preserve at least part of the ecological values present in the wetlands.

– Ecological, Economic and Social Importance

The wetlands store water and releases it slowly, thereby lowering flood peaks and allowing downstream areas to be protected. In urban areas, subject to rapid storm water run-off and flooding, the wetlands, particularly in the South-Western coastal zone, serve this important function as, "sponges", by absorbing flood water and mitigating downstream property damage. The other important functions of wetlands include, fishery production, wildlife habitat (including habitats that support major birds, as well as elephant populations), livestock grazing, and water for other uses. The wetlands, in particular, also provide recreational open space, and attractive habitats for bird and wildlife.

Many rural communities around the wetlands depend on them to meet their basic needs.

– Extent and Distribution

Sri Lanka possesses three hectares of inland water for every square kilometre of land (De Silva, 1988). It has one of the highest densities of lakes, tanks, ponds, marshes, and other still water, available in any country in the world. Not surprisingly, with its ancient hydraulic civilisation, and emphasis on self-sufficiency in rice production, about 95% of Sri Lanka's inland fresh water habitats are man-made, comprising mainly of rice paddies, and village reservoirs. The Directory of Asian Wetlands, which carries a description of the significance of 947 internationally important Asian Wetlands, has listed 41 wetland sites in Sri Lanka as being internationally important. A list of 35 additional sites, considered to be of national importance, has been prepared by Kotagama et al.

– Wetland Protection and Management

There are several institutions presently involved in wetland management, both at central and local levels. Several agencies hold land jurisdiction over specific wetland areas. For example, areas protected by the Fauna and Flora Ordinance, are managed by the Department of Wildlife Conservation, and the wetlands within the coastal zone are looked after by the Coast Conservation Department. Similarly, by virtue of the provisions of the National Environmental Act, the Central Environmental Authority (CEA) has the overall power to recommend strategies and policies, for the management of Natural Resources in several areas, including Wildlife, Forestry,

Land use, etc. Therefore, a high degree of coordination is required for concerted action by all agencies. The Cabinet of Ministers approved the setting up of a National Wetland Steering Committee (NWSC), by the CEA. This Committee consists of representatives from other agencies involved in the conservation and development of wetlands, and representatives of Non-Governmental Organisations, and acts as a Forum for the coordination on related activities. It also acts as a venue for the identification of information gaps. The primary objectives of this Committee are –

- to develop a concise policy for the sustainable management of wetlands;
- to coordinate and monitor activities in and around wetlands;
- to identify research and studies necessary for the conservation and management of wetlands to be carried out by different agencies and universities.

The CEA received technical and financial assistance from the Government of the Netherlands, in September 1991, to implement a Wetland Conservation Project, under the supervision of the NWSC. The activities of the Project includes –

- Updating and complementing of base data on wetlands;
- Prioritisation of wetlands for conservation and management;
- Preparation of conservation management plans for selected wetlands;
- Provision of guidance for implementation of these plans.

Phase I of the Project was completed in September 1992. Phase II of the Project is presently on-going. Several conservation management plans on selected wetlands have been completed under this project.

– Policies and Institutions

The importance of establishing concise policies on wetland management and the strengthening of related institutions, has been recognized through a number of recent documents, including the National Conservation Strategy (1988), and the National Environmental Action Plan (1991). However, a number of severe constraints were identified hampering adequate wetland management. Most of these are related to –

- Land use policies (an overwhelming number of Agencies – 40 within 7 Ministries – are involved in wetlands development, allocation and management);
- Inadequacy of the protection of biodiversity (intense development pressure and heavy encroachment on protected wetlands);
- Institutional inefficiencies (inadequate environmental legislation, confusing agencies' responsibilities in wetland management, low level of coordination, low public awareness).

To improve the situation, the CEA is implementing the Wetland Conservation Project (WCP). The primary objectives of this Project are –

- to preserve Sri Lanka's varied wetland eco-systems; and
- to strengthen the capabilities of the relevant authorities in conceptualising, planning, implementing, and monitoring wetland management;

The first objective is met through a number of project activities, such as the reporting and surveying of resources and status of wetlands; the valuation of economic and ecological values of wetlands; the preparation of conservation management plans for selected wetlands (Minneriya Reservoir, Bellanwila-Attidiya Marsh, Bundala National Park).

The second objective is more of a long-term nature. The activities such as the

preparation of an Institutional Action Plan for Wetland Conservation in Sri Lanka; the drafting of National Wetland Heritage Act; and the preparation of a National Wetland Conservation and Development Strategy.

Sri Lanka is covered with a network of of man-made tanks (please see Figure 3). A close inspection of the topographical maps reveals that in some localities, the density of tanks exceeds 1.4 tanks for an area of a mere one square mile. Although a large number of these tanks are in use at present, a considerable proportion lie in an abandoned state, under forest cover.

Small-scale water conservation systems referred to as village tanks, are a distinctive feature of the Dry zone of Sri Lanka. Village tanks in Sri Lanka fall mainly into the non-system type, which depend entirely on direct rainfall and run-off water from their catchment areas. As stated in the Irrigation Ordinance No. 32 of 1946, minor irrigation schemes are those that have been constructed by the proprietors, without Government aid, or with the aid of masonry works and sluices supplied free of charge by the Government, and maintained by the proprietors. Thus, any irrigation project which served less than 80 ha. (200 acres), was considered as minor, and others fell into the major category. However, the operation and maintenance of minor irrigation works is the responsibility of the Department of Agrarian Services.

This village tank system (or cascades) which still form a common phenomenon in most parts of the Dry zone, appear to be time-tested land and water management systems, with a remarkable degree of harmony with their natural environment.

The most critical aspects of water management, as it relates to the village tanks, concern the collective decisions by the community on the timing and distribution of tank-water, use and the maintenance of the tank system. The Forum for such decisions are the Kanna (season) Meetings. The Kanna Meetings are held prior to each cultivation season. These meetings are organised by the Vel Vidane, who is elected by the cultivators, for a period of three years. The Vel Vidane is entrusted with several other responsibilities, apart from organizing the Kanna Meetings. These include, operating sluices; ensuring a fair distribution of water to all fields in the command area; mobilizing farmers to repair and maintain the tank system; conflict resolution on irrigation and other related issues; reporting to the local Agrarian Service Centre; and, acting as a liaison between cultivators and the local Agrarian Services Commissioner's staff.

The emphasis in recent years has ben on major irrigation schemes. Well-planned water management systems have been established under the major irrigation schemes. The water distribution pattern is designed based on the scientific and engineering considerations, and the management of water is the responsibility of a bureaucracy.

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Figure 1

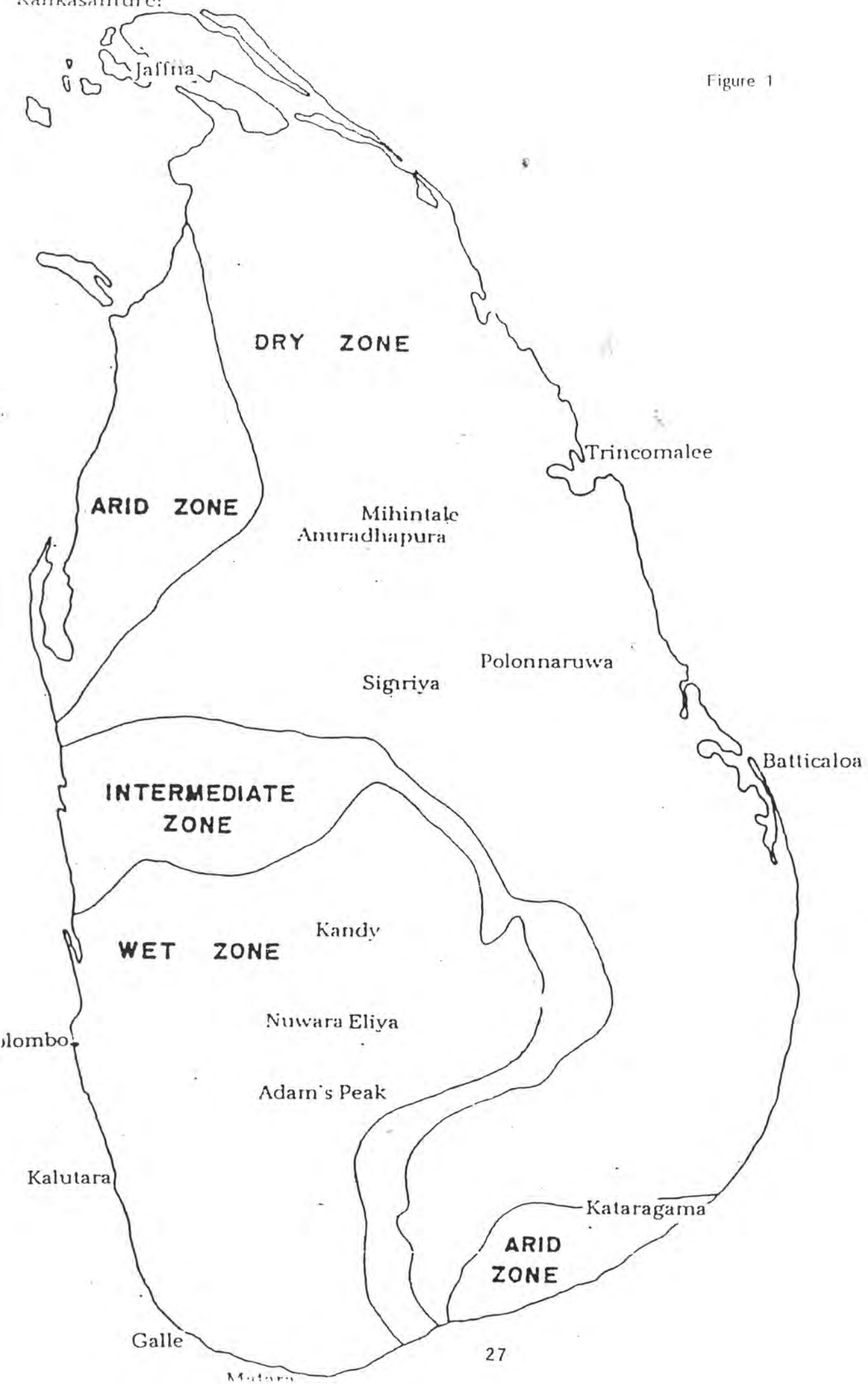
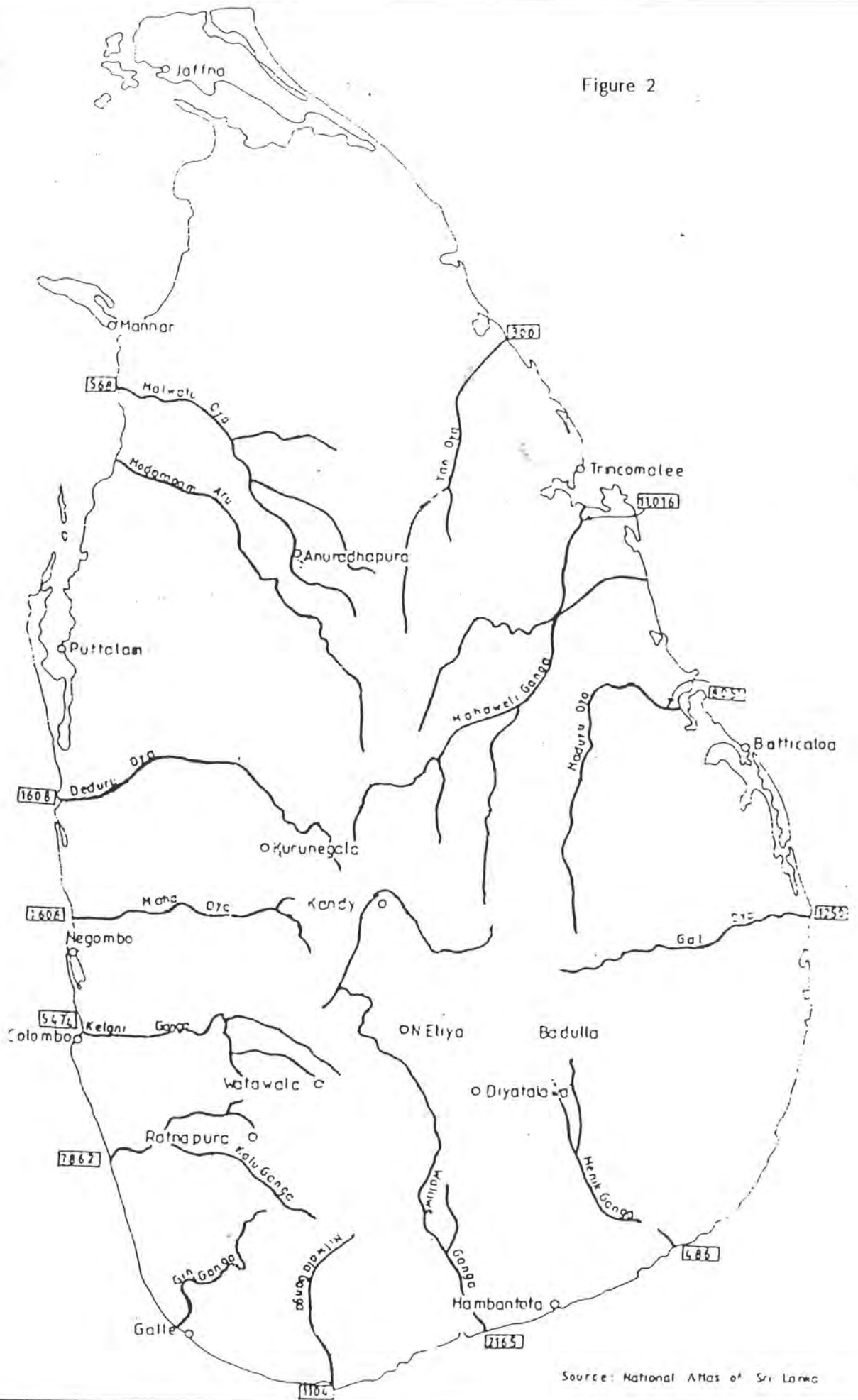


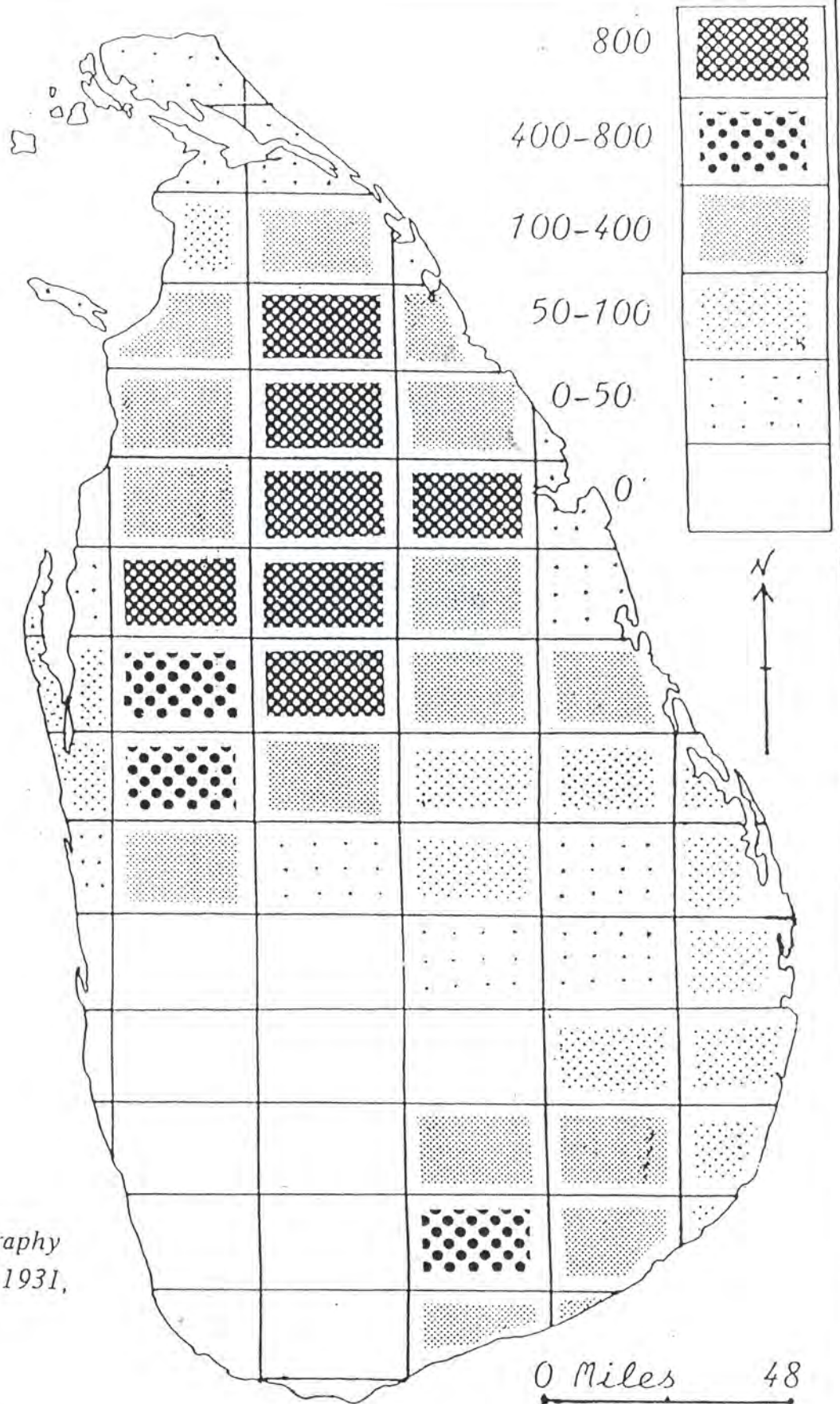
Figure 2



Source: National Atlas of Sri Lanka

Figure 3

SMALL TANKS
DISTRIBUTION



Source:
Cook, E. R.; *A Geography
of Ceylon*, London 1931,
Fig. 59, p. 149.

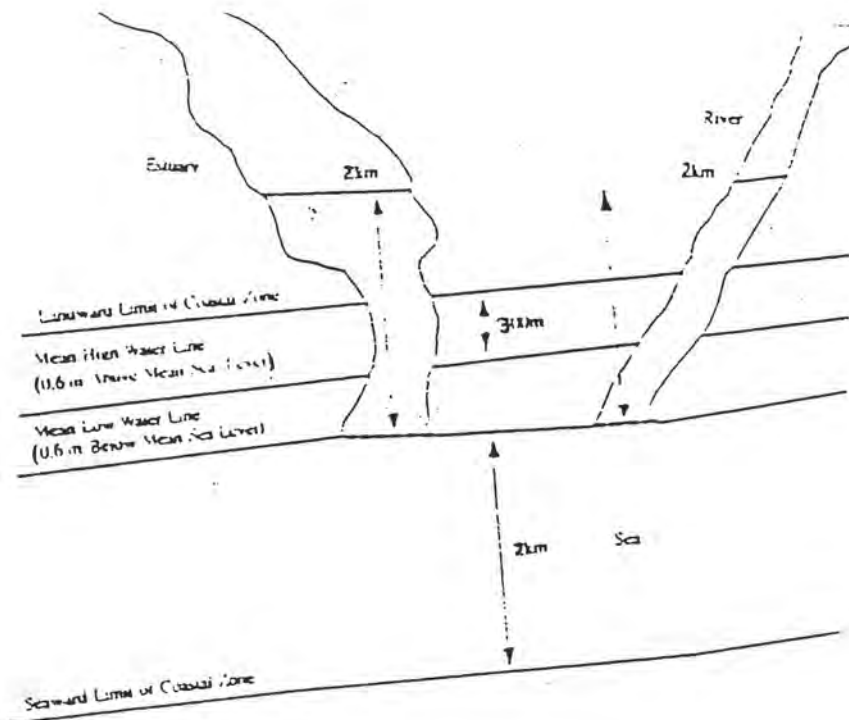
CHAPTER 4

COASTAL AND MARINE ENVIRONMENT

4.1. Introduction

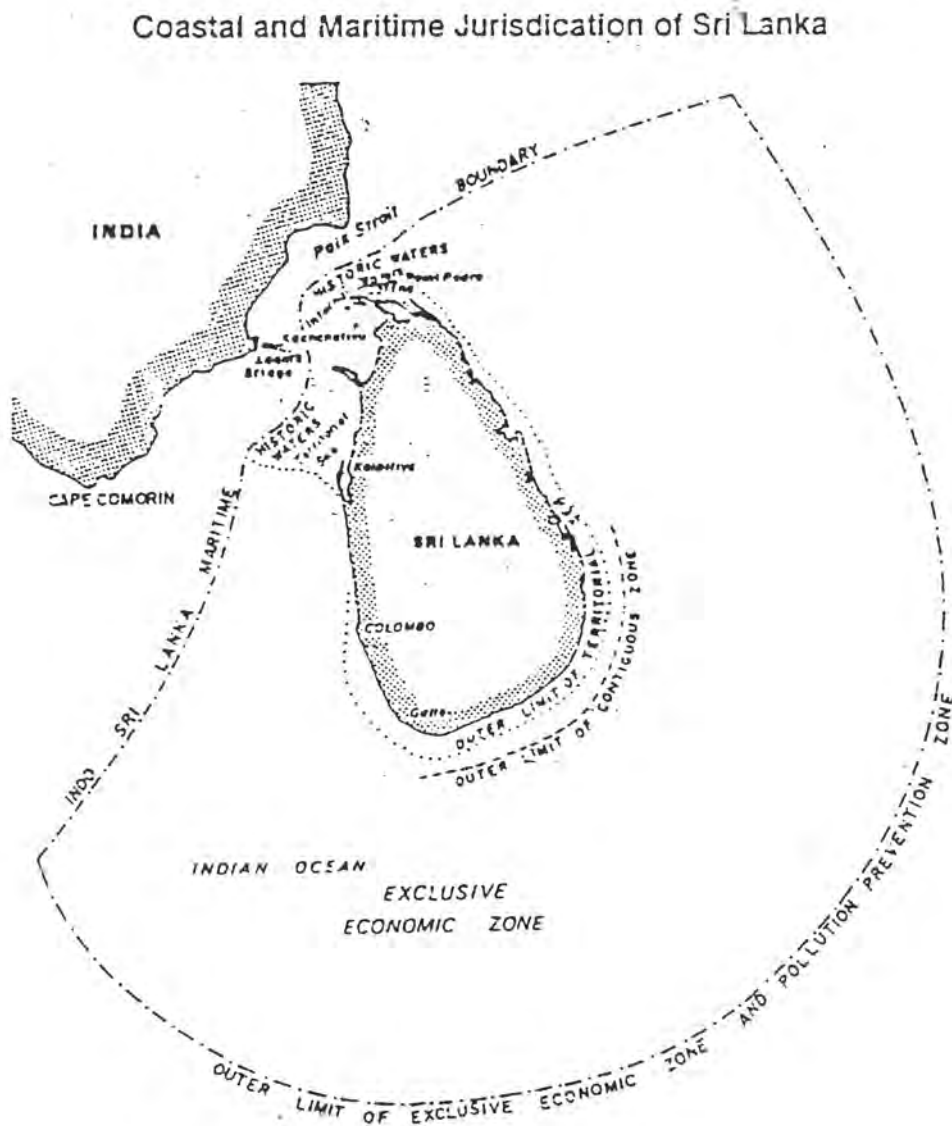
Sri Lanka has a coastline of 1,585 kilometres in length, and in the Coast Conservation Act of Sri Lanka, the "Coastal Zone", is defined as – "That area lying within a limit of three hundred metres landward of the Mean High Water Line and a limit of two kilometres seaward of the Mean Low Water Line and in the case of rivers, streams, lagoons, or any other body of water connected to the sea either permanently or periodically, the landward boundary shall extend to a limit of two kilometres measured perpendicular to the straight base line drawn between the natural entrance points thereof and shall include waters of such rivers, streams and lagoons or any other body of water so connected to the sea" (see Figure 1:1).

Figure 1:1 The Sri Lanka Coastal Zone



The coastal zone in Sri Lanka encompasses sandy beaches, extensive lagoons and estuaries, mangroves, coastal marshes, and dunes. Seaward of the coastline lie reefs of coral or sand stone and shallow beds of coastal and estuarine seagrass. Beneath and beyond extends the continental shelf. Except in the north, where it links Sri Lanka and India, this submerged plateau reaches outward to 20 kilometres, before it falls away through the continental slope to the deep seafloor. The continental shelf covers 26,000 square kilometres or half the land area of Sri Lanka. Sri Lanka's exclusive Economic Zone covers an even larger area: over 230,000 square kilometres of the ocean. (see figure 1:2).

Figure 1:2 Coastal and Maritime Jurisdiction of Sri Lanka



4.2. Coastal Zones, State and Activities

The long coastal zone of Sri Lanka is vital to the Nation's economy. Colombo and many other large towns are situated on the coast, and the population density in the coastal zone is significantly higher than inland. More than 80% of the country's industrial units are located in and around Colombo, and a higher portion of the remaining industries including Industrial Promotion Zones are situated in the coastal areas. 80% of the country's fish catch is from the sea. Mineral beach sand is an important industrial export. The tourist industry is also largely concentrated in the coastal areas, the major attraction being the sandy beaches. The three major harbours in Sri Lanka, namely, Colombo, Galle, and Trincomalee, are connected to the international shipping routes.

4.3. Protection and Management of Coastal and Marine Environment

The expanding international trade and commerce accelerated population migration to the coastal areas in Sri Lanka, over the past five centuries. Since independence in 1948, the coastal population expanded in size and economic importance particularly in the west, south and south-west. The census in 1981, recorded a population of over 5.04 million, which is 34% of the total population living in the coastal Divisional Secretariat Divisions, of whom 45% were living in the urban areas. The major economic activities in these areas are fishing, tourism, industry, and agriculture.

Fishing is the predominant economic activity providing full-time employment to about 80,000 persons, part-time employment to about 10,000 more, and indirect employment to about another 5,000, contributing to 1.9% of the Gross Domestic Production in 1988. Marine fisheries contribute to about 65% of the animal protein and 13% of the total protein consumed by the Sri Lankans. The export of fish and aquatic products drew an average 616 million Rupees in foreign exchange from 1980 to 1987. That was 2.8% of Sri Lanka's total non-traditional export earnings. Ten fishery harbours serve large fishing vessels, while most traditional vessels and smaller fibre-glass boats are landed on beaches closer to the fishing villages. The beaches are also used by fishermen to fish, mend nets, repair boats, and build temporary dwelling units.

Mangroves, coral reef and sea grasses are specialized eco-systems in the coastal and maritime regions of Sri Lanka. Mangroves are salt tolerant, woody, seed-bearing plants, occurring along the sheltered inter-tidal coast lines and in association with estuaries and lagoons. Mangroves vary in size, from shrubs to tall trees. Depending on the measurement standards and methods, mangroves are estimated to vary from 6,000 to 13,000 hectares.

According to the land use map of the Survey Department, the aerial extent of mangroves in six districts are -

District		Extent (ha)
Puttalam (West coast)	-	2,970
Batticaloa (East coast)	-	1,520
Trincomalee (North-East coast)	-	1,020
Gampaha (West coast)	-	723
Ampara (East coast)	-	54
Colombo (West coast)	-	9

Even though the Jaffna peninsula has an extensive coverage of mangroves, the extent has not been estimated recently.

Sri Lanka's low tide which rarely exceeds 75 centimetres, limits the mangroves occurring range to a narrow inter-tidal belt and extends less than a kilometre landward from the mean low tidal level. Mangroves are discontinuously distributed along the coastline, and absent altogether along exposed shorelines affected by high-wave energy. They occur mostly within the embankments and along the estuaries and lagoons.

From the 55 species of mangroves recorded world-wide, 23 species have been registered in Sri Lanka. They fall into two categories, true mangroves and mangrove associates.

The mangrove vegetation in Sri Lanka is widely harvested for subsistence and commercial operations. Species such as *Rhizophora*, *Bruguiera*, and *Avicenna*, are commonly used as firewood for domestic stoves and kilns. The same species are used in charcoal making, but at few locations. Poles from the same species are used in constructing the dwellings of the fishermen. Leaves and tender branches of these species are used as a fodder.

The coral reefs are shallow tropical water eco-systems that rank among the world's most biologically diverse and productive natural resources, and can be considered as the most conspicuous shallow water marine habitat in Sri Lanka. They are spectacular for their colour and the diversity of species they support. In the three major reef types, namely, coral reefs, sandstone reefs, and boulder reefs, 171 species of stony corals have been recorded. The Coral reefs are found mainly as fringing reefs, except for reefs on the continental shelf, off the north-western coast.

The open ocean near coral reefs provide most of the catch for the demersal fisheries industry, and huge quantities of fish and invertebrates for the marine trade. The coral reefs act as natural breakwaters, reducing coastal erosion, and offer unsurpassed recreational, educational, and research opportunities.

Coral mining for manufacturing lime for the building industry is the cause of most of the destruction of coral reefs in Sri Lanka. Physically damaging fishing methods, such as fishing with explosives, and trammel netting, also destroy coral reefs.

Careless glass-bottomed boats, anchor chains, collection and sale of souvenirs, extraction of coral sand, and the clearing of coral reefs for the passage of boats, could be ranked as the other major threats to coral reefs.

Sea grasses also support highly productive fisheries. A major portion of the marine fish catch is from the north-western and north-eastern coasts, where the sea grass beds abound. Also the sea grasses bind sediments and stabilize the bottom against erosion, and provide a habitat for the dugong and protected sea-turtles, as also providing food for several marine organisms.

More than 75% of the coastline of Sri Lanka is beach-fringed, covering an estimated 11,800 hectares. Most beaches are sandy, but they vary greatly in width and slope. Some barrier beaches lie across lagoons or marshes, and isolate them from the sea. At some other places, incipient barrier beaches form spits that are free at one end. Barrier beaches predominate along the south-western and southern coasts, with spits more common in the west and the east. Spits shift positions regularly, and change the location of estuary inlets.

Dunes are wind blown accumulations of sand that remain unstable unless covered by vegetation. Prominent sand dunes lie along the north-eastern, north-western, and south-western coasts.

Distinctive communities of plants inhabit the beach and dune systems. This vegetation promotes accretion, binds sediments, provides moderate protection against coastal erosion, and helps to reduce transport of sand by wind.

4.4. Pressures on the Marine Environment

The major sources of pollution of marine and coastal environment are: oil pollution from shipping and shipping crafts, discharge of industrial effluents, and discharge of sewage and domestic waste. A major international shipping route about eight kilometres away from the southern and south-western coasts of Sri Lanka, carries an estimated annual traffic of over 5,000 tankers, posing risks of an accidental oil spill. Clearing of oil tanks in and around ports, causes minor discharges that account for frequent tar-balls on the south-western beach.

The temporary housing settlements and hotels that illegally discharge raw sewage, contribute significantly to the faecal pollution of beaches and coastal waters.

The coastal and inland industries contribute chemical, heavy metal, and organic pollutants. The paper and sugar factories, tanneries, and industrial estates, are the major contributors of chemical pollution.

4.5. Impact of Climate Change and Sea-Level Rise

The impacts of possible sea-level rise due to climate change is of primary concern in view of the high population density and intensity of development in the coastal areas, especially the western and south-western coasts. Inundation, erosion, flooding of coastal areas, and salt water intrusion and other impacts on the quality of water, would be of particular concern.

The most evident impact of sea-level rise is the inundation. A major portion of the coastline of Sri Lanka is backed by estuaries, lagoons and other wetlands. The coastal fisheries in Sri Lanka, depend immensely upon the productivity of the coastal wetlands. The changes in the extent of wetlands, and in the salinity regime of estuaries, would significantly affect coastal fisheries. Inundation would also pose a considerable threat to the infra-structure and communication facilities along the coast affecting the tourism trade, in addition to the local communities.

On an average, a one metre rise in sea-level, would cause shores to erode 50–200 metres of the sandy beaches. Even at present, coastal erosion is a critical problem in certain areas.

Sea-level rise increases the risk of flooding in four ways, namely, by destroying beaches and sand dunes, the protective effect that they now have on the coast will be removed leaving many coastal areas vulnerable; loss of mangroves and salt marsh areas will lead to increased coastal flooding; Sea-level rise would cause an increase in flooding from rainstorms and river surges, due to decreased drainage; and, there will be an increase in the magnitude of storm surges.

Salt water intrusion is of particular concern in Sri Lanka, because the water-supply intake to the City of Colombo is located only 7 kilometres upstream in the Kelani river. Salt water intrusion will also result in – the increased salinity of ground water, the impaired effectiveness of septic tanks and adverse effects on coastal agriculture.

4.6. Other Marine Resources

Fishery is an important marine resource in Sri Lanka. For management purposes, marine fish resources are classified as coastal (within 40 kms of the coast), off-shore (40–100 kms), and deep sea (beyond 100kms).

Coastal fisheries provide upto 97% of the marine fish production, and employment to about 90% of the coastal population. The peak production recorded in 1983 was 184,049 tons. The areas of the highest fish concentrations are found inside or close to the continental slope. It is estimated

that the annual sustainable yield of coastal fisheries is 250,000 tons, of which, two-thirds are pelagic species, while the balance are demersal and semi-demersal species.

4.7. Conclusion

Coral mining, operation of lime kilns, the possession of coral within the coastal zone, sand mining, marine and coastal environmental pollution, etc., are prohibited activities under various Acts of Law. Restricted enforcement began in 1990, and since then several cases have been filed in the Courts of Law. The deficiency of resources to execute the existing legal provisions to regulate these human activities that lead to resource degradation, is a major concern in coastal resources management.

The population swell has led to an immense density of dwellings in the coastal zone. Some of these settlements are located in erosion prone or otherwise distinctly vulnerable areas. Several vulnerable coastal stretches are heavily populated with people living in temporary structures built almost at the edge of the beach, by encroachments on State lands. A re-location programme has to be seriously contemplated, as it has a critical bearing on both the social and environmental aspects.

The coastal inhabitants depending on the maritime and coastal resources in Sri Lanka, are among the impoverished members of the community. Despite their understanding of the value of these resources, they are compelled by poverty to exploit these resources to meet their essential needs. Therefore, the approaches to conserve the coastal and marine environment as any other natural resource, must be integrated with a poverty alleviation programme, providing the opportunities for alternate sources of income for those dependent populations.

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CHAPTER 5

ATMOSPHERE AND CLIMATE

5.1. Introduction

Sri Lanka is a tropical island lying between the latitudes of 5°55' N and 9°49'N, and the longitudes 79°42'E and 81°52'E. It has a land area of 65,610 sq.kms, and a shore-line of 1585 kms. The topography comprises central hills with a maximum elevation of 2700m. surrounded by a broad lowland peneplane at an average elevation of 75m. Both the temperature distribution and the rain-fall pattern are characteristic of the particular nature of the topography.

5.2. Climate

- Atmosphere

The atmosphere over Sri Lanka has the same features as that of a typical country in the tropical belt. The average sea-level pressure is 1010 mbar. The average cloud cover over the country varies between 4 octas in March and 6.4 octas in July. The relative humidity varies generally from 70% during the day to 90% at night in the south-west and central parts of the country. In the north-west and south-east regions, the day-time humidity drops to about 60%.

- Temperature

The mean annual temperature (mat) in the lowlands is around 27°C with a daily range of 6°C. In the central hills at an altitude of over 2000m, the 'mat' is around 15°C with a daily range of 10°C. The northern coastal belt experiences the highest 'mat' of over 27.5°C. The mean daily temperature over the island has a range between 9°C and 34°C (1).

- Winds

Westerly winds prevail over the island from May to September. The winds at mean sea-level are from the south-west and this season is known as the South-West Monsoon (SWM) season. During December to February, easterly winds blow across the island, with winds at mean sea-level tending to be north-easterly. This period is hence known as the North-East Monsoon (NEM) season. The two intermediate periods, March-April and October-November are referred to as inter-monsoon periods. During these periods, the south-westerly winds from the southern hemisphere and the north-easterly winds from the northern hemisphere converge over the island generating large scale convective activity and heavy rains (2).

- Rainfall

The annual rainfall in Sri Lanka varies between 900 mm and 6000 mm. The island is divided into two main zones, the Wet Zone and the Dry Zone according to the distribution of annual rainfall. The Wet Zone, which covers the south-western plains and the central hills receives on an average, an annual rainfall exceeding 2500 mm, while the Dry Zone, which covers the north and eastern plains, receives rainfall below 2000 mm annually. The transition area receiving rainfall in the range of 2000-2500 mm is known as the Intermediate Zone. However, there have been deviations from this general pattern quite often. The maximum rainfall (over 5000 mm), is experienced on the western slopes of the central hills, while the minimum (below 1000 mm), is experienced at the north-western and south-eastern extremes of the island. The seasonal distribution of rainfall is influenced by two wind regimes, the SWM experienced from May to September, and the NEM experienced from December to February. The SWM brings rain mostly to the Wet Zone, while the NEM brings rain to the Dry Zone. During the two inter-monsoonal periods, March-April and October-November, convectonal rainfall is received, which are fairly widespread.

5.3. Air Pollution

- Measurements

Measurement of ambient air quality in Sri Lanka, has not been carried out on a regular systematic basis. Some short term measurements have been carried out, in and around the City of Colombo, which indicate that the transport sector causes the largest amount of air pollution in urban areas. Suspended Particulate Matter (SPM), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), and Lead (Pb), concentrations are above or close to the World Health Organisation (WHO) guidelines. The SPM, NO_2 , SO_2 , and Pb have the highest concentrations in the descending order of magnitude (3).

The National Building Research Organisation (NBRO), has carried out a preliminary assessment of air quality within the Colombo City, during the period 1989-91. The principal parameters selected were the Sulphation rate (SR), and Dust Fall (DF), which gave an indication of the level of total sulphur and dust, respectively present in ambient air (4). The average values of SR showed a variation between 3 and 45 $\text{mg/m}^2/\text{day}$, the lowest being in a residential area, while the highest was at a busy traffic intersection. Of the 49 locations monitored, 42 had average values less than 20 $\text{mg/m}^2/\text{day}$, which was considered the maximum permissible level. The DF average varied between 130-800 $\text{mg/m}^2/\text{day}$. The distribution in 27 locations had values below 300 $\text{mg/m}^2/\text{day}$, which was the maximum permissible value taken.

The Ceylon Institute of Scientific and Industrial Research (CISIR), has carried out measurement of CO and Total Hydro-Carbon (THC) levels in the City of Colombo, over a period of one year. Their measurements show that CO levels reach a maximum value of 4800 $\mu\text{g/m}^3$, and THC reach a level of 4 ppm at major traffic intersections (5).

- Forecasting

Air pollutants such as CO, SO_2 , NO_x , and HC are emitted during combustion of petroleum products and biomass. In Sri Lanka, almost 100% of the gasoline and 90% of diesel are consumed by the transport sector. Gasoline contains about 0.3 g of lead per litre, while diesel contains about 0.5-1.0% by weight of sulphur (6). These contribute to the presence of lead and SO_2 in the air, respectively. In addition, sulphur containing heavy diesel, furnace oil, and residual oil are used in operating electricity generating plants, by the Ceylon Electricity Board. These are operated only to supplement hydro-power plants. During the period 1987-92, their contribution has been ranging between 0.2% and 20%. The current levels of emissions from petroleum combustion in various sectors are given in Table 5.1 (6). It is anticipated that in future, both electricity generation by thermal power plants and operation of vehicles will grow, resulting in increased emission of polluting gases. The details of their contribution to air pollution will be discussed in the relevant chapters.

5.4. Global Warming and Climate Change

- Greenhouse Effect

The Earth maintains its present level of mean global temperature so as to bring about a balance between the radiation it receives from the sun, and the radiation it emits into the outer space. The former is in the form of ultra-violet, visible and near infra-red radiation, while the latter is in the form of long wave far infra-red radiation. There are certain trace gases in the atmosphere which are transparent to the former, but absorb the latter. Among these gases, the most

important one is Carbon Dioxide (CO_2). The next is Methane (CH_4), followed by Nitrous Oxide (N_2O), and Chloro-Fluoro-Carbons (CFCs).

The phenomena of trapping terrestrial long wave radiation, while permitting transmission of solar short-wave radiation, takes place within greenhouses which are used in temperate regions, for growing food crops during cold seasons. Because of the analogy of this phenomena, with the warming of the atmosphere, due to trapping of terrestrial infra-red radiation by certain gases present in it, the latter is known as the Greenhouse Effect, and the gases responsible are referred to as Greenhouse Gases (GHG). The amount of radiation emitted by the Earth, is a function of its average temperature. When some of this radiation is trapped within the terrestrial system, in order to maintain the balance between the incoming and outgoing radiations, the Earth's average temperature will have to increase. Had the GHG not been present in the atmosphere, the Earth's average temperature would have been about 33% less than what it is today, and it would not have been possible to sustain animal or human life on it. While the GH effect is considered a necessity, what poses a problem is an enhancement of GH warming, due to increasing amounts of GHG emitted to the atmosphere.

- Global Warming

By analysing air bubbles trapped in the deep ice in the Arctic, the concentrations of both CO_2 and CH_4 , were found to have increased from the turn of this century (7). According to data given in Table 5.2, the concentration of CO_2 has increased at the rate of 0.5% per year during the past few decades, while CH_4 and N_2O have increased by factors 0.9% and 0.25%, respectively. The concentrations of CFCs which are recently introduced industrial gases, are found to increase at the rate of 4% in respect of their two main components CFC 11 and CFC 12.

The increase in GHG concentration during this century has caused an enhanced warming of the Earth amounting to about 0.5°C in the average surface temperature. According to climate model calculations, the Earth's average surface temperature is expected to increase by an amount in the range of 1.5°C to 4.5°C , with a best guess of 2.5°C , corresponding to a doubling of CO_2 concentration (7). If the current trend continues (business as usual scenario), this situation is expected to take place in about 70 years. Though this appears to be a small variation, when it occurs in the average global temperature, it is significant as evident from past history. Over the last 7000 years or so, the Earth's average temperature has remained constant to within $\pm 1^\circ\text{C}$.

- Sources of Greenhouse Gases

The annual GHG emissions estimated for Sri Lanka, using IPCC Guidelines, are given in Table 5.3 (9).

- Carbon Dioxide Emissions

The rapid industrialisation that has taken place in the western world has contributed mostly to a Carbon Dioxide concentration in the atmosphere. Out of a total estimated emission of 21.86 Pg/year for Carbon Dioxide emitted from fossil fuel burning and industry, North America and Europe emit 44%, while South Asia emits only 3.35% (8). These emissions do not however account for Carbon Dioxide emitted from biomass burning, which is the main source of energy in the developing countries, including Sri Lanka. The emission of Carbon Dioxide from fossil fuel burning and the cement industry in Sri Lanka for 1990, has been 4.07 Gg, which is 0.02% of the world emission. The total emission of Carbon Dioxide, including biomass burning and forest clearing is estimated to be 17.7 Tg (9). The highest per capita CO_2 emission excluding the biomass component, is found in the USA, which is 19.7 t/year. The world average is 4.2 t/y, while for Sri Lanka it is only 0.23 t/year (8).

- Methane emission

The emission of Methane from paddy fields is an important source in Asia, which accounts for 90% of all paddy cultivated in the world. A recent study has shown that the contribution from paddy fields is not as high as estimated previously (10). The preliminary estimates made for Sri Lanka show that out of a total anthropogenic emission of 800 Gg of Methane, about half is produced from paddy fields (9). The balance is mainly from ruminant animals, and land filling with organic matter.

- Nitrous Oxide

The main source of this gas is forest soils, which occur when it is disturbed during forest clearing. It is also emitted as a result of application of nitrogen containing fertilizers. The total world emission is 21 ± 8 Tg (N), while Sri Lanka has contributed 0.6 Gg during 1990 (9).

- Chloro-Fluoro-Carbons and Chloro-Bromo-Carbons (Halon)

The important feature of these gases is that their global warming potential is several thousand times that for CO_2 . Hence, even a very small concentration which is of the order of a few hundred parts per trillion, could make a significant contribution to global warming. A recent survey has shown that Sri Lanka consumes about 200-240 tons of CFCs and Halons annually, which is only 0.012 kg per capita (11).

- Impact of Global Warming

A recent study funded by the Asian Development Bank (ADB), carried out in Sri Lanka, has shown that the most vulnerable area due to climate change is the sea-level rise and its consequences (12). Next is the impact on agriculture, particularly the reduction of crop yield. Among the other effects are salt water intrusion to water supply intakes, increased coastal erosion, increases in vector population and inundation of low-lying land etc.

- Response strategies

- Government Programmes

Though Sri Lanka ratified the framework Convention on Climate Change, last November, the subject of climate change is still not included in the developmental agenda of the country. However, the Government has launched several programmes which would eventually mitigate the emission of GHG or the impact of climate change or enhance GHG sinks, though such activities were not initiated with a view to address climate change. Among these are:

- (a) The National Environmental Action Plan;
- (b) The Energy Conservation Programme;
- (c) The Coastal Region Management Strategy; and
- (d) The Forestry Master Plan.

- Asian Development Bank Study

The Sri Lanka study lays emphasis on the development of options and strategies based on the principle of 'no regrets', which advocates policy initiatives that increase the prospects for economic growth, while limiting environmental damage. The key elements of such policy include measures for promoting energy efficiency and energy conservation, getting energy prices right to improve the operation of commercial energy markets, prevention of deforestation, afforestation policies to enhance the ability of the natural eco-systems to respond to the sea-level rise, and the socio-economic development of the people to enhance their ability to respond to climate change.

Reference

1. National Atlas, Survey Department, Colombo, 1990.
2. Sri Lanka Country Report on the Greenhouse Effect and Its Impact on the SAARC Region, Central Environmental Authority, Colombo, 1991.
3. Report on 'Motor Vehicle Pollution Control in Sri Lanka', National Resources and Environmental Policy Project, Colombo, 1992.
4. Report on 'Colombo Air Quality Monitoring Programme', Phase I, Environmental Division, National Building Research Organisation, Colombo, 1993.
5. Methes J A P, Internatl Report, Ceylon Institute of Scientific and Industrial Research, Colombo, 1990.
6. Report on 'Clean Air 2000 – Action Plan' for Air Quality Management in the Colombo Metropolitan Area, Metropolitan Environment Improvement Programme, Battaramulla, 1992.
7. Report on 'Scientific Assessment of Climate Change' prepared for Intergovernmental Panel on Climate Change, WMO, Geneva, 1990.
8. The World Resources Institute, World Resources 1992–93, Ed. Al Hammond, Oxford Press, New York, 1992.
9. Ratnasiri P A J, Greenhouse Gas Inventory for Sri Lanka (1990), in Proceedings of Latin American Regional Workshop for Estimating National GHG Emissions, Sao Jose dos Campos, Brazil, March 1993.
10. Mitra A P, Greenhouse Gas Emission in India, 1991 Methane Campaign, Scientific Report 2, CSIR, Delhi, 1992.
11. Sri Lanka Country Programme for Phase Out of Ozone Depleting Substances, Ministry of Environment & Parliamentary Affairs, 1994.
12. Sri Lanka Country Study under ADB–Regional Study of Global Environmental Issues Project (Draft Final Report), Marga Institute, Colombo, 1993.
13. Keeling G M, Pitts M C, and Young D F, Ozone Reference Models for the Middle Atmosphere (New CIRA), in 'Middle Atmosphere Programme (Ed. A M Keeling), SCOSTEP Secretariat, Illinois, 1990.
14. Poulton N, Action on Ozone, UNEP, 1993.

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Table 5.1

Emission from Petroleum Combustion

Pollutant	Annual emission in t				
	Transport	Industry	Energy & Comm.	Household	Total
SPM	3453	358	1.6	100	3913
SO ₂	455	9791	107	113	10467
NO _x	5928	1243	20	77	7268
HC	38364	69	0.2	13	38446
CO	199736	98	1.0	8.33	199843

Table 5.2

Greenhouse Gases in the Atmosphere

GHG	Present Concentration ('90)	Rate of annual increase
Carbon dioxide	353 ppm	0.5%
Methane	1.72 ppm	0.9%
Nitrous oxide	310 ppb	0.25%
CFC 11	280 ppt	4.0%
CFC 12	480 ppt	4.0%

Table 5.3

Source	Annual Emission Gg					
	CO ₂	CH ₄	CO	N ₂ O	NO _x	NMVOC
Forest clearing	4477	17.5	175	0.35	3.70	-
Mobile combustion (transport)	2023	0.73	69.2	0.05	17.5	13.2
Petroleum combustion (stationary)	1431	0.23	20.2	0.01	5.1	4.0
Biomass combustion	9216	10.31	1680	-	30.2	-
Cement & Lime Industry	554	-	-	-	-	-
Rice Fields	-	407	-	-	-	-
Ruminant Animals	-	188	-	-	-	-
Animal waste	-	9	-	-	-	-
Land filling	-	122	-	-	-	-
Fertilizer	-	-	-	0.15	-	-
Total	17,701	755	1944	0.56	56.5	17.2

Table 5.4

**Consumption of Ozone depleting substances
in Sri Lanka, 1990-92**

Substance	Consumption t		
	1990	1991	1992
CFC 11	46.3	39.1	34.6
CFC 12	161.7	162.4	204.8
CFC 113	1.1	1.9	0.1
CFC 115	1.0	0.6	-
Halon 1211	0.45	0.9	0.6
CCl ₄	3.9	22.4	17.6
MCF	2.0	2.0	2.0

MCF - Methyl Chloroform

CHAPTER 6

WASTES, TOXIC AND HAZARDOUS CHEMICALS

6.1. Introduction

Production and consumption inevitably create wastes and environmental emissions as by-products which pollute the soil, water bodies and air, in the absence of adequate waste disposal systems. Sufficient information with regard to the quality and quantities of wastes which are generated in Sri Lanka is not available at present. Chemical based industries tend to produce hazardous wastes. There is, at present, no legislation on the management of toxic and dangerous products, and wastes, in Sri Lanka. However, a number of laws on specific chemicals exist, notably, the Control of Pesticides Act (1980); and also the Malathion Control Act (1985); the Cosmetic Drugs and Devices Act (1980); the Fertilizer Act (1941); the Import and Export (Control) Act (1969); the Poison, Opium and Dangerous Drugs Act (1929); and, the Explosives Act (1956).

Especially during the last six years, serious attempts have been made to control industrial pollution, firstly through the 1988 amendments to the National Environmental Act (NEA) 1980, and subsequently through the development in 1990 of regulations introducing an Environmental Protection Licensing Scheme (EPLS), with specific effluent standards, and later, the imposing regulations on Environmental Impact Assessments (EIA).

6.2. Waste Production

- Municipal and Household Wastes

Perhaps the most noteworthy characteristic of solid waste is their variety. In addition to the normal household wastes, there is combustible rubbish, such as paper, cardboard, wood or leaves; large objects such as discarded furniture; appliances and bags; and recyclable items, such as, broken glass and bottles, metal and iron wastes. Household wastes do not pose a major threat to the environment of most rural areas in Sri Lanka, but, in the many urban areas, the management of domestic and other solid wastes, have become an environmental issue.

The production data of municipal and household wastes island-wide is not available. The total solid waste generation in the Colombo Metropolis, has been estimated between 700 to 800 tons per day. Wastes in most Sri Lankan cities have a high content of organic vegetable matter, which undergo rapid putrefaction, due to the climatic conditions. Large amounts of this type of wastes are generated and the costs of its disposal are on the rise.

The Colombo Municipality alone, generates 550 tons of municipal wastes daily, including 100 tons per day of market garbage. The wastes originating in the city's markets are mostly from vegetables or offal and bones from animals, birds, fish, etc. It is observed that vegetables are delivered in bulk to the markets, and the cleaning and sorting operations are carried out in the premises, resulting in a large volume of waste material.

The population and industrial growth in Colombo, and in some of the urban areas, have overwhelmed the capacity of municipal institutions and environmental regulations, in order to protect the rivers, canals, low-lying lands and marshes, adversely affecting the quantity and quality of the surface and ground water supplies, soil quality, and the flood control mechanism.

- Industrial Wastes

Industries have been classified into 9 sectors by the Central Environmental Authority (CEA), viz., Basic Metal; Chemical Industries; Food; Machinery and Equipment; Mineral Products; Paper and Pulp; Textile and Leather; Timber and Wood; and Transport. Sub-categories within various processes have been identified within these sectors, depending on the degree of pollution caused by

waste generation. Among the other industries, pesticide and other chemical manufacturing, petroleum refineries, sugar factories, distilleries and blending of alcoholic liquor, processing of mineral sands and ores, pulp and paper manufacturing, textile mills involved in bleaching, dyeing and printing, tanneries and leather finishing, iron and steel industries, paint and varnish manufacturing, pharmaceutical, soap and detergents, and rubber processing, are considered to be highly polluting.

There are no reliable data in terms of quantities or quality of industrial wastes island-wide. This is mainly because, industries claim lack of knowledge about their effluents, emissions and wastes, or, are unwilling to pass on such information. However, immediately prior to the promulgation of the EPLS regulations, it was estimated by the CEA, that the number of industries requiring licences in 1989 was 7610, of which 39.47% were classified as non-polluting, 31.73% as of low pollution potential, 24.97% as of medium pollution potential, and 3.82% as of high polluting potential.

- Hazardous Wastes

At present, Sri Lanka is working on the formulation of a National Definition of Hazardous Wastes. The current definition (Section 23Z of the National Environmental Act), i.e., "any waste which has toxic, corrosive, flammable, radioactive or infectious characteristics", is inadequate in that it uses many terms that require further definition.

There is little information available about hazardous wastes generated in the country. These have been partially estimated in 1991, by a team from the Ceylon Institute of Scientific and Industrial Research (CISIR), in association with the CEA and the Colombo Municipal Council (CMC), which focused on hazardous wastes produced and subsequently deposited off-site (vide Annex 1). However, according to the Environment Resources Management (ERM), the volume of hazardous wastes generated in Sri Lanka, would be higher than the estimation made by CISIR/CEA/CMC, especially with regard to solvent wastes, oils and organic wastes, including pesticides, phenols, and paints. (The pesticide wastes in Sri Lanka, as estimated by the CEA is given in Annex 2).

However, the hazardous wastes generated in Sri Lanka are minimal compared with those generated in industrialised countries.

6.3. Waste Disposal

- Disposal of Municipal Wastes and Household Wastes

According to a recent study, nearly 90% of the solid wastes generated by the Colombo Municipality is collected, but the percentage of the collection in some other municipalities and urban council areas is much lower, ranging between 36% and 52%. In the areas of some of the smaller urban authorities, the percentage of collection is as low as 5%.

The most common waste disposal in Sri Lanka is open dump, as the operation is simple and inexpensive. In some instances the communities set fire to the waste, to reduce the total volume or to curtail the ill-effects on the neighbourhood. There are several landfills (claimed to be sanitary landfills), in which each layer of waste is covered with soil or gravel. But, these do not meet the criteria of sanitary landfills, and, in practice, the distinction between these and the open dumps is not always sharp, since the thin earth layers may be ineffective to mitigate pollution, and moreover, the system may not be conducive to bio-degradation. Some institutions use simple incinerators to dispose their wastes.

The informal sector had been very effective and cost-efficient in the collection of paper, glass, metal and iron, as there had been a market for re-use and re-cycling. But recent developments have undermined the market, and the informal collection system is no longer functioning effectively. The system needs to be revitalised by way of introducing incentives and subsidies, to make collection and recycling economically viable.

– Disposal of Industrial Wastes

Most of the industrial wastes in Sri Lanka undergo little or no treatment before discharge. A few of the industrial estates are equipped with treatment plants, but many are not. Moreover, most industries are not in industrial estates, and have virtually no waste treatment facilities. Some times solvent wastes are reduced by evaporation, followed by residues being discharged into lands or into waterways, through drains or soakaway. Combustible solid waste has generally been disposed of by burning on site, occasionally in low technology simple fixed hearth incinerators with limited or no control facilities. Industries in declared industrial zones are often permitted to dump solid wastes at selected dump sites. A few industries are equipped with appropriate end of pipe treatment facilities, but most industries require at least an additional stage of treatment to ensure compliance with existing standards. At present two model industrial estates with common waste treatment plants are being developed.

6.4. Transboundary Movements of Wastes

As mentioned earlier, there is no legislation governing the management of wastes in Sri Lanka, apart from laws relating to certain specific categories of chemicals.

Sri Lanka ratified the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal in August 1992. The Ministry of Environment and Parliamentary Affairs (MEPA) acts as the focal point, and the Central Environmental Authority acts as the Competent Authority to the Convention.

MEPA has established a coordinating committee for the implementation of the Basel Convention with representatives of the relevant organisations in the country. Among the matters this committee is working on, is defining hazardous wastes and recommendations regarding formulating national legislation to back up the Basel Convention.

6.5. Old Landfill Sites and Remedial Actions

Most landfill sites in Sri Lanka are not adequately designed or controlled with due regard to environmental factors. It is only recently that attempts have been made to adopt more technically sophisticated landfills in combination with effective management systems. A properly engineered landfill site for the waste disposal of the Colombo Municipal Council is being designed, with provisions for hazardous waste disposal, by the Metropolitan Environmental Improvement Project, with World Bank assistance. If successful, this would be a model for the other urban areas.

5.6. Recovery, Recycling and Waste Prevention

– Recyclable Waste

Waste prevention is most desirable but not always possible. When generation of wastes is inevitable, the most favourable option to manage it is through recovery, recycling and re-use. The recovery, recycling and re-use options depend on the nature of the waste, the available technology, the economic and ecological factors. These options reduce the amount of wastes for final disposal.

- Recovery and Recycling Activities for Municipal and Domestic Wastes

The municipal solid waste is predominantly organic in nature (approximately 85%), coupled with high moisture content, which makes it unsuitable for incineration. The organic character makes these wastes ideally suited for composting, which eventually reduces the wasteload on landfills. At present research is being carried out, to use market garbage (100 tons per day) generated by the Colombo Municipal Council to produce bio-gas and compost manure. Market research for these products is also being carried out. If successful, this would be a model for organic waste disposal in other areas. In the rural areas of Sri Lanka, domestic organic waste has not yet become a serious problem, as the people in these areas are re-using or recycling much of these wastes by traditional methods, but there are some problems regarding the management of bulky items such as paddy straw and paddy husk.

In urban areas, the potential to recover/recycle/re-use waste paper, glass and metal cannot be fully tapped without introducing pre-sorting at point source. Pre-sorting is also necessary in respect of used plastics, but, in this case, it is mainly to exclude rather than to recycle, since these are mostly contaminated, largely non re-usable and non bio-degradable. Most of the present landfills are choked with used plastics and plastic bags, which hinder the bio-degradation of other items in the landfill.

- Recovery and recycling Activities for Industrial Waste

Many wastes generated by industry are suitable for recovery, recycling and re-use. Waste oils, solvents, and electro-plating wastes are among the most common of those wastes in Sri Lanka, which are suited for resource recovery.

Solvent wastes are often ideal for on-site recovery requiring relatively low-investment and small space requirements. Recovery would be easier and more economical in the centralised treatment system so that the final disposal load can be further minimised by waste exchanging. At present some of the industrial wastes are collected by third parties for various purposes.

6.7. Anticipatory and Integrative Policies for the Management of Wastes

The future waste management practices in Sri Lanka would be focused on waste minimization, recovery, recycling and re-use technologies and practices.

The need for an industrial pollution management strategy has been identified as a high priority need by the Integrated Management Strategy (IMS) developed by the Urban Development Authority. The basis of this strategy is source management control or waste minimization. The Government has made a policy decision to establish all high and medium polluting industries, in industrial estates with the required waste treatment facilities. In the area of waste minimization the Government is in the process of developing a national waste minimization programme.

The need for a regional approach to waste management has also been recognized. Attempts are also being made at present to explore the possibilities to get private sector involvement in waste management.

6.8. Conclusion

The adverse environmental impacts of hazardous wastes and toxic chemicals can be mitigated by using effective waste management strategies which eventually will lead not only to a better environment, but also to cost savings in the manufacturing processes, as well as waste disposal systems. Ongoing development activities with Environmental education and awareness creation islandwide are needed to create public support, properly formulated and articulated environmental laws will help to induce the adoption of waste minimization practices, technical research and development will make it feasible for industry to incorporate waste prevention, recovery, recycling and re-use technologies into their manufacturing processes.

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ISIC Code Description	C1 Food Beverage Tobacco	C2 Textile Footwear Leather	C3 Wood Wood Products	C4 Paper Printing	C5 Chemicals Petroleum	C7 Basic Metals Products	C8 Metal Fabrication Products	C6&C9 Non Metallic Products	D Services Utilities	TOTALS
Employees (x100)	95	100	30	40	40	25	20	10	50	410,000
Acid/Alkali Wastes (x10 ³)	227	2000	10	1.0	36	46	5	10	20	2,346
Corrosives Oxidisers Reducers	5	1000	55	50	20	20	--	--	5	1,155
Solvents & Resins	--	100	10	5	5	4	1	2	--	127
Oils (non-PCBs)	10	10	15	5	20	20	20	10	40	150
Organic chemicals Pests, Phenols, Paints	5	10	4	2	10	--	5	5	2	43
PCBs	--	--	1	--	1	--	--	--	2	4
Metallic residues sludges, salts	10	100	5	20	50	10	15	50	20	280
Cyanides	--	--	--	--	--	--	10	--	--	10

Cont'd.....1

ISIC Code Description	C1 Food Beverage Tobacco	C2 Textile Footwear Leather	C3 Wood Wood Products	C4 Paper Printing	C5 Chemicals Petroleum	C7 Basic Metals Products	C8 Metal Fabrication Products	C6&C9 Non Metallic Products	D Services Utilities	TOTALS
Inorganic chemicals Salts, Residues	10	120	100	--	20	10	5	30	40	240
Contaminated Soil Equipment	10	100	10	5	25	5	20	15	50	240

¹The unit of measure in this table reproduced from the CISIR/CEA/CMC paper is cubic meters per annum except in the case of acids and alkalis where the unit is 1000 cubic meters per annum (Ref. Consulting Services for Strategy, Guidelines and Institutional Strengthening for Industrial Pollution Management; Component A - Stage A2, Identification of Alternative Strategies - Volume 1 -Main Text November 1993 - by Environmental Resources Management (ERM) - London.

Waste Type	Quantity Generated per annum
Empty steel drums (200 litre)	6,000 - 7,000
Outdated Pesticides	
* Liquid	600 - 800 kg
* Solid	1,000 kg
Packing material (includes cardboard, polythene, cans, etc)	8,000 kg

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Source: CEA

²Ref. Consulting Services for Strategy, Guidelines and Institutional Strengthening for Industrial Pollution Management; Part A - Stage A2, Identification of Alternative Strategies - Volume 1, October - November 1993 - by Environmental Resources Management (ERM) - Ltd

CHAPTER 7

NATURAL DISASTERS

7.1. Introduction

A natural disaster could be defined as an event or series of events which seriously disrupt the normal activities of people. In other words, it is a function of both a physical event and the state of the human society. It is an outcome of the interaction of one or several extreme physical events and vulnerable human population.

The United Nations defines a Natural Disaster as "the impact of a natural event upon a vulnerable community resulting in disruption, damage and casualties, which cannot be relieved by the united capacity of locally mobilized resources". However, disasters are not natural hazards, but disasters happen when a natural hazard occurs where there are vulnerable communities. Sri Lanka is a disaster prone developing country. Due to the absence of major calamities, disaster management did not receive adequate consideration in the past. However, during the past ten years, in Sri Lanka, the occurrences of natural disasters were intense.

Although there were no significant geological or climatological changes that had taken place during the last few decades in the world, the vulnerability to natural events has increased dramatically, particularly, in poor countries due to changes in the natural environment, through excessive exploitation of natural resources.

Therefore, the impact of natural disasters has become devastating. Some hazards look like natural, for instance, floods due to torrential rain. Yet human activities such as deforestation, use of marginal land, encroachment of catchment areas of rivers, destruction of water-sheds etc., can make changes in hydrology, causing intense floods and severe drought.

7.2. Land Related Natural Disasters

Sri Lanka is fortunate, in that it does not experience volcanic eruptions, and hardly any significant damage is reported as a result of earthquakes. However, floods, landslides, excessive soil erosion and coastal erosions are becoming serious issues in Sri Lanka. Very often, most of these extreme natural events occur together. For instance, severe cyclone storms are followed by heavy rain, causing floods, landslides, inland and coastal soil erosion, coastal flooding etc.

- Landslides

There is a sharp increase in land slide occurrences in the recent years, in many parts of the central hill country. The National Buildings Research Organisation's survey in 1986, revealed that the districts in the hill country are prone to landslides (at least 10,000 sq. km are considered vulnerable). The landslides cause very severe destructions to life and property. Some villages were buried in a matter of minutes.

The major reason for the increase in the occurrence of landslides, is the unplanned land use, due to the vast increase in population. The other contributing factors are excessive precipitation and the intensity of the rainfall, clearing of hill slopes for various developmental activities, irrigation reservoirs and channels, deforestation etc. Generally, landslides do occur during the two monsoon periods. Hence, regular attempts have to be made for the prevention of landslides, and other related disasters such as floods.

7.3. Forest Fires

Human intervention, such as graziers set fires to eliminate dead grass to improve pastures, chena cultivators set fires to clear land for cultivation, and hunters set fires to get animals moving, are the main reasons for forest fires, in Sri Lanka, rather than natural causes.

Table 7.1. Forest Fires in Sri Lanka

Year	No. of fires reported	Total surface burned
1979	30	112 ha
1980	76	701 ha
1981	28	189 ha
1982	31	269 ha
1983	135	1928 ha
1988	120	225 ha
1989	115	200 ha
1990	140	375 ha
1991	125	298 ha

However, losses due to forest fires are minimal, when compared to the damage caused by deforestation. Another reason is the climate of Sri Lanka, which makes regeneration of vegetation easy and fast, after a fire. Although the probability of the danger of forest fire is small, and shows a stable level, with the increasing demands for land and the spreading of plantations, the danger of forest fires are likely to increase.

7.4. Inland Water Related Natural Disasters

- Floods

Floods are a frequent phenomena in Sri Lanka. It can be extensive or partial. Invariably, during the two monsoon and depressional periods, due to excessive rain, many parts of the country experienced major floods. Even during the inter-monsoon period, a number of minor floods do occur in various parts of the island. The floods are always devastating; floods not only causes loss of lives, land and property, but also destroys the livelihood of the peasants particularly. As Sri Lanka is basically an agricultural country, the damage caused by floods is tremendous.

- Drought

The concept of drought varies depending on the location. However, it is generally, identified as insufficiency and failure of rainfall and unavailability of ground water. Drought increases with the destruction of vegetation cover and harmful interference with nature. Sri Lanka is broadly classified into four zones based on annual precipitation.

Arid zone	(below 1000 mm)
Dry zone	(1000-1900 mm)
Intermediate zone	(1900-2500 mm)
Wet zone	(above 2500 mm)

Severe drought occurred during the years 1947-49, 1953-56, 1965, 1974-77, 1981-83, and 1992. During the last decade (1981-1990), the Government has spent Rs. 374 million on drought relief activities.

7.5. Climatic and Meteorological Disasters

- Tropical Storms and Cyclones

Every year cyclones and depressions do form in the Bay of Bengal and Arabian Sea area. These influence the Sri Lanka weather directly or indirectly, often creating disaster situations. Based on past experience, at least two tropical cyclones form in the North Indian Ocean, per year. The number had been as high as nine (9), in the year 1966. The frequency of formation of cyclones in this area is highly seasonal, mainly during May-June and October-December. The following table shows the number of storms formed in the Bay of Bengal and the Arabian Sea.

Table 7.2. Storms and Cyclonic Storms affecting Sri Lanka

Decade	All Storms in Bay of Bengal and Arabian Sea	No. of Storms reached Sri Lanka East Coast
1951-60	41	0
1961-70	43	3 (1964, '66, '67)
1971-80	64	1 (1978)
1981-90	86	0

Source: Indian Meteorological Department Atlas (1979); Sri Lanka Meteorological Department data.

Out of the 12 cyclonic storms that reached the east coast of Sri Lanka during the last century (1881-1980), 10 have been recorded as having occurred in the November-December period. Of these 12 cyclonic storms, 4 were severe (1907, 1922, 1964 and 1978). The most devastating one was that of 1978, when 915 human lives were lost. In addition, houses and properties were destroyed, and thousands rendered homeless, while some victims were partially or permanently disabled. The vegetation in the affected area was also lost.

7.6. Marine Environment related Natural Disasters

The island of Sri Lanka claims a coastline of 1,585 kms, facing the infinite ocean. During the monsoon period, storm surges cause serious damage to coastal areas, especially in the Western and South-Western stretches. The tropical storms generally cause flash floods, due to the upsurge of sea water up-stream. This also generates waves with high energy, which erodes the beaches. The beaches and sand dunes are washed away attributed to wave scour, as the sea level near the shore rises.

Coastal erosion has become a serious problem in Sri Lanka, especially along the Western and South-Western coast. It not only causes significant damage to property, but also disrupts the fishing, navigation, recreation and other coast based activities, and destroys mangroves, coastal lagoons etc., causing floods inland. As both the highway and railway tracks are on or near these coastal sectors, and as these two areas are thickly populated, damage caused by coastal erosion is tremendous. It is estimated that 175,000-285,000 sq. metres of coastal land is lost annually.

Coastal erosion is becoming a serious threat to the tourist industry. Most of the hotels (more than 75%), are built near the beaches. Due to coastal erosion, most of these buildings have been

destroyed and tourists have been deprived of sunny beaches. Also, heavy expenditure has to be incurred to protect the Southern railway and highway.

7.7. Prevention, Mitigation and Management of Natural Disasters

The effects of disasters are varies. These could be listed as –

1. Deaths;
2. Injury and other health hazards;
3. Loss of livelihood and disruption of life in the community;
4. Damage and destruction of property and agricultural land;
5. Damage and destruction of subsistence and cash crops;
6. Disruption and dislocation of services;
7. Damage to national infra-structure;
8. Disruption of Government machinery;
9. Damage to the eco-system; and
10. Loss to the national economy.

Disaster mitigation requires the contribution of the social and human sciences, as well as technological solutions. There should be a national policy on disaster mitigation, including –

1. The introduction of improved professional practice in the areas of agriculture, land use planning, construction and maintenance;
2. The fostering of scientific and engineering endeavours, as tools of sustainable development;
3. The shifting of emphasis to pre-disaster planning and preparedness, while ensuring the post-disaster relief operations, recovery, and rehabilitation; and
4. The integration of disaster prevention and preparedness, in the national, as well as in the sub-national level planning process.

In Sri Lanka, the disaster preparedness and mitigation plan clearly identifies the Vigilance Groups who will signal the disasters. It also identifies the Technical and Advisory Groups, to cover the four major areas of floods, landslides, epidemics and industrial accidents. Moreover, The plan identifies the necessity of having the disaster mitigation committees at the village, provincial and national levels.

There is a difference in the impact of disasters between the rich and poor countries. In the rich countries, disasters have a low social impact and a high economic impact, whereas in the poor countries, the economic impact, in dollar terms, is likely to be much less than the social impact, due to far greater loss of lives and disruption of activities. The probability of the occurrence of natural disasters like floods, droughts, landslides and cyclones, are bound to increase in the future, and uncertainties of the weather is further aggravated by environmental degradation, deforestation, and desertification. The explosion in population will also invariably increase the landlessness, which leads to encroachment of catchment areas and environmentally sensitive areas. The removal of forest cover will enhance the soil erosion, very often resulting in floods and landslides.

7.8. Land Use Control and Natural Disasters

The land use practices undoubtedly have a direct relationship with natural disasters. Environmentalists claim that most of the disasters are man-made, caused by deforestation, especially the hill-tops and terrains. The destruction of the trees on the hill sides which help the earth to absorb water, allow the rains to cascade down the denuded slopes, eroding the soil and overwhelming the river channels. Moreover, the geo-thermal deposits in the area are also under threat, as the water seeping will not take place due to illegal logging.

The rapid population increase is undoubtedly an indirect cause for some of the natural disasters faced. The increasing pressure on land for agriculture and settlements have led to loss of bio-diversity and soil degradation. As a result, the forest cover which was 70% in the beginning of this century, has been reduced to 44% in 1960, and 20.3% in 1993. The depletion is around 30,000 ha per annum. The cultivation of steep slopes, shifting cultivation, inadequate soil conservation measures, vulnerability of eco-systems, and land tenure problems, etc., led to land degradation. Moreover, in the past land policies have often not been consistent, and generally only taken short-term benefits into consideration. The exploitation of forests, and unplanned gem mining also contribute to land degradation.

It is necessary to take a number of measures in order to mitigate natural disasters and environmental degradation due to land use, such as land policies, maintenance and conservation of State land including forests; creation of public awareness on environmental issues; water-shed management; introduction of suitable land use practices and planning; quick mitigatory action on natural disasters etc.

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PART II

CAUSES AND CONSEQUENCES

CHAPTER 8

POVERTY AND THE ENVIRONMENT

POPULATION, CONSUMPTION PATTERNS AND POVERTY

8. Introduction

8.1. Demography

- Population growth

The census of 1981 showed the population figure for Sri Lanka as 14,846.800 million. According to a recent census, the population in 1991 stood at 17.247,000. The projected population for the year 2001, at a high estimation is 21.3 million and the low estimate is 20 million.

The growth rate of the population has registered a drop during the last decade. In 1992 the growth rate was 1.1 %.

The crude birth rate, per thousand population, has diminished from 28.2 in 1981, to 20.0 in 1990. A strong balance appears to be maintained between male and female births. In 1980, male births per thousand female births was 1,043, whereas in 1990, it remained at 1,053.

A general improvement in health is reflected by the reduction in infant and maternal mortality during the last decade. Infant deaths per thousand live births have been reduced from 31.0 in 1982, to 19.3 in 1990. Similarly foetal deaths per thousand live births have been reduced from 24.0 in 1980, to 13.4 in 1990. Maternal deaths have been kept low at 0.6 per thousand live births in 1981, and at 0.5 in 1986.

There was also a marked improvement in respect of life expectancy. It is significant that the life expectancy of females, had been higher. According to the census of 1963, male life expectancy was 63.3, and female 63.7; in 1971, male 64, and female 66.8; in 1981, male 67.6, and female 72.1.

- Migration flows

- from rural to urban areas

The urban population grew from 2.8 million in 1971 to 3.19 million in 1991. The rural population too grew from 9.84 million in 1971 to 11.654 million in 1981. The growth rate among the urban population appears to be slightly higher than in the rural areas. The density of population in the Capital City of Colombo, has increased from 2.660 per sq. km in 1982, to 2.991 per sq. km in 1991. The increase in the density of population in the hill capital of Kandy, is also very significant, in that it grew from 486 persons per sq. km in 1982, to 657 per sq. km in 1991.. However, most of the rural towns have recorded only a marginal increase during the last ten years.

A close analysis of internal migration shows a rather complex picture of in-flows and out-flows in urban and rural centres. The net migration to the capital city of Colombo has dropped to 82,960 in 1981, from 160,590 in 1971. The largest net out-flows had taken place from the capital cities of the South, namely Matara and Galle. The Southern Province has a long history of migration, with people venturing out for greener pastures. What is most significant in the analysis is that the net in-flow was highest in the case of the largest agricultural districts of Anuradhapura and Polonnaruwa - 166,955 and 112,721 respectively in 1981.

- among countries and in the region

The wide-scale intra-regional and inter-regional migration commenced only three to four decades ago. The migration to the developed countries was a phenomenon which was mainly confined to the elite classes, with only a few selected professionals enjoying this privilege.

The petroleum boom in the Middle-East countries and the rise in their standard of living created an unprecedented demand for middle-level skilled and unskilled workers, as well as domestic aides. Sri Lanka was able to compete on equal terms with other countries such as India, Bangladesh, the Philippines, etc., in breaking into the labour markets of the Middle-East. The Middle-East countries also attracted some professionals with attractive perks. There are clear indications that the labour market in the Middle-East countries is rapidly reaching saturation, with most of their infrastructural work being achieved. Much of the skilled and unskilled labour was required for the development of the infrastructure, such as the construction of roads, buildings, etc.

There is also the brain drain to the developed countries, and consequently, Sri Lanka loses a fair percentage of its trained professionals each year. However, Sri Lanka's open economic policies, particularly the concessions offered to those employed overseas, have slightly slowed down the trend of the brain drain. This is also partly due to the over-supply of professionals to developed countries from the developing world.

There are indications that new opportunities may come up for labour markets in the Newly Industrialised Countries in South East and East Asia, including Japan.

8.2. Consumption Patterns

- Level of Revenue

An analysis of the money supply over the past 10 years indicates that it has been on the increase. In 1981 the total currency supply was 5.64 billion rupees, increased to 27.5 billion, in 1991.

The savings in fixed deposits with Government and Commercial Banks increased from 20.3 billion rupees in 1981, to 108.9 billion, in 1991. (Source: Central Bank of Sri Lanka). The GNP per capita current prices have increased from Rs. 11,254/- in 1987, to Rs. 21,030/- in 1991. Private consumption expenditure has increased from Rs. 8480/- in 1987, to Rs. 15,673/- in 1991. The total household expenditure at current market prices has also increased from Rs. 13.7 billion in 1986, to Rs. 23.3 billion in 1990. A notable feature is the increase in the percentage of household income spent on food. Whereas, only 41.6% was spent on food in 1986, 47% was spent in 1991. Further, the daily supply of calories per person has increased substantially from 2200 units in 1981, to 2292 units in 1990. A comparison of the balance sheets of 1989 and 1991, reveals a per capita availability of 136.22 kg of cereals in 1991, as against 127.43 kg in 1989. (Source: Dept of Census and Statistics).

- Structure of consumption by group, revenue levels

Although figures for consumption by the different revenue groups are not available, an analysis of the average income of the State Sector Employees in 1991 gives an indication of the extent of access to products of growth. Out of the total of 700,592 State Sector Employees, 578,702 (i.e., 68.33%), earned a monthly income of Rs. 1750/- to Rs. 3000/- (Source: Dept. of Census and Statistics). Despite the rise in the general wage rate to reach 330% between 1981 and 1991, the increase in prices of consumer and other goods, has not permitted the workers to take advantage of the wage increases.

– Rural v. urban consumption patterns

It is clear that a large percentage of the earnings of a family is expended on food. However, in the urban sector, a fair portion of the income is disbursed on entertainment. This phenomenon is virtually absent in the rural sectors. Fortunately, both for the urban and rural poor, they are able to apply a large slice of their income on food, for, basic services such as health and education are offered free by the State. This explains the ability of the Sri Lankan poor to maintain a relatively high quality of life, despite the low per capita income.

– Social values and attitudes

Social values and attitudes also contribute to the patterns of expenditure. Social events such as weddings, funerals and other functions impose a heavy burden the average family. A sense of competition and a desire to do better than the neighbour, compels many families to incur expenditures, well beyond their means, and invariably leads them into incurring debts. The impact of the open economy is felt both in the urban and rural centres. Mass media, particularly the audio-visual media, has taken a highly consumer oriented value system to the doorstep of the villager. Whilst the urban and rural poor may be motivated by the this same media to work harder in order to indulge in consumer articles, the process may also, well compromise their saving habits.

– The global effect of consumption patterns on the environment

The present consumption patterns are indeed having a strong impact on the environment. The increase in consumption of meat is making demands on the available land for production purposes, for, it is well known that animals, particularly cattle, are poor converters of food in the food cycle, and that it takes much less land to produce grains and cereals for direct consumption.

The demand on petroleum based energy is taking a heavy toll on the existing petroleum resources of the world. The present levels of energy consumption, particularly in the developed countries, are totally out of proportion to the availability of raw materials for the production of energy. We have virtually borrowed these resources from future generations, depriving them of their legitimate access to such resources.

The consumption of timber for production of furniture and similar uses, as well as for fuelwood is resulting in the depletion of forest cover. In Sri Lanka within a short span of 90 years, the forest cover in the country has been reduced from 80% to 19%.

The use of animal based products such as leather goods, hides, and ivory products does lead to the depletion of wild animals. The widespread use of non-degradable plastic and packing material, further contributes to the creation of insurmountable problems for the urban centres.

The wasteful use pattern of valuable basic resources such as water for drinking as well as for irrigation purposes, will also certainly tend to cause, in the long-term, an adverse impact on the underground water-supply.

8.3. Poverty and Environment

It would be too simplistic to conclude that environmental degradation is the result of poverty. There are many other factors contributing to environmental degradation. However, poverty if not properly handled, can be a contributory cause for environmental degradation. The poor are still dependent on land for their sustenance in most of the countries of the SAARC region. The farmers

in most of these countries adopt agricultural practices which are harmful to the environment, as they are not offered alternate forms of farming. Presently, research is being conducted on 'integrated cropping patterns for settled farming'. It would be possible to wean the shifting cultivation farmers away from this practice when settled farming systems are introduced.

Similarly the poor living around forest land and urban centres still depend on fuelwood for their energy requirements. It would almost be impossible to keep them from depleting forests in their search for fuelwood through legislation or regulations, unless alternate energy systems are introduced to them. Many countries have already started growing, on an organised scale, trees for fuelwood to cater to the energy requirements of this sector of the population.

The depletion of soil from cultivation of sloping lands is a common phenomenon in all countries of this region. The poor cultivating these lands, invariably do not have the financial capacity to undertake soil conservation measures such as the construction of bunds, ridges etc. Long-term financing arrangements have to be made through grants, subsidies etc., in order to encourage farmers to adopt improved techniques.

8.4. Conclusion

There is an important role that the governments can play to prevent the adverse impact of poverty on the environment. A positive step would be to introduce environment friendly technologies to the people. For instance, solar powered equipment if widely used can prevent the denudation of forests for fuelwood energy. Similarly widespread use of treated rubberwood as timber, will help in the conservation and protection of valuable varieties.

Environment protection is not a new concept to many a rural based community. It has been part of their tradition to live in harmony with their environment. In fact, some communities treat their environment with awe and respect, for, they have learnt through the experience of their respective generations, the advantages of living in harmony with their environment. A strong communications programme targeted at disadvantaged communities, in addition to other strategies would certainly contribute greatly, to arrest the trend towards environmental degradation.

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CHAPTER 9

POPULATION AND LIFE STYLE

9.1. Introduction

The aim of this Chapter is to indicate the need for a life style compatible with sustainable development in keeping with the realities of the situation in South Asia. The realities on the one hand pertain to the current high population densities aggravated by a high population growth potential, and on the other, the near total use already of the primary resource of arable land. The countries of South Asia had, however, sustained comparatively high populations for several centuries, although the phenomenon of the doubling of population within a generation is a recent one. The traditional life styles especially related to food consumption patterns therefore would have had special merits to have enabled the continued sustenance of the high populations in South Asia. The material in the sub-sections of this chapter are hence developed with the aim indicated above.

9.2. Population Figures by Country and Region Compared to World Population Trends

It is useful to consider the population growth situation in the region and also for the specific constituent countries, since the problems of coping have to be attended to country-wise, the critical factors are country based. Regional figures would more accurately reflect the problems of groups of countries in the region. What must be remembered is that for the next few decades, the growth in numbers of the human population will be more than 90 million per year, and the highest ever in history. The added seriousness of the situation in the decades beyond, depends on action being taken now, on a basis of urgency. The postponement of action on an urgent basis means, increasing the seriousness of the problem we hand over to our children and grand children. In the case of population also, growth grows on earlier growth. Hence, the larger increases will be in countries, which are already having high increases. By region, the added growth of population will be in Asia, Africa and Central and South America (Latin America). By country, the problems will be in the poorer countries, which already have high population increase problems. Table 1 indicates the situation by region in 1990 and 2025. The relevant statistics of some selected countries, are given in Table 2. The figures for some countries outside the region are indicated for purposes of comparison. These figures are taken from the World Population Report – 1992, of the United Nations Fund for Population Activities (UNFPA).

9.3. Concept of Demographic Transition

The growth rate varies from, 0.1 in the developed countries like Germany, to 2.9 in a poor developing country like Pakistan. The birth rates for these countries are 11 and 42 respectively.

The death rates are generally high in countries with high birth rates (14 or more); are low for countries with low birth rates, but still having high growth rates (about 8), and the death rates are even higher for countries which are highly developed and have been developed countries for many years, like the United Kingdom and Germany (about 11).

We are experiencing the truly new and unprecedented phenomenon of rapid population increase. The basic causes are the high birth rates and the rapid lowering of the death rates, especially by the control of epidemics and better health care. In the above Tables, the increasing rapidity of population growth was seen. Will this continue? Or, is the reduction of this rate now possible? There are countries where the population increase has been controlled. These all happen to be developed countries. On the other hand, the poorer developing countries have to cope with an ever increasing population. There is a pattern in this change-over from high population growth to low population growth. This is seen from Table 3 below. Before the beginning of the trend for high population increase, we have the situation of high birth rates and high mortalities. This has been the situation in the centuries past, and has been a kind of a stable situation. The new phenomenon seen from the middle of this century was the sudden reduction of mortality rates with high birth

able - 1

Population Situation in 1990 and in 2025
(Non-South Asian Regions are included for comparison)

	Pop. in Millions		Ay. Growth rate %	Birth rate	Death rate	Life expect- ancy	Infant Mortalit
	1990	2025		(90-95)	(90-95)	(90-95)	(90-95)
World Total	5292	8504	1.7	26	09	66	63
More develop- ed regions	1207	1354	0.5	14	10	75	12
Less develop- ed regions	4085	7150	2.1	30	09	63	70
<u>Africa</u>	642	1597	3.0	43	13	54	94
<u>N.America</u>	276	322	0.7	14	09	76	08
<u>America (Latin)</u>							
	448	757	1.9	27	07	68	48
South Asia	1201	2162	2.3	33	11	59	91

Table - 2

Population Situation in 1990 and in 2025
(Some Non-south Asian Countries included for comparison)

	Pop. in Millions	Av. Growth rate %	Birth rate	Death rate	Life expect- ancy	Infant Mortality	GNP per capita US \$ (1989)
	1990	2025	(90-95)	(90-95)	(90-95)	(90-95)	
<u>Asia</u>	3113	4913	1.8	27	08	64	--
China	1139	1513	1.4	21	07	27	350
Japan	124	128	0.4	12	08	05	23810
Korea (S)	43	52	0.9	15	06	21	4400
Thailand	56	81	1.4	20	07	24	1220
<u>South Asia</u>							
Afghanistan	17	41	2.7	52	22	162	180
Bangladesh	116	235	2.7	41	14	108	180
Bhutan	1.5	3.1	2.3	38	16	118	--
India	853	1442	2.1	31	10	88	340
Nepal	19	35	2.3	36	13	118	180
Pakistan	123	267	2.9	42	11	98	370
Sri Lanka	17	25	1.3	21	06	24	430
<u>Europe</u>	498	515	0.2	13	11	11	--
United Kingdom	57	60	0.2	14	11	08	14610
Germany	78	71	-0.1	11	12	08	20440
<u>Oceania</u>	27	38	1.4	19	08	23	--

rates continuing. All the countries of South Asia, except Sri Lanka, are still in this stage. Therefore, population increase is at a high rate. The third stage is where the birth rates are low, as has been achieved in the developed countries, and in Sri Lanka in the South Asian region. The fourth and the post transition stable stage, is where mortality rates rise owing to the comparatively higher age composition of the population to that of the birth rates. This stage has been reached by most of the developed countries. This change-over is called demographic transition. Since non of the countries in South Asia have completed the transition, the population related problems will continue to worsen in the region.

Table 3

Country	Birth Rate	Death Rate	Growth Rate	Type of Country
India	31	10	2.1	Developing
Pakistan	42	11	2.9	Developing
Afghanistan	52	22	2.7	Developing
Bangladesh	41	14	2.7	Developing
Bhutan	38	16	2.3	Developing
Nepal	36	13	2.3	Developing
Sri Lanka	21	6	1.3	Developing
(United Kingdom	14	11	0.2	Developed)

9.4. Potential for Population Growth

All the countries in South Asia, except Sri Lanka, are still in the Stage 2 of this demographic transition. The prevalence of this higher birth rates mean that a large number of the population is still young, and therefore, a larger population of the female population is in the child bearing ages, or still have to reach the child bearing ages. This situation applies to all populations in the first 3 stages of demographic transition. Even after a two-child norm is attained, the growth potential continues for several decades, because the number of young families continue to increase. Hence, all the countries in South Asia continue to have a high population growth potential, and the populations in Afghanistan, Bangladesh, Bhutan, Nepal, and Pakistan, will be more than double the 1990 figure, by the end of the first quarter of the 21st century. India's already huge population of 853 million in 1990, will increase by 590 million, i.e., by about 70% by the year 2025. Sri Lank's increase by that time will be 7.4 million, an increase of 43%.

9.5. Consequences of Past Population Growth on the Quality of Life

Although the increase of the GDP in the years after the war had been slow in South Asia compared to those of East Asia etc., yet remarkable strides had been made by these countries, especially in food production. Increases in food production has generally been more than those of the population in these countries. Yet, the doubling of these populations in this period has resulted in much lower gains in the quality of life indicators than would have been otherwise possible. Although the general mortality rate has been considerably reduced, infant mortality is more than 100 in several of the South Asian countries. GDP per capita in the region is the lowest compared to any region with the highest, Sri Lanka, being only about US\$ 500.

Therefore 'poverty alleviation' and not 'poverty eradication' is the most important development related activity on the agenda of South Asian Nations. The fact that 'poverty alleviation' is foremost in the development agenda indicates that South Asia has come to terms with poverty as a fact of life, and not as a totally undesirable situation needing complete elimination. One of the necessary requirements of economic progress is high per capita productivity. This is virtually impossible where

there is high unemployment. Social imperatives make it necessary to emphasize on some form of employment, in place of productive employment. This is an inevitable result of past population growth in societies which did not earlier have the means for rapid economic development. The annual addition to the labour force is the consequence of high birth rates of 15 or more years previously. On account of this, even countries such as Sri Lanka, which has reduced the growth rates to 1.3% recently, have to cope with much higher additions to her labour force. In the case of the other countries with continued higher birth rates, this phenomenon will vitiate development efforts well into the 21st century.

9.6. Population-related Indices in Relation to Quality of Life and Environment

In this section some of the indices other than food consumption related indices are discussed. The most commonly used composite index of development is the GDP per capita, and GNP per capita. As regards this index, the highest performer of the region, Sri Lanka, has an index which is about 1/40 as that for developed countries. As this index is influenced by the way the economies are structured, and the high income related costs of living, other composite indices have been suggested. These are, the cost of living factor, adjusted Purchasing Power Parity (PPP), the Physical Quality of Life Index (PQLI), and the Human Development Index, developed by the UN (UNDP, New York 1991). In the two latter indices, desirable social outcomes of development are taken into account. In these, factors such as infant mortality, life expectancy, adult literacy, school enrolment ratio, are taken into account, together with quantified physical factors such as per capita daily calorie supply. The UN Human Development Indicator ranking, groups countries into 3 categories – those with High Human Development, Medium Human Development, and Low Human Development. In this grouping one has to note that only Sri Lanka, with rank 76, of the 160 countries listed, falls into the medium group, while all other South Asian Nations (except Iran, rank 90), are in the Low grouping. In GDP per capita, and GNP per capita (PPP), all South Asian countries are even below the average of developing countries as a whole. None of these countries, except Sri Lanka, obtain even the minimum calorie requirements. Environment-related development indices are also now compiled as World Environment Data (Population Reference Bureau – Washington D.C.). Selected figures relating to Human Development Indicators, are given in Table 4, and Environment-related indices are given in Table 5.

Although Sri Lanka has a low population growth rate, and a barely satisfactory calorie supply, it takes only 20 years to halve its forest cover, while Nepal has only 17 years. These indicate that use of land for food production, cannot be significantly increased. South Asian countries are far below a developed country like Japan, in per capita energy consumption, and number of motor vehicles per 1000 population. As such it is unrealistic to aim at life styles related to such high levels of strains on the environment.

9.7. Life Styles Represented by Food Consumption Patterns

The above Tables indicate that only Sri Lanka, out of the countries in the South Asian Region (excluding Iran), has a barely satisfactory per capita calorie supply rate. Here too, one has to note the changes in the food production index (1979/81 = 100), and food import dependency rates (UNDP, Human Development Indicators, 1991). Sri Lanka, Maldives, and Bangladesh, the countries with the highest population density, already show a decline, while still depending on food imports. At the same time malnutrition prevalence is quite high (Table 6).

Table - 4

Human Development Indicators (UNDP - 1991)

Group	Country	Rank	Life Expectancy (1990) at birth, yrs. Total Female	Pop. with access to %	Health Services 87/89	Safe Water 88/90	Sanitation 88/90	Daily Calorie supply & of needs	Adult Lit. '90	Combined Primary & sec. enrolmt. ratio '88	GNP per capita US\$ '88	Real GDP per capita PPP \$ '89
Med.												
H.D.	Sri Lanka	76	70.9	73.1	93	60	50	106	83	88	430	2253
Low												
H.D.	Maldives	99	62.5	--	97	70	31	80	--	--	420	--
	Pakistan	120	57.7	57.8	55	55	18	92	35	29	370	1789
	India	121	59.1	59.3	--	75	--	94	48	67	340	910
	B'desh	135	51.8	51.3	45	81	10	83	35	41	120	320
	Nepal	140	52.2	51.6	--	37	06	34	26	60	120	896
	Bhutan	147	48.9	48.2	65	32	07	--	38	18	--	--
All Dev.												
countries			62.8	64.2	64	68	45	109	64	72	770	2296
Industrial			74.5									
countries											17017	15043
World			64.7								1226	4522

Table - 5

World Environment Data (Population reference Bureau Washington DC. 1991)

Region/Country	Pop. Est. Mid 1990 Millions	Pop. Change % 55-90/90-2025	Per Capita Cal. Supply % of needs	Years to Halve Forest Cover	Per Capita Consumption of Energy Consumption '87/Barrels of oil equ. '85, %	Electric Energy from Fossil Fuel '85, %	Access Safe Water Sani- tation '85, %	GDP from Agri- culture '88, %	Motor Vehicles /1000 Popula- tion 1970s/ 1980s
World	5321	92/60	--	--	9.2	64	54/33	--	--/-
Asia	3116	106/57	--	--	3.4	69	--	--	--/-
Afghanistan	16	70/148	95	--	0.7	39	17/-	--	4/-
B'desh	115	154/103	84	77	0.3	91	46/5	54	-/1
Bhutan	2	90/103	90	693	0.2	62	-/-	56	-/3
India	853	116/69	96	231	1.3	71	56/9	68	2/-
Nepal	19	121/83	93	17	0.2	5	28/-	44	2/-
Pakistan	115	178/118	95	173	1.1	53	44/19	73	2/3
Sri Lanka	17	97/42	104	20	0.7	20	40/44	74/-	11/-
(Japan	124	37/4	113	--	18	61	-/-	98	280/408)

Table 6 - Food Production Index

Country	Food Prod. Index 87/89 79/80=100	Food Import Dependency Ratio		Child Malnutrition % under 5 years '80-90 (underweight %)
		'69-71	'86-88	
Sri Lanka	87	40.3	26.7	38
Maldives	97	64.8	79.9	10
Pakistan	103	3.6	13.7	52
India	113	2.8	3.4	61
Bangladesh	93	8.4	12.5	66
Nepal	107	0.3	3.0	70
Bhutan	121	--	--	38

Against these figures, one has to consider the protein consumption patterns some time ago, when livestock production was not a major industry in the region. One has to accept that protein supply per capita is much worse than the calorie supply situation. Some comparative figures are given below (Table 7).

Table 7 - Daily Per Capita Protein Supply for Selected Countries, 1966
(H.H. Cole, W.H. Freeman and Co. 1966)

Country	Total Protein grms/day approx.	% of Animal Protein grms/day approx.
U.S.A.	90	65
U.K.	85	45
India	50	07
Pakistan	45	08
Sri Lanka	45	10

Of the animal protein content about 50% was from meat and poultry in the U.S.A. and U.K., while in India and Pakistan, milk and milk products were the major source of protein. In Sri Lanka, fish was a major source of animal protein.

The already low per capita calorie supply, and even lower per capita protein supply, indicate the need to significantly increase the total supply of food in the region. This increase in rate has to be continued, outpacing the population increase, well into the 21st century, even if measures to stabilize population growth are undertaken within this century. With the near saturation in the use of arable land, and considering the effects of intensive food production measures, this task of achievement seems hopeless. Food supply is only a basic quality of life need. The aspirations of the people demand supplies of other consumption goods, which are also dependent on land and energy supply. While the challenge of the provision of calorie/protein has to be met, one has to consider the most efficient means of doing so. In this context, it will be useful to consider the economics of food production, from a resource point of view.

All food consumed by the animal and vegetable kingdoms come from one source - the synthesis of sugars by the plants using carbon dioxide, water and sunlight, through photo synthesis. The plants then convert this elementary food material into starches, proteins, etc. The primary

purpose is the sustenance and growth of the plant. Various other organisms and animals consume these plant based foods, and the purpose here is also the sustenance and growth of the organism or animal. The animal tissues are consumed by other organisms and carnivorous animals, and these organisms are consumed by other carnivores. This process forms what is called a food chain. Man is also one link in this food chain, but being omnivorous, has the ability to consume the primary vegetable foods, also directly.

Each stage of the process involves the use of basic materials and energy, and this conversion has a low efficiency. The first stage involving photo synthesis, using carbon dioxide and water, takes place in the context of an abundance and a perennial supply of solar energy. A higher efficiency in the use of solar energy is not necessary for the process. While the re-conversion of food produced by one organism, is used for the sustenance and growth of the consuming organism, there is an efficiency factor involved in making up for an overall loss of efficiency as the food goes up the food chain. Moreover, each conversion stage involves the release of waste products into the environment. In photo synthesis, the waste product is oxygen, which is required for the maintenance of life on earth, but there are other waste products from metabolism and decay, which can pollute the environment. This is a fundamental rule which cannot be ignored in food production. For instance, the production of 1 unit of beef may require the use of land, water, nutrient and energy resources necessary for the production of 20 units of grain. Other meats such as poultry, may need less, but is still comparatively inefficient. The release of pollutants to the environment is also in the same proportion as resource use.

Therefore food production especially in the already crowded and arable scarce South Asian region, has to be more efficient resource economic-wise. This means a reliance to a greater extent of direct consumption of primary food products such as grain. The food consumption patterns, prevalent before livestock production became a major industry in this respect, was adapted to the resource-economic sustenance of large populations, and represented a sustainable style of food production and consumption.

While grain production is resource-economic compared to livestock production, the release of pollutants to the environment is also proportionately less. Therefore, such a practice is environmentally sustainable. Protein is usually associated with animal foods, although leafy vegetables also have protein. The protein content of some food materials are given in Table 8.

Table 8 – Protein Content of Some Food Materials
(Human Nutrition – Mc David and Mudambi – Prentice Hall, India 1973)

Food Stuff	Protein grms/100 grms of edible portion
Cereal	
Rice raw milled	6.8
Bread White	7.8
Pulses	
Black gram	24.0
Green gram	24.0
Ground nut cake	41.0
Nuts and Fruits	
Cashew	21.0
Coconut dry	6.8
Leafy Vegetables	
Drumstick leaves	6.7
Jak	1.9
Milk Products	
Cow milk	3.2
Buffalo milk	4.3
Milk powder	25.8
Meats	
Eggs	13.3
Fish depending on variety	18.0
Beef	22.6
Prawns	20.8

The proportion of protein in vegetable foods is usually lower than in the case of flesh foods, but is compensated for, by eating larger quantities. Also some of the vegetable proteins lack some amino acids, required for their assimilation. Hence, it is necessary in such cases, to select a variety of food stuffs, to compensate for this deficiency. Yet, vegetable protein taken judiciously, can be as nourishing as animal foods, without the attendant problems of toxic by-products.

Fish has also been an important source of animal protein, especially for island nations. For such countries and those having a seaboard, the harvesting of ocean fish represents an enormous extension of the 'cultivable' areas of such countries. Here too, the use of fish as food, could be maximised by a reference to the food chain, as indicated below. (R.C. Sharma – Population Trends, Resources, and Environment – Dhanapal Pae & Sons, Delhi 1975).

Table 9 – Indicative Ocean Food Chain

1 kg of man	Trophic level 5
10 kg of big fish	Trophic level 4
100 kg of small fish	Trophic level 3
1000 kg of zoo plankton	Trophic level 2
10000 kg of phytoplankton	Trophic level 1

The relative production requirements at each trophic level needed to sustain 1 kg of men, is indicated here. In the harvesting of fish, it is therefore 10 times as efficient to harvest from trophic level 3, as from trophic level 4. With research efforts, trophic level 2 could also be utilised. The sophisticated life styles demand big fish such as seer or tuna, while there is a tendency to convert small fish very inefficiently into chicken feed, although direct consumption of small fish, has been traditional in South Asia.

In the context of the arguments given above, the possible life style regarding food consumption point to the era before livestock production became a major industry. Such a consumption pattern, with grain/vegetable as the staple with fish as the major animal protein supplement, is the only sustainable food consumption pattern possible, in the crowded regions of South Asia. Being less polluting, it is also environmentally sustainable. The increase of population in an already underfed region, demands increases in food production. If scarce resources of land, water, energy, and nutrients are devoted to inefficient means of food production, the nutrition status of the future will be much more precarious than even at present.

9.9. Life Styles Compatible with Sustainable Development

The primary need of food has been dealt with exhaustively above. The same arguments could be used to develop a completely compatible life style. South Asia has a long way to go to reach a reasonably high level of human development. The key human development indication (HDI), have to be selected, such as infant mortality, child survival index, literacy, life expectancy, access to health services, safe water, sanitation, and targetted for the achievement of a high HDI, without wasting any effort on high energy use, high polluting, high resource use life styles, which in the South Asian context, is not achievable, except for a small proportion of the population. New technologies also provide for the alternatively satisfying life styles, such as the use of telecommunications which are much more energy efficient, than physical travel. Since modern communities demand transport of persons and goods, clean and efficient means for mass transit schemes have to evolved, in place of the inefficient use of small units of personal transport.

Some figures are given below, to indicate the consumption patterns of the currently developed countries. (People and Environment – World Resources Institute, Oxford University Press 1994).

Table 10 – Consumption Figures of Selected Items per person 1986/1990

Country Status	Fossil Fuel Gigajoules	Aluminium M/Tons	Copper M/Tons	Beef Kg	Round Timber Cu.M
Industrialised	160	14.13	8.06	27.2	1.29
Developing	17.3	0.69	0.48	4.3	0.48

Attempts to achieve the consumption patterns of the current industrialised world is unrealistic for two reasons. The developing world already short of resources for essential development needs, even now has a higher population – 4.1 billion in 1990, compared to 1.2 billion in the developed regions. The total world consumption then, has to be 4 times the current consumption, which is environmentally untenable, even if resources can be found. Further, the increase in population by the year 2025, is estimated to be more than 3 billion in the developing countries, while the respective increase in the developed countries is reckoned to be about 150 million. Therefore, such consumption patterns have not only to be achieved, but also sustained for a larger population, under such circumstances.

Above all there is a need for a concerted education effort, to make the general population as well as the policy makers perceive, that achievement of satisfying life styles does not necessarily mean, the achievement of consumption levels as that in the developed countries. The first task is to develop realistic but worthwhile development indicators, compatible with meeting real human needs, in an environmentally sustainable context. The indicators, such as that utilized by the UN, HDI, and that that elaborated by ESCAP, for areas such as health, education, education, leisure (1992), could be used as starting points. Indicators such as GDP per capita, include a range of items from butter to guns. There is therefore a need to exclude from the economic or social performance indicators, the negative factors, or, to account for them as negative factors. Some of the valuable social indicators such as literacy, or even telephones and radios per 1000 persons, are not resource wasteful as the provision of indicators involving cars or beef consumption. The indicator computation could be made self regulating, by including environmental factors, so that the resource wasteful practices such as the conversion of edible fish to chicken feed, or using good edible grains as livestock feed, are counted as negative factors. This is an extension of environment economics and green audit to social and economic indicators of progress. Factors such as the enjoyment of leisure in environmentally satisfying surroundings have to be included in such indices, so that there will be built-in inducements for improvement of the human condition in an environmentally sustainable context.

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References

1. 'Human Nutrition', Mc David and Mudambi, Prentice Hall, India, 1973
2. 'Study on the Quality of Life in the ESCAP Region – Education', W S Perera, ESCAP, 1992
3. 'World Environment Data', Population Reference Bureau, Washington D C, 1991
4. 'World Population Data', Population Reference Bureau, Washington D C, 1988
5. 'Population Trends, Resources and Environment', R C Sharma, Dhanpal Pae (also for quotations from H H Cole and Freeman & Sons), New Delhi, 1975
6. 'Study on the Development of Quality of Life Indicators in Asia and the Pacific', United Nations ESCAP, New York, 1991
7. 'The State of the World Population', United Nations Fund for Population Activities (UNFPA), New York, 1992
8. 'Human Development Indicators', United Nations UNDP, New York, 1991
9. 'World Resources – 1994/95', World Resources Institute (with UNEP and UNDP), Oxford University Press, New York 1994

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CHAPTER 10

URBANISATION AND ENVIRONMENTAL ISSUES

10.1. Trends and Patterns

It is stated by the Department of Census and Statistics that the urban population in Sri Lanka is growing slowly. Unlike many developing countries in Asia, the rate of growth of the urban population has not been spectacular.

Between 1946 and 1981 (last census), the proportion of the urban population to the total population increased from 15.4% to only 21.5% (see Table I).

During the inter-censal period 1971 to 1981, the rate of growth of the urban population was lower than the rate of growth of the total population. However, during the preceding period 1961 to 1971, the urban population grew at a much faster rate of about 4.5% per annum. This growth was mainly due to re-classification of villages as towns. It may be possible that since 1971, the urban population has increased, but it is not reflected in the census of 1981, as there was no re-classification of villages as towns during that decade, nor since 1981. It is felt that with the rapid economic growth since 1977, there is a greater urbanisation of the country which is not reflected in the urban statistics. This is more so with the establishment of several "Mahaweli towns" in the Mahaweli River Development Scheme over the past twenty years. Therefore, it can be approximated that Sri Lanka's present urban population is in the region of 28% - 30% of the total population.

However, it could be stated that Sri Lanka has had a slow rate of urbanisation prior to 1981, due to a number of factors. The economic activities during the first three decades after independence did not generate any impetus to urbanisation. The plantation industry which constituted a major share of the manufacturing sector, was confined to the plantation areas, and had no direct effect on urban development. Even the import substitution industries, which were State sponsored, took place in areas where raw materials and labour were available in rural areas.

Thus, while the overall rate of growth of the urban population has been slow during the period since independence, i.e., 1948 to 1981 (last census) the urban growth has been mainly in the bigger towns located in the Colombo District and the South-West of the country. (see Map of Sri Lanka, showing locations of urban population).

10.2. Future Trends and Prospects

The pattern of urbanisation that took place in developed countries, where an increasing share of the labour force was transferred from agriculture to industry and the service sector, will not occur in the same pattern in Sri Lanka. It is possible that the expansion of the service sector, will take place at a faster rate, than that of the manufacturing sector.

However, with countrywide policies for industrialisation, especially in the establishment of free trade zones, garment factories and industrial estates, in order to achieve 'Newly Industrialised Country' (NIC) status by the turn of this century, it is possible that the pace of urbanisation in the future will be at a much faster rate, than what has been experienced over the last four decades.

What is likely to take place is a pattern of "decentralised urbanisation", with two or three major counter magnets to Colombo - perhaps in Trincomalee and Galle. The decentralised urban pattern will be the rapid growth of small and medium towns, both in number and in size, due to the decentralised development policies and programmes as well as due to the demographic situation in the rural sector.

It can be seen from Table 2 that the share of the urban to the total population has increased from about 24% in 1991, to nearly 40% by 2021. The pace of urbanisation would accelerate during the first two decades of the 21st century, and will gradually slow down thereafter.

PART II

CAUSES AND CONSEQUENCES

CHAPTER 8

POVERTY AND THE ENVIRONMENT

POPULATION, CONSUMPTION PATTERNS AND POVERTY

8. Introduction

8.1. Demography

- Population growth

The census of 1981 showed the population figure for Sri Lanka as 14,846.800 million. According to a recent census, the population in 1991 stood at 17.247,000. The projected population for the year 2001, at a high estimation is 21.3 million and the low estimate is 20 million.

The growth rate of the population has registered a drop during the last decade. In 1992 the growth rate was 1.1 %.

The crude birth rate, per thousand population, has diminished from 28.2 in 1981, to 20.0 in 1990. A strong balance appears to be maintained between male and female births. In 1980, male births per thousand female births was 1,043, whereas in 1990, it remained at 1,053.

A general improvement in health is reflected by the reduction in infant and maternal mortality during the last decade. Infant deaths per thousand live births have been reduced from 31.0 in 1982, to 19.3 in 1990. Similarly foetal deaths per thousand live births have been reduced from 24.0 in 1980, to 13.4 in 1990. Maternal deaths have been kept low at 0.6 per thousand live births in 1981, and at 0.5 in 1986.

There was also a marked improvement in respect of life expectancy. It is significant that the life expectancy of females, had been higher. According to the census of 1963, male life expectancy was 63.3, and female 63.7; in 1971, male 64, and female 66.8; in 1981, male 67.6, and female 72.1.

- Migration flows

- from rural to urban areas

The urban population grew from 2.8 million in 1971 to 3.19 million in 1991. The rural population too grew from 9.84 million in 1971 to 11.654 million in 1981. The growth rate among the urban population appears to be slightly higher than in the rural areas. The density of population in the Capital City of Colombo, has increased from 2.660 per sq. km in 1982, to 2.991 per sq. km in 1991. The increase in the density of population in the hill capital of Kandy, is also very significant, in that it grew from 486 persons per sq. km in 1982, to 657 per sq. km in 1991.. However, most of the rural towns have recorded only a marginal increase during the last ten years.

A close analysis of internal migration shows a rather complex picture of in-flows and out-flows in urban and rural centres. The net migration to the capital city of Colombo has dropped to 82,960 in 1981, from 160,590 in 1971. The largest net out-flows had taken place from the capital cities of the South, namely Matara and Galle. The Southern Province has a long history of migration, with people venturing out for greener pastures. What is most significant in the analysis is that the net in-flow was highest in the case of the largest agricultural districts of Anuradhapura and Polonnaruwa - 166,955 and 112,721 respectively in 1981.

- among countries and in the region

The wide-scale intra-regional and inter-regional migration commenced only three to four decades ago. The migration to the developed countries was a phenomenon which was mainly confined to the elite classes, with only a few selected professionals enjoying this privilege.

The petroleum boom in the Middle-East countries and the rise in their standard of living created an unprecedented demand for middle-level skilled and unskilled workers, as well as domestic aides. Sri Lanka was able to compete on equal terms with other countries such as India, Bangladesh, the Philippines, etc., in breaking into the labour markets of the Middle-East. The Middle-East countries also attracted some professionals with attractive perks. There are clear indications that the labour market in the Middle-East countries is rapidly reaching saturation, with most of their infrastructural work being achieved. Much of the skilled and unskilled labour was required for the development of the infrastructure, such as the construction of roads, buildings, etc.

There is also the brain drain to the developed countries, and consequently, Sri Lanka loses a fair percentage of its trained professionals each year. However, Sri Lanka's open economic policies, particularly the concessions offered to those employed overseas, have slightly slowed down the trend of the brain drain. This is also partly due to the over-supply of professionals to developed countries from the developing world.

There are indications that new opportunities may come up for labour markets in the Newly Industrialised Countries in South East and East Asia, including Japan.

8.2. Consumption Patterns

- Level of Revenue

An analysis of the money supply over the past 10 years indicates that it has been on the increase. In 1981 the total currency supply was 5.64 billion rupees, increased to 27.5 billion, in 1991.

The savings in fixed deposits with Government and Commercial Banks increased from 20.3 billion rupees in 1981, to 108.9 billion, in 1991. (Source: Central Bank of Sri Lanka). The GNP per capita current prices have increased from Rs. 11,254/- in 1987, to Rs. 21,030/- in 1991. Private consumption expenditure has increased from Rs. 8480/- in 1987, to Rs. 15,673/- in 1991. The total household expenditure at current market prices has also increased from Rs. 13.7 billion in 1986, to Rs. 23.3 billion in 1990. A notable feature is the increase in the percentage of household income spent on food. Whereas, only 41.6% was spent on food in 1986, 47% was spent in 1991. Further, the daily supply of calories per person has increased substantially from 2200 units in 1981, to 2292 units in 1990. A comparison of the balance sheets of 1989 and 1991, reveals a per capita availability of 136.22 kg of cereals in 1991, as against 127.43 kg in 1989. (Source: Dept of Census and Statistics).

- Structure of consumption by group, revenue levels

Although figures for consumption by the different revenue groups are not available, an analysis of the average income of the State Sector Employees in 1991 gives an indication of the extent of access to products of growth. Out of the total of 700,592 State Sector Employees, 578,702 (i.e., 68.33%), earned a monthly income of Rs. 1750/- to Rs. 3000/- (Source: Dept. of Census and Statistics). Despite the rise in the general wage rate to reach 330% between 1981 and 1991, the increase in prices of consumer and other goods, has not permitted the workers to take advantage of the wage increases.

– Rural v. urban consumption patterns

It is clear that a large percentage of the earnings of a family is expended on food. However, in the urban sector, a fair portion of the income is disbursed on entertainment. This phenomenon is virtually absent in the rural sectors. Fortunately, both for the urban and rural poor, they are able to apply a large slice of their income on food, for, basic services such as health and education are offered free by the State. This explains the ability of the Sri Lankan poor to maintain a relatively high quality of life, despite the low per capita income.

– Social values and attitudes

Social values and attitudes also contribute to the patterns of expenditure. Social events such as weddings, funerals and other functions impose a heavy burden the average family. A sense of competition and a desire to do better than the neighbour, compels many families to incur expenditures, well beyond their means, and invariably leads them into incurring debts. The impact of the open economy is felt both in the urban and rural centres. Mass media, particularly the audio-visual media, has taken a highly consumer oriented value system to the doorstep of the villager. Whilst the urban and rural poor may be motivated by the this same media to work harder in order to indulge in consumer articles, the process may also, well compromise their saving habits.

– The global effect of consumption patterns on the environment

The present consumption patterns are indeed having a strong impact on the environment. The increase in consumption of meat is making demands on the available land for production purposes, for, it is well known that animals, particularly cattle, are poor converters of food in the food cycle, and that it takes much less land to produce grains and cereals for direct consumption.

The demand on petroleum based energy is taking a heavy toll on the existing petroleum resources of the world. The present levels of energy consumption, particularly in the developed countries, are totally out of proportion to the availability of raw materials for the production of energy. We have virtually borrowed these resources from future generations, depriving them of their legitimate access to such resources.

The consumption of timber for production of furniture and similar uses, as well as for fuelwood is resulting in the depletion of forest cover. In Sri Lanka within a short span of 90 years, the forest cover in the country has been reduced from 80% to 19%.

The use of animal based products such as leather goods, hides, and ivory products does lead to the depletion of wild animals. The widespread use of non-degradable plastic and packing material, further contributes to the creation of insurmountable problems for the urban centres.

The wasteful use pattern of valuable basic resources such as water for drinking as well as for irrigation purposes, will also certainly tend to cause, in the long-term, an adverse impact on the underground water-supply.

8.3. Poverty and Environment

It would be too simplistic to conclude that environmental degradation is the result of poverty. There are many other factors contributing to environmental degradation. However, poverty if not properly handled, can be a contributory cause for environmental degradation. The poor are still dependent on land for their sustenance in most of the countries of the SAARC region. The farmers

in most of these countries adopt agricultural practices which are harmful to the environment, as they are not offered alternate forms of farming. Presently, research is being conducted on 'integrated cropping patterns for settled farming'. It would be possible to wean the shifting cultivation farmers away from this practice when settled farming systems are introduced.

Similarly the poor living around forest land and urban centres still depend on fuelwood for their energy requirements. It would almost be impossible to keep them from depleting forests in their search for fuelwood through legislation or regulations, unless alternate energy systems are introduced to them. Many countries have already started growing, on an organised scale, trees for fuelwood to cater to the energy requirements of this sector of the population.

The depletion of soil from cultivation of sloping lands is a common phenomenon in all countries of this region. The poor cultivating these lands, invariably do not have the financial capacity to undertake soil conservation measures such as the construction of bunds, ridges etc. Long-term financing arrangements have to be made through grants, subsidies etc., in order to encourage farmers to adopt improved techniques.

8.4. Conclusion

There is an important role that the governments can play to prevent the adverse impact of poverty on the environment. A positive step would be to introduce environment friendly technologies to the people. For instance, solar powered equipment if widely used can prevent the denudation of forests for fuelwood energy. Similarly widespread use of treated rubberwood as timber, will help in the conservation and protection of valuable varieties.

Environment protection is not a new concept to many a rural based community. It has been part of their tradition to live in harmony with their environment. In fact, some communities treat their environment with awe and respect, for, they have learnt through the experience of their respective generations, the advantages of living in harmony with their environment. A strong communications programme targeted at disadvantaged communities, in addition to other strategies would certainly contribute greatly, to arrest the trend towards environmental degradation.

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CHAPTER 9

POPULATION AND LIFE STYLE

9.1. Introduction

The aim of this Chapter is to indicate the need for a life style compatible with sustainable development in keeping with the realities of the situation in South Asia. The realities on the one hand pertain to the current high population densities aggravated by a high population growth potential, and on the other, the near total use already of the primary resource of arable land. The countries of South Asia had, however, sustained comparatively high populations for several centuries, although the phenomenon of the doubling of population within a generation is a recent one. The traditional life styles especially related to food consumption patterns therefore would have had special merits to have enabled the continued sustenance of the high populations in South Asia. The material in the sub-sections of this chapter are hence developed with the aim indicated above.

9.2. Population Figures by Country and Region Compared to World Population Trends

It is useful to consider the population growth situation in the region and also for the specific constituent countries, since the problems of coping have to be attended to country-wise, the critical factors are country based. Regional figures would more accurately reflect the problems of groups of countries in the region. What must be remembered is that for the next few decades, the growth in numbers of the human population will be more than 90 million per year, and the highest ever in history. The added seriousness of the situation in the decades beyond, depends on action being taken now, on a basis of urgency. The postponement of action on an urgent basis means, increasing the seriousness of the problem we hand over to our children and grand children. In the case of population also, growth grows on earlier growth. Hence, the larger increases will be in countries, which are already having high increases. By region, the added growth of population will be in Asia, Africa and Central and South America (Latin America). By country, the problems will be in the poorer countries, which already have high population increase problems. Table 1 indicates the situation by region in 1990 and 2025. The relevant statistics of some selected countries, are given in Table 2. The figures for some countries outside the region are indicated for purposes of comparison. These figures are taken from the World Population Report – 1992, of the United Nations Fund for Population Activities (UNFPA).

9.3. Concept of Demographic Transition

The growth rate varies from, 0.1 in the developed countries like Germany, to 2.9 in a poor developing country like Pakistan. The birth rates for these countries are 11 and 42 respectively.

The death rates are generally high in countries with high birth rates (14 or more); are low for countries with low birth rates, but still having high growth rates (about 8), and the death rates are even higher for countries which are highly developed and have been developed countries for many years, like the United Kingdom and Germany (about 11).

We are experiencing the truly new and unprecedented phenomenon of rapid population increase. The basic causes are the high birth rates and the rapid lowering of the death rates, especially by the control of epidemics and better health care. In the above Tables, the increasing rapidity of population growth was seen. Will this continue? Or, is the reduction of this rate now possible? There are countries where the population increase has been controlled. These all happen to be developed countries. On the other hand, the poorer developing countries have to cope with an ever increasing population. There is a pattern in this change-over from high population growth to low population growth. This is seen from Table 3 below. Before the beginning of the trend for high population increase, we have the situation of high birth rates and high mortalities. This has been the situation in the centuries past, and has been a kind of a stable situation. The new phenomenon seen from the middle of this century was the sudden reduction of mortality rates with high birth

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Population Situation in 1990 and in 2025
(Non-South Asian Regions are included for comparison)

	Pop. in Millions		Ay. Growth rate %	Birth rate	Death rate	Life expect- ancy	Infant Mortalit
	1990	2025		(90-95)	(90-95)	(90-95)	(90-95)
World Total	5292	8504	1.7	26	09	66	63
More develop- ed regions	1207	1354	0.5	14	10	75	12
Less develop- ed regions	4085	7150	2.1	30	09	63	70
<u>Africa</u>	642	1597	3.0	43	13	54	94
<u>N.America</u>	276	322	0.7	14	09	76	08
<u>America (Latin)</u>							
	448	757	1.9	27	07	68	48
South Asia	1201	2162	2.3	33	11	59	91

Table - 2

Population Situation in 1990 and in 2025
(Some Non-south Asian Countries included for comparison)

	Pop. in Millions	Av. Growth rate %	Birth rate	Death rate	Life expect- ancy	Infant Mortality	GNP per capita US \$ (1989)
	1990		(90-95)	(90-95)	(90-95)	(90-95)	
<u>Asia</u>							
China	3113	4913	1.8	27	08	65	64
Japan	1139	1513	1.4	21	07	71	27
Korea (S)	124	128	0.4	12	08	79	05
Thailand	43	52	0.9	15	06	71	21
South Asia	56	81	1.4	20	07	67	24
Afghanistan	17	41	2.7	52	22	43	162
Bangladesh	116	235	2.7	41	14	53	108
Bhutan	1.5	3.1	2.3	38	16	50	118
India	853	1442	2.1	31	10	60	88
Nepal	19	35	2.3	36	13	54	118
Pakistan	123	267	2.9	42	11	59	98
Sri Lanka	17	25	1.3	21	06	72	24
Europe	498	515	0.2	13	11	75	11
United Kingdom	57	60	0.2	14	11	76	08
Germany	78	71	-0.1	11	12	76	08
Oceania	27	38	1.4	19	08	73	23

rates continuing. All the countries of South Asia, except Sri Lanka, are still in this stage. Therefore, population increase is at a high rate. The third stage is where the birth rates are low, as has been achieved in the developed countries, and in Sri Lanka in the South Asian region. The fourth and the post transition stable stage, is where mortality rates rise owing to the comparatively higher age composition of the population to that of the birth rates. This stage has been reached by most of the developed countries. This change-over is called demographic transition. Since non of the countries in South Asia have completed the transition, the population related problems will continue to worsen in the region.

Table 3

Country	Birth Rate	Death Rate	Growth Rate	Type of Country
India	31	10	2.1	Developing
Pakistan	42	11	2.9	Developing
Afghanistan	52	22	2.7	Developing
Bangladesh	41	14	2.7	Developing
Bhutan	38	16	2.3	Developing
Nepal	36	13	2.3	Developing
Sri Lanka	21	6	1.3	Developing
(United Kingdom	14	11	0.2	Developed)

9.4. Potential for Population Growth

All the countries in South Asia, except Sri Lanka, are still in the Stage 2 of this demographic transition. The prevalence of this higher birth rates mean that a large number of the population is still young, and therefore, a larger population of the female population is in the child bearing ages, or still have to reach the child bearing ages. This situation applies to all populations in the first 3 stages of demographic transition. Even after a two-child norm is attained, the growth potential continues for several decades, because the number of young families continue to increase. Hence, all the countries in South Asia continue to have a high population growth potential, and the populations in Afghanistan, Bangladesh, Bhutan, Nepal, and Pakistan, will be more than double the 1990 figure, by the end of the first quarter of the 21st century. India's already huge population of 853 million in 1990, will increase by 590 million, i.e., by about 70% by the year 2025. Sri Lank's increase by that time will be 7.4 million, an increase of 43%.

9.5. Consequences of Past Population Growth on the Quality of Life

Although the increase of the GDP in the years after the war had been slow in South Asia compared to those of East Asia etc., yet remarkable strides had been made by these countries, especially in food production. Increases in food production has generally been more than those of the population in these countries. Yet, the doubling of these populations in this period has resulted in much lower gains in the quality of life indicators than would have been otherwise possible. Although the general mortality rate has been considerably reduced, infant mortality is more than 100 in several of the South Asian countries. GDP per capita in the region is the lowest compared to any region with the highest, Sri Lanka, being only about US\$ 500.

Therefore 'poverty alleviation' and not 'poverty eradication' is the most important development related activity on the agenda of South Asian Nations. The fact that 'poverty alleviation' is foremost in the development agenda indicates that South Asia has come to terms with poverty as a fact of life, and not as a totally undesirable situation needing complete elimination. One of the necessary requirements of economic progress is high per capita productivity. This is virtually impossible where

there is high unemployment. Social imperatives make it necessary to emphasize on some form of employment, in place of productive employment. This is an inevitable result of past population growth in societies which did not earlier have the means for rapid economic development. The annual addition to the labour force is the consequence of high birth rates of 15 or more years previously. On account of this, even countries such as Sri Lanka, which has reduced the growth rates to 1.3% recently, have to cope with much higher additions to her labour force. In the case of the other countries with continued higher birth rates, this phenomenon will vitiate development efforts well into the 21st century.

9.6. Population-related Indices in Relation to Quality of Life and Environment

In this section some of the indices other than food consumption related indices are discussed. The most commonly used composite index of development is the GDP per capita, and GNP per capita. As regards this index, the highest performer of the region, Sri Lanka, has an index which is about 1/40 as that for developed countries. As this index is influenced by the way the economies are structured, and the high income related costs of living, other composite indices have been suggested. These are, the cost of living factor, adjusted Purchasing Power Parity (PPP), the Physical Quality of Life Index (PQLI), and the Human Development Index, developed by the UN (UNDP, New York 1991). In the two latter indices, desirable social outcomes of development are taken into account. In these, factors such as infant mortality, life expectancy, adult literacy, school enrolment ratio, are taken into account, together with quantified physical factors such as per capita daily calorie supply. The UN Human Development Indicator ranking, groups countries into 3 categories – those with High Human Development, Medium Human Development, and Low Human Development. In this grouping one has to note that only Sri Lanka, with rank 76, of the 160 countries listed, falls into the medium group, while all other South Asian Nations (except Iran, rank 90), are in the Low grouping. In GDP per capita, and GNP per capita (PPP), all South Asian countries are even below the average of developing countries as a whole. None of these countries, except Sri Lanka, obtain even the minimum calorie requirements. Environment-related development indices are also now compiled as World Environment Data (Population Reference Bureau – Washington D.C.). Selected figures relating to Human Development Indicators, are given in Table 4, and Environment-related indices are given in Table 5.

Although Sri Lanka has a low population growth rate, and a barely satisfactory calorie supply, it takes only 20 years to halve its forest cover, while Nepal has only 17 years. These indicate that use of land for food production, cannot be significantly increased. South Asian countries are far below a developed country like Japan, in per capita energy consumption, and number of motor vehicles per 1000 population. As such it is unrealistic to aim at life styles related to such high levels of strains on the environment.

9.7. Life Styles Represented by Food Consumption Patterns

The above Tables indicate that only Sri Lanka, out of the countries in the South Asian Region (excluding Iran), has a barely satisfactory per capita calorie supply rate. Here too, one has to note the changes in the food production index (1979/81 = 100), and food import dependency rates (UNDP, Human Development Indicators, 1991). Sri Lanka, Maldives, and Bangladesh, the countries with the highest population density, already show a decline, while still depending on food imports. At the same time malnutrition prevalence is quite high (Table 6).

Table - 4

Human Development Indicators (UNDP - 1991)

Group	Country	Rank	Life Expectancy (1990) at birth, yrs. Total Female	Pop. with access to %	Health Services 87/89	Safe Water 88/90	Sanitation 88/90	Daily Calorie supply & of needs	Adult Lit. '90	Combined Primary & sec. enrolmt. ratio '88	GNP per capita US\$ '88	Real GDP per capita PPP \$ '89
Med.												
H.D.	Sri Lanka	76	70.9	73.1	93	60	50	106	88	88	430	2253
Low												
H.D.	Maldives	99	62.5	--	97	70	31	80	--	--	420	--
	Pakistan	120	57.7	57.8	55	55	18	92	35	29	370	1789
	India	121	59.1	59.3	--	75	--	94	48	67	340	910
	B'desh	135	51.8	51.3	45	81	10	83	35	41	120	320
	Nepal	140	52.2	51.6	--	37	06	34	26	60	120	896
	Bhutan	147	48.9	48.2	65	32	07	--	38	18	--	--
All Dev.												
countries			62.8	64.2	64	68	45	109	64	72	770	2296
Industrial			74.5									
countries											17017	15043
World			64.7								1226	4522

Table - 5

World Environment Data (Population reference Bureau Washington DC. 1991)

Region/Country	Pop. Est. Mid 1990 Millions	Pop. Change % 55-90/90-2025	Per Capita Cal. Supply % of needs	Years to Halve Forest Cover	Per Capita Consumption of Energy Consumption '87/Barrels of oil equ. '85, %	Electric Energy from Fossil Fuel '85, %	Access Safe Water Sani- tation '85, %	GDP from Agri- culture '88, %	Motor Vehicles /1000 Popula- tion 1970s/ 1980s
World	5321	92/60	--	--	9.2	64	54/33	--	--/-
Asia	3116	106/57	--	--	3.4	69	--	--	--/-
Afghanistan	16	70/148	95	--	0.7	39	17/-	--	4/-
B'desh	115	154/103	84	77	0.3	91	46/5	54	-/1
Bhutan	2	90/103	90	693	0.2	62	-/-	56	-/3
India	853	116/69	96	231	1.3	71	56/9	68	2/-
Nepal	19	121/83	93	17	0.2	5	28/-	44	2/-
Pakistan	115	178/118	95	173	1.1	53	44/19	73	2/3
Sri Lanka	17	97/42	104	20	0.7	20	40/44	74/-	11/-
(Japan	124	37/4	113	--	18	61	-/-	98	280/408)

Table 6 - Food Production Index

Country	Food Prod. Index 87/89 79/80=100	Food Import Dependency Ratio		Child Malnutrition % under 5 years '80-90 (underweight %)
		'69-71	'86-88	
Sri Lanka	87	40.3	26.7	38
Maldives	97	64.8	79.9	10
Pakistan	103	3.6	13.7	52
India	113	2.8	3.4	61
Bangladesh	93	8.4	12.5	66
Nepal	107	0.3	3.0	70
Bhutan	121	--	--	38

Against these figures, one has to consider the protein consumption patterns some time ago, when livestock production was not a major industry in the region. One has to accept that protein supply per capita is much worse than the calorie supply situation. Some comparative figures are given below (Table 7).

Table 7 - Daily Per Capita Protein Supply for Selected Countries, 1966
(H.H. Cole, W.H. Freeman and Co. 1966)

Country	Total Protein grms/day approx.	% of Animal Protein grms/day approx.
U.S.A.	90	65
U.K.	85	45
India	50	07
Pakistan	45	08
Sri Lanka	45	10

Of the animal protein content about 50% was from meat and poultry in the U.S.A. and U.K., while in India and Pakistan, milk and milk products were the major source of protein. In Sri Lanka, fish was a major source of animal protein.

The already low per capita calorie supply, and even lower per capita protein supply, indicate the need to significantly increase the total supply of food in the region. This increase in rate has to be continued, outpacing the population increase, well into the 21st century, even if measures to stabilize population growth are undertaken within this century. With the near saturation in the use of arable land, and considering the effects of intensive food production measures, this task of achievement seems hopeless. Food supply is only a basic quality of life need. The aspirations of the people demand supplies of other consumption goods, which are also dependent on land and energy supply. While the challenge of the provision of calorie/protein has to be met, one has to consider the most efficient means of doing so. In this context, it will be useful to consider the economics of food production, from a resource point of view.

All food consumed by the animal and vegetable kingdoms come from one source - the synthesis of sugars by the plants using carbon dioxide, water and sunlight, through photo synthesis. The plants then convert this elementary food material into starches, proteins, etc. The primary

purpose is the sustenance and growth of the plant. Various other organisms and animals consume these plant based foods, and the purpose here is also the sustenance and growth of the organism or animal. The animal tissues are consumed by other organisms and carnivorous animals, and these organisms are consumed by other carnivores. This process forms what is called a food chain. Man is also one link in this food chain, but being omnivorous, has the ability to consume the primary vegetable foods, also directly.

Each stage of the process involves the use of basic materials and energy, and this conversion has a low efficiency. The first stage involving photo synthesis, using carbon dioxide and water, takes place in the context of an abundance and a perennial supply of solar energy. A higher efficiency in the use of solar energy is not necessary for the process. While the re-conversion of food produced by one organism, is used for the sustenance and growth of the consuming organism, there is an efficiency factor involved in making up for an overall loss of efficiency as the food goes up the food chain. Moreover, each conversion stage involves the release of waste products into the environment. In photo synthesis, the waste product is oxygen, which is required for the maintenance of life on earth, but there are other waste products from metabolism and decay, which can pollute the environment. This is a fundamental rule which cannot be ignored in food production. For instance, the production of 1 unit of beef may require the use of land, water, nutrient and energy resources necessary for the production of 20 units of grain. Other meats such as poultry, may need less, but is still comparatively inefficient. The release of pollutants to the environment is also in the same proportion as resource use.

Therefore food production especially in the already crowded and arable scarce South Asian region, has to be more efficient resource economic-wise. This means a reliance to a greater extent of direct consumption of primary food products such as grain. The food consumption patterns, prevalent before livestock production became a major industry in this respect, was adapted to the resource-economic sustenance of large populations, and represented a sustainable style of food production and consumption.

While grain production is resource-economic compared to livestock production, the release of pollutants to the environment is also proportionately less. Therefore, such a practice is environmentally sustainable. Protein is usually associated with animal foods, although leafy vegetables also have protein. The protein content of some food materials are given in Table 8.

Table 8 – Protein Content of Some Food Materials
(Human Nutrition – Mc David and Mudambi – Prentice Hall, India 1973)

Food Stuff	Protein grms/100 grms of edible portion
Cereal	
Rice raw milled	6.8
Bread White	7.8
Pulses	
Black gram	24.0
Green gram	24.0
Ground nut cake	41.0
Nuts and Fruits	
Cashew	21.0
Coconut dry	6.8
Leafy Vegetables	
Drumstick leaves	6.7
Jak	1.9
Milk Products	
Cow milk	3.2
Buffalo milk	4.3
Milk powder	25.8
Meats	
Eggs	13.3
Fish depending on variety	18.0
Beef	22.6
Prawns	20.8

The proportion of protein in vegetable foods is usually lower than in the case of flesh foods, but is compensated for, by eating larger quantities. Also some of the vegetable proteins lack some amino acids, required for their assimilation. Hence, it is necessary in such cases, to select a variety of food stuffs, to compensate for this deficiency. Yet, vegetable protein taken judiciously, can be as nourishing as animal foods, without the attendant problems of toxic by-products.

Fish has also been an important source of animal protein, especially for island nations. For such countries and those having a seaboard, the harvesting of ocean fish represents an enormous extension of the 'cultivable' areas of such countries. Here too, the use of fish as food, could be maximised by a reference to the food chain, as indicated below. (R.C. Sharma – Population Trends, Resources, and Environment – Dhanapal Pae & Sons, Delhi 1975).

Table 9 – Indicative Ocean Food Chain

1 kg of man	Trophic level 5
10 kg of big fish	Trophic level 4
100 kg of small fish	Trophic level 3
1000 kg of zoo plankton	Trophic level 2
10000 kg of phytoplankton	Trophic level 1

The relative production requirements at each trophic level needed to sustain 1 kg of men, is indicated here. In the harvesting of fish, it is therefore 10 times as efficient to harvest from trophic level 3, as from trophic level 4. With research efforts, trophic level 2 could also be utilised. The sophisticated life styles demand big fish such as seer or tuna, while there is a tendency to convert small fish very inefficiently into chicken feed, although direct consumption of small fish, has been traditional in South Asia.

In the context of the arguments given above, the possible life style regarding food consumption point to the era before livestock production became a major industry. Such a consumption pattern, with grain/vegetable as the staple with fish as the major animal protein supplement, is the only sustainable food consumption pattern possible, in the crowded regions of South Asia. Being less polluting, it is also environmentally sustainable. The increase of population in an already underfed region, demands increases in food production. If scarce resources of land, water, energy, and nutrients are devoted to inefficient means of food production, the nutrition status of the future will be much more precarious than even at present.

9.9. Life Styles Compatible with Sustainable Development

The primary need of food has been dealt with exhaustively above. The same arguments could be used to develop a completely compatible life style. South Asia has a long way to go to reach a reasonably high level of human development. The key human development indication (HDI), have to be selected, such as infant mortality, child survival index, literacy, life expectancy, access to health services, safe water, sanitation, and targetted for the achievement of a high HDI, without wasting any effort on high energy use, high polluting, high resource use life styles, which in the South Asian context, is not achievable, except for a small proportion of the population. New technologies also provide for the alternatively satisfying life styles, such as the use of telecommunications which are much more energy efficient, than physical travel. Since modern communities demand transport of persons and goods, clean and efficient means for mass transit schemes have to evolved, in place of the inefficient use of small units of personal transport.

Some figures are given below, to indicate the consumption patterns of the currently developed countries. (People and Environment – World Resources Institute, Oxford University Press 1994).

Table 10 – Consumption Figures of Selected Items per person 1986/1990

Country Status	Fossil Fuel Gigajoules	Aluminium M/Tons	Copper M/Tons	Beef Kg	Round Timber Cu.M
Industrialised	160	14.13	8.06	27.2	1.29
Developing	17.3	0.69	0.48	4.3	0.48

Attempts to achieve the consumption patterns of the current industrialised world is unrealistic for two reasons. The developing world already short of resources for essential development needs, even now has a higher population – 4.1 billion in 1990, compared to 1.2 billion in the developed regions. The total world consumption then, has to be 4 times the current consumption, which is environmentally untenable, even if resources can be found. Further, the increase in population by the year 2025, is estimated to be more than 3 billion in the developing countries, while the respective increase in the developed countries is reckoned to be about 150 million. Therefore, such consumption patterns have not only to be achieved, but also sustained for a larger population, under such circumstances.

Above all there is a need for a concerted education effort, to make the general population as well as the policy makers perceive, that achievement of satisfying life styles does not necessarily mean, the achievement of consumption levels as that in the developed countries. The first task is to develop realistic but worthwhile development indicators, compatible with meeting real human needs, in an environmentally sustainable context. The indicators, such as that utilized by the UN, HDI, and that that elaborated by ESCAP, for areas such as health, education, education, leisure (1992), could be used as starting points. Indicators such as GDP per capita, include a range of items from butter to guns. There is therefore a need to exclude from the economic or social performance indicators, the negative factors, or, to account for them as negative factors. Some of the valuable social indicators such as literacy, or even telephones and radios per 1000 persons, are not resource wasteful as the provision of indicators involving cars or beef consumption. The indicator computation could be made self regulating, by including environmental factors, so that the resource wasteful practices such as the conversion of edible fish to chicken feed, or using good edible grains as livestock feed, are counted as negative factors. This is an extension of environment economics and green audit to social and economic indicators of progress. Factors such as the enjoyment of leisure in environmentally satisfying surroundings have to be included in such indices, so that there will be built-in inducements for improvement of the human condition in an environmentally sustainable context.

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References

1. 'Human Nutrition', Mc David and Mudambi, Prentice Hall, India, 1973
2. 'Study on the Quality of Life in the ESCAP Region – Education', W S Perera, ESCAP, 1992
3. 'World Environment Data', Population Reference Bureau, Washington D C, 1991
4. 'World Population Data', Population Reference Bureau, Washington D C, 1988
5. 'Population Trends, Resources and Environment', R C Sharma, Dhanpal Pae (also for quotations from H H Cole and Freeman & Sons), New Delhi, 1975
6. 'Study on the Development of Quality of Life Indicators in Asia and the Pacific', United Nations ESCAP, New York, 1991
7. 'The State of the World Population', United Nations Fund for Population Activities (UNFPA), New York, 1992
8. 'Human Development Indicators', United Nations UNDP, New York, 1991
9. 'World Resources – 1994/95', World Resources Institute (with UNEP and UNDP), Oxford University Press, New York 1994

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CHAPTER 10

URBANISATION AND ENVIRONMENTAL ISSUES

10.1. Trends and Patterns

It is stated by the Department of Census and Statistics that the urban population in Sri Lanka is growing slowly. Unlike many developing countries in Asia, the rate of growth of the urban population has not been spectacular.

Between 1946 and 1981 (last census), the proportion of the urban population to the total population increased from 15.4% to only 21.5% (see Table I).

During the inter-censal period 1971 to 1981, the rate of growth of the urban population was lower than the rate of growth of the total population. However, during the preceding period 1961 to 1971, the urban population grew at a much faster rate of about 4.5% per annum. This growth was mainly due to re-classification of villages as towns. It may be possible that since 1971, the urban population has increased, but it is not reflected in the census of 1981, as there was no re-classification of villages as towns during that decade, nor since 1981. It is felt that with the rapid economic growth since 1977, there is a greater urbanisation of the country which is not reflected in the urban statistics. This is more so with the establishment of several "Mahaweli towns" in the Mahaweli River Development Scheme over the past twenty years. Therefore, it can be approximated that Sri Lanka's present urban population is in the region of 28% - 30% of the total population.

However, it could be stated that Sri Lanka has had a slow rate of urbanisation prior to 1981, due to a number of factors. The economic activities during the first three decades after independence did not generate any impetus to urbanisation. The plantation industry which constituted a major share of the manufacturing sector, was confined to the plantation areas, and had no direct effect on urban development. Even the import substitution industries, which were State sponsored, took place in areas where raw materials and labour were available in rural areas.

Thus, while the overall rate of growth of the urban population has been slow during the period since independence, i.e., 1948 to 1981 (last census) the urban growth has been mainly in the bigger towns located in the Colombo District and the South-West of the country. (see Map of Sri Lanka, showing locations of urban population).

10.2. Future Trends and Prospects

The pattern of urbanisation that took place in developed countries, where an increasing share of the labour force was transferred from agriculture to industry and the service sector, will not occur in the same pattern in Sri Lanka. It is possible that the expansion of the service sector, will take place at a faster rate, than that of the manufacturing sector.

However, with countrywide policies for industrialisation, especially in the establishment of free trade zones, garment factories and industrial estates, in order to achieve 'Newly Industrialised Country' (NIC) status by the turn of this century, it is possible that the pace of urbanisation in the future will be at a much faster rate, than what has been experienced over the last four decades.

What is likely to take place is a pattern of "decentralised urbanisation", with two or three major counter magnets to Colombo - perhaps in Trincomalee and Galle. The decentralised urban pattern will be the rapid growth of small and medium towns, both in number and in size, due to the decentralised development policies and programmes as well as due to the demographic situation in the rural sector.

It can be seen from Table 2 that the share of the urban to the total population has increased from about 24% in 1991, to nearly 40% by 2021. The pace of urbanisation would accelerate during the first two decades of the 21st century, and will gradually slow down thereafter.

TABLE 1
GROWTH OF URBAN AREAS AND URBAN POPULATION, 1871-1981

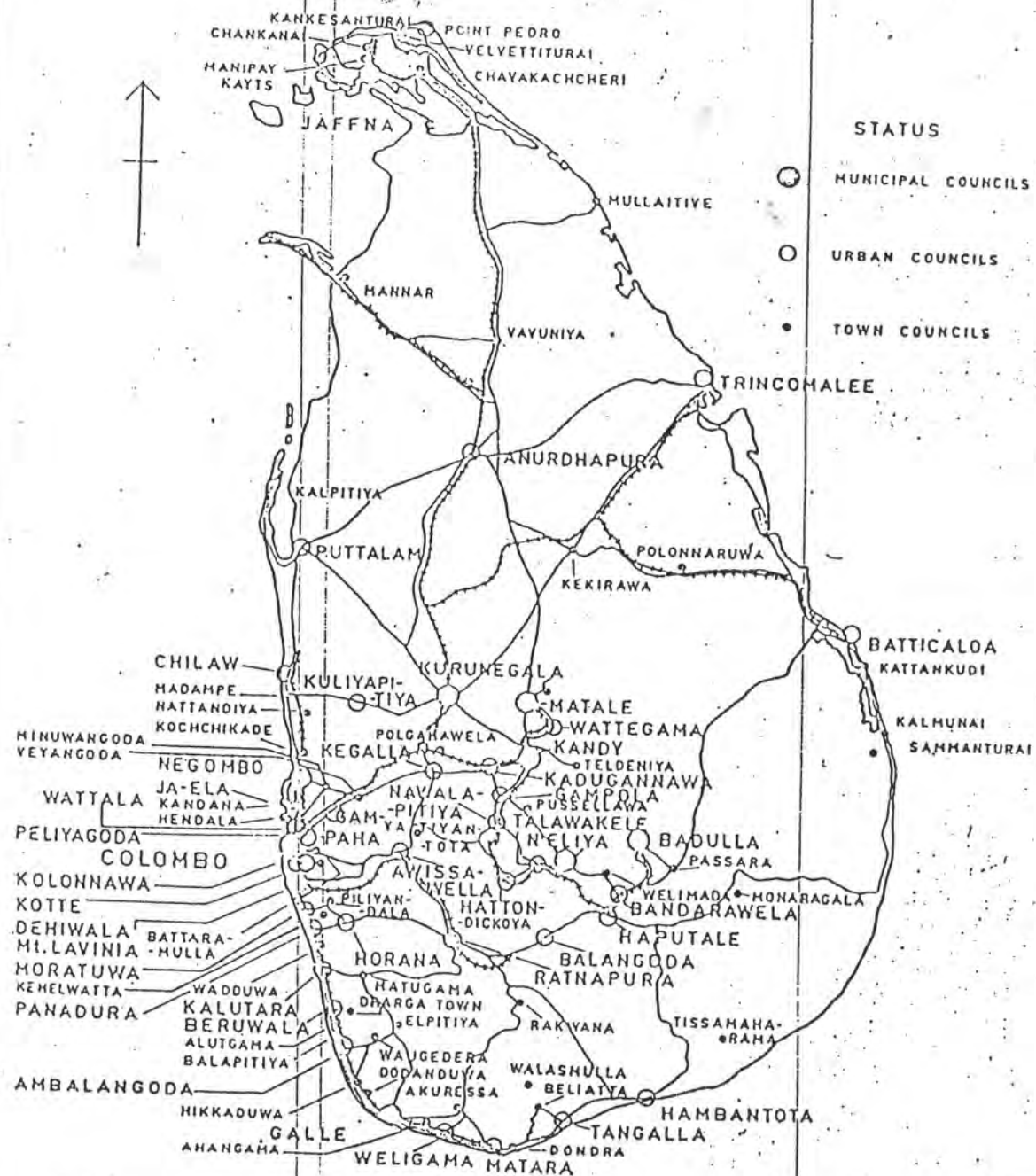
Average Annual Growth (%)

YEAR	URBAN POPULATION	PERCENTAGE URBAN	TOTAL URBAN AREAS	TOTAL POPULATION	URBAN POPULATION
1871	260,376	10.8	19	-	-
1881	281,065	10.2	20	1.42	0.78
1891	321,413	10.7	20	0.86	1.35
1901	414,025	11.6	28	1.72	2.56
1911	542,945	13.2	37	1.42	2.74
1921	637,870	14.2	42	0.91	1.62
1931	737,272	13.9	42	1.68	1.47
1946	1,023,042	15.4	42	1.52	2.20
1953	1,239,133	15.3	43	2.84	2.77
1963	2,016,285	19.1	89	2.65	4.88
1971	2,848,116	22.4	135	2.20	4.23
1981	3,192,489	21.5	134	1.70	1.21

SOURCE : Compiled from the Reports of Census of Population -

by Dr. A.T.P.I. Abeykoon.

TOWNS OF SRI LANKA



SOURCE:
Data compiled from Census Reports,
Department of Census and Statistics,
Colombo Ceylon.

10 5 0 10 20 30 40 MILES.

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TABLE 2

GROWTH OF TOTAL POPULATION AND URBAN POPULATION,
1991 - 2021

	(nos. in thousands)						
	1991	1996	2001	2006	2011	2016	2021
Total Population	17,261	18,334	19,337	20,332	21,294	22,129	22,827
Urban Population	4,315	4,638	5,102	5,760	6,659	7,834	9,092
Percent Urban	24.9	25.3	26.4	28.3	31.3	35.4	39.8

AVERAGE ANNUAL GROWTH RATES
(Percent)

	1991-96	1996-2001	2001-06	2006-11	2011-16	2016-21
Total Population	1.2	1.1	1.0	0.9	0.8	0.5
Urban Population	1.5	1.9	2.4	2.9	3.2	3.0

Compiled by: Dr. A.T.P.I. Abeykoon.

10.3. Environmental Issues

With the expected rapid growth of urbanisation as per Table 2 above – i.e., annual average growth rates of 1.5 (1991 – 1996); 1.9 (1996 – 2001); 2.4 (2001 – 2006); 2.9 (2006 – 2011); 3.2 (2011 – 2016); and 3.0 (2016 – 2021), it would be necessary to analyse the impact of this expansion, vis-à-vis the environment.

It will be most likely that the urban expansion will be accommodated as follows:-

1. Infill (densification) and use of vacant lands in urban areas..
2. Suburbanisation – mainly cutting down of existing coconut and rubber plantations surrounding urban areas and filling of paddy fields.
3. Urban re-development.
4. Reclamation of surrounding low-lying lands (wetlands).
5. Utilisation of hill-slopes.

Infill or densification of existing urban areas with increase of urban population seems an attractive proposition and will not affect the environment adversely, if the densification is properly planned and executed. Even the use of existing vacant lands in urban areas for purposes of urban development will be appropriate. However, in the utilisation of vacant land in urban areas, it will be necessary to reserve land needed as open spaces and for recreational uses, applying the required planning criteria.

In suburbanisation, the current practice is to cut down existing coconut and rubber plantations and fill paddy fields. It would be necessary to assess, as to whether this practice is economically viable. If not, urban expansion, especially the private sector attempts at housing schemes, will eat into good coconut and rubber land. The filling up of paddy fields for urban uses is discouraged by the Department of Agrarian Services, as it causes loss of paddy land, and also causes problems of drainage.

Urban re-development is of course the best solution to accommodate urban expansion. Most of Sri Lanka's urban centres have blighted areas with improper use of land. It is necessary (as is the trend now), to implement a planned programme of urban re-development with high-rise building development for commercial and residential purposes.

The reclamation of wetlands has become attractive for urban expansion, due to low land values and availability of such land close to urban areas. But, indiscriminate filling of wetlands is causing damage and environmental problems of an acute nature. This has a dual problem, namely, disturbance of the wetland due to reclamation, and, disturbance of the surrounding highland which act as burrow pits.

Therefore, it is necessary to prepare planning guidelines and regulations for the utilisation of wetlands for urban expansion. One such large wetland is the Muthurajawela Marsh, which is North of Colombo. Already a detailed study has been undertaken to fill 450 acres of the marsh for urban expansion.

Finally urban expansion also affects the surrounding hills in most urban areas situated in the hill country.

It is startling to see the picturesque scenery of Nuwara Eliya being destroyed by urban activities and home gardens. Even in Kandy, the surrounding hills are being levelled for urban uses causing problems of soil erosion and earth slips. Even housing under the model village programme utilising hill slopes needs to be carefully planned. Regulations for the use of hill slopes for urban expansion needs to be drafted and implemented soon.

10.4 Status and Trends

(a) Urban Housing

The acute problem of shelter, like other urbanization problems, are mostly confined to Colombo's shanty and slum settlements. With nearly 50% (or 65,000 households) of the Colombo Municipal Council area's population cramped in such settlements, the urban housing component of the Million Houses Programme (MHP), launched by the Government in 1984, was aimed at rehabilitating these settlements. Living quarters in these settlements are overcrowded and built of improvised material on marginal, usually flood prone land. Occupants typically lack legal rights to the land they occupy. Through the MHP, families in shanty and slum settlements have been given legal tenure to the land, along with loans of up to Rs. 15,000 to improve their shelter through a Housing Option Loans Package (HOLP). As of August 1993, nearly 40,000 shanty and slum families had benefitted from the MHP.

To overcome the acute shortage of land, especially for low-income housing, the Government reduced the minimum size of plots for residential development from 303 to 152 sq m and in some special cases to 51 sq m. The resulting increase in spot densities has strained the infrastructure to its limits, and local officials have been unable to control illegal and unauthorized constructions. These are usually extensions for providing a cooking area, which, due to restricted space, often abuts liltis, cattle sheds, or poultry runs in the adjoining plots. These add to unhygienic cooking conditions.

(b) Water Supply and Sanitation

As shanty and slum improvement schemes increase so does the demand for water. Rehabilitation settlements have, therefore, posed a challenge to the National Water Supply and Drainage Board (NWS & DB). Existing supply lines are already overloaded and new supply now appears feasible only by tapping ground water where the quality is found suitable for human consumption. Collection of rain water is also being explored for drinking purposes.

(c) Water Pollution

In the Colombo District, in 1993, 87% of the approximately 272,500 housing units had pit toilets, bucket toilets, or none at all. Just over half (52%) of all housing units had piped water, and only little over a third (37.8%) had protected wells. About 10% of the housing units used shallow wells which are highly susceptible to domestic contamination, or untreated river water, or other similar sources. Under these conditions, with an average of 5.8 persons per household (1993), there is a high potential for the spread of water borne diseases among 150,000 of Colombo's resident population. Today, this high risk group may have increased by more than 20,000 because of the urban growth in the last ten years. The numbers at risk will be higher still if piped or protected well water becomes contaminated, since only 375,000 residents in Colombo are serviced by sewers.

Conditions in the Gampaha District are potentially more serious. About 60% of the 266,00 housing units had pit toilets, bucket types, or none. Only 9% of the housing units received piped water, 66% used protected wells, and the remaining 25% used unprotected wells, rivers and other sources. Under these conditions 364,000 people were at high risk from possible water contamination in 1981. Today, the number is 409,000.

If Colombo and the adjacent areas increase their growth rate over the next ten years, as forecast, water pollution problems will obviously grow more serious unless there is significant new investment in water and sanitation infrastructure.

In areas where wells are the sole source of drinking water, the building of septic tanks within a 152 sq. m. plot poses a problem since by-laws require septic tanks to be at least 15.25 m. away from a well, whether one's own or a neighbour's, in order to prevent contamination. Several surveys have shown that, in practice, these by-laws are not strictly adhered to.

The local authorities along the sea coast face a peculiar problem when squatters encroaching on sea coast reservations are in the practice of relieving themselves directly on the beach. The excreta washed away by the sea, resurface and pollute other beaches, some of which are frequented by Tourists. Providing these settlements with toilet facilities of any form has not yet proved effective.

(d) Solid Waste Collection and Disposal

Domestic garbage disposal requires urgent attention in the Colombo Urban Area (CUA). In most parts of CUA, garbage is either collected by "hand carters" from residences and piled up at central collection points, or households are expected to bring their garbage to these points. The collected garbage remains for a number of days polluting the environment and inviting rats, dogs and crows as well as scavenging by the poor, until garbage trucks take it away for disposal, generally by dumping in marshy lands away from residential areas.

Safe and convenient disposal sites, however, have become increasingly scarce. As a result, the whole process of garbage collection and disposal has become inefficient; garbage piled at temporary locations often remains unattended for a considerable period, causing a nuisance and a health hazard to residents. With a rising urban pollution and garbage output, cost effective alternatives to the present garbage collection and disposal systems have become an urgent need.

(e) Filling up of Stormwater Basins

Fast escalating urban land prices force low and middle income households to seek cheaper residential lands away from the city centre. One direct result is the filling of marshy land for residential development as mentioned earlier. A network of such marshy land within the CUA had, for long, served as a natural drainage system. The filling of these stormwater basins - over 200 ha. by the Sri Lanka Land Reclamation and Development Corporation (SLLRDC) alone since 1968 - impedes drainage and this causes flash floods in low lying areas during heavy rain. In the absence of a clear policy to maintain the stormwater basins, (not only in Colombo but also in other urban area) local authorities have no alternative but to approve applications for filling by developers or individual house builders.

10.5 Recommended Strategies and Actions

This section deals with the responses required to manage urban pollution in Sri Lanka. Solutions should focus on improving the water management capabilities of urban local authorities, improving domestic waste disposal methods - both on-site and off-site - and mobilizing additional resources for the upkeep of urban services provided by the authorities.

(a) **Metropolitan Environmental Improvement Programme (MEIP)**

Colombo is now well into this UNDP/World Bank funded project. Prior to the commencement of MEIP in Colombo, a survey was undertaken to study the major environmental issues confronting the Colombo Metropolis. The issues identified by this survey were -

- Disposal of solid waste - both Municipal and Industrial;
- Deteriorating surface and ground water quality;
- Flooding and stagnation of water;
- Traffic congestion and noise;
- Adverse outdoor air quality

The main objective of MEIP is to up grade the metropolitan environment and ensure that its future growth is sustainable and safe for inhabitants who live in the metropolis. Like any major programme the MEIP, commenced with studies, feasibility reports and strategy papers. On the completion of these, resources marshalled to ensure that follow-up investment is made. The Government considered this programme as a lead environmental programme and assigned high priority to its implementation.

Recommendations :

The activities identified and are under preparation and implementation are :

- a The formulation of an Environmental Management Strategy for the Colombo metropolis; (meaning completion)
- b Development of a strategic plan for solid waste management for the Colombo metropolis;
- c Preparation of a Master Plan for the restoration of the Beira Lake;
- d Demonstration project titled "Environmental Improvements to the Low Income Settlements Located along Selected Canal Banks of the Colombo City".

(see appendix 2)

(b) **Improving Urban Waste Disposal Infrastructure in Sri Lanka**

Inadequate disposal of municipal refuse and sewage poses the biggest health hazard to urban inhabitants. Colombo city is seaward, but other urban centres are not, and they use on-site methods for sewage disposal. The disposal of municipal refuse is very unsatisfactory even in the capital city. It is a common sight to see heaps of refuse piling up on street corners without being removed regularly. Some urban centres have started experiencing problems of contaminated ground water and surface water, largely due to the dumping of sewage and garbage. The problem is further compounded by the presence of

low-income settlements along waterways or canals in urban areas. This is especially common within the Greater Colombo area. Though Colombo is seaward, waste is discharged directly into the sea without any treatment.

Solid waste management is usually handled by the local authorities. Several local authorities in the CUA are collaborating to develop a regional system of solid waste disposal. Landfill and composting are the two options for disposal. Of these, it has been found that landfilling is the most suitable. The high moisture of urban waste in Sri Lanka precludes the possibility of incineration as a cost-effective alternative.

Large capital investments are required for transport and to prepare the site and construct transfer stations, if necessary.

Waste management capabilities and a reasonable level of technical expertise is available only in the major municipalities. Other local authorities are unable to access the necessary expertise and are thus badly equipped to manage such programmes.

Identifying land becomes an issue, not only due to lack of suitable vacant land, but also due to one local authority not being willing to accept the garbage of another. Recently a large area was identified for a sanitary landfill in a Colombo suburb which had World Bank funding but due to objections of the local politicians the site is being reviewed.

(c) **Integration of Environmental Issues in Urban Development Planning**

Tools for urban planning in Sri Lanka are well established with the Department of Town and Country Planning and the Urban Development Authority (UDA). These tools are very evident in the City Development Plan prepared in 1985. The plan addresses basic needs of development like water supply, communications and other utilities but overlooks the environmental limitations, (as was the pattern then), which could constrain growth, eventually. One of the notable weaknesses is the absence of plans for waste disposal. Therefore, it is very essential that the environmental dimension is integrated to the overall planning process of urban development. It is also imperative that in future, when planning for sustainable urban growth, the problem of urban poor should be recognized and adequately addressed though much action has been taken under the Ministry of Housing and Construction during the late President of Sri Lanka Ranasinghe Premadasa's tenure. Minister of Housing and Construction.

The Urban Development Authority (UDA) is the principal institution responsible for the planning, development and control of urban activities. It operates through a network of urban local authorities to which UDA has devolved some of its functions. The UDA has developed plans for the City of Colombo, and draft plans have been prepared for several other urban centres. Most of the urban local authorities give high priority to the development of infrastructure to support expanding urban growth. They recover the capital and operating cost incurred through a system of rates. A common notion is that environmental protection is a State function and, therefore, no cost should be passed down to the user. This approach has to change, the urban authorities should include environmental costs and establish mechanisms for recovering them. At present,

the generation of revenue in Municipal and Urban Councils is inadequate for providing waste treatment systems where such option is deemed necessary.

Recommendations :

- Develop the environmental capabilities of the UDA and selected urban authorities. To begin with, the UDA could establish an Environment Cell. (This is being pursued by the Ministry of Environment and Parliamentary Affairs.
- Develop appropriate environmental tools like guidelines, development controls, criteria, and standards to control environmental degradation in urban centres.
- Establish a tariff and rates system for services provided for the upkeep of the urban environment by local authorities.
- Ensure that every urban local authority has within its staff environmental expertise.

(d) Restoration of Degraded Urban Environments

The Ministry of Environment and Parliamentary Affairs decentralized certain functions of the Central Environmental Authority (CEA) to local authorities and District Secretariats with effect from 1st January, 1994. (see annex I)

Urban waterbodies and low-lying lands have been subjected to increasing environmental deterioration. Such scars are evident within the Colombo metropolis. Beira Lake in the heart of the city, once a pristine waterbody, has today turned into a cess pool. On its banks are located several commercial establishments, hotels and also a large number of low-income settlements. Beira is the recipient of sewage, domestic waste waters, garbage, and waste from commercial establishments.

Another critical area is the southern suburb city of Ratmalana, and northern suburb of Ekala which in the early 1950s were being developed as industrial suburbs. Today they are turned into residential-cum-industrial suburbs with conflicting land uses. It is common to see industries and residences located side-by-side. The waste from industries as well as residence have polluted the Bolgoda Lake and the Lunawa Lagoon, both of which had recreational use in the past. Similarly, in the hills the lakes within the cities of Kandy and Nuwara Eliya have deteriorated - the main causes being sewage discharge, garbage dumping, silting, and chemical wash-offs.

Recommendations :

- Develop and implement Restoration Master Plans - individually for Beira Lake, Kandy Lake and the Nuwara Eliya Lake. These master plans should address environmental conservation measures and examine the development potential for tourism and recreational use. (Beira is already identified by the World Bank for restoration).
- As suggested in the MEIP Work Programme, commission feasibility studies immediately for the industrial zones of Ratmalana and Ekala to establish common waste water treatment facilities. These plans should also look at integrated environmental management practices in the two zones.

- Commission studies to establish the level of environmental degradation in urban centres like Kandy and Nuwara Eliya. Other large urban centres could be studied on completion of these two areas. It may be useful to link up this effort with the on-going NORAD/CEA supported programmes to develop District Environmental Profiles.
- Develop an appropriate institutional framework and capability for the implementation of the different master plans and feasibility reports. Identify internal as well as external investment requirements for implementing short and medium term actions identified in these plans.
- Implement the recommendations of the National Environmental Action Plan (revised) 1993-1998 on Urban and Industrial Pollution.

Reference

- 1 Census Reports - Department of Census and Statistics - Govt of Sri Lanka
- 2 * Dr A T P I Abeykoon - 'Demographic Implications in the Development of Medium and Small Towns in the Regional Development Context'.
- 3 * Hemantha Jayaweera - 'Urban Expansion and Need for Planning Guidelines for Development of Wetlands'.
- 4 * S W P Bulankulame - 'Urbanization, Sri Lanka style'.
- 5 Ministry of Environment & Parliamentary Affairs, Sri Lanka
National Report to the United Nations Conference on Environment & Development 13.03.94
section on Urbanization prepared by S W P Bulankulame and P Illangovan.
- 6 Ministry of Environment & Parliamentary Affairs, Sri Lanka
National Environment Action Plan (revised) 1994-1998.
- * Presented at the "Symposium on Small Medium Town Development"
Galle, Sri Lanka, January, 1993.

CHAPTER 11

AGRICULTURE AND FISHERIES

11.1. Introduction

Sri Lanka's agriculture has two main components, i.e., plantation agriculture and domestic agriculture. Plantation agriculture includes Tea (221,840 ha), Rubber (197,856 ha), Coconut (416,420 ha), and other minor export crops. Plantation agriculture is of relatively recent origin, particularly after the conquest of the island by the British. Domestic agriculture has a much larger history. The recorded history relating to domestic agriculture dates back to the 3rd century BC, and the civilisation of this country has revolved around agriculture since that time. The discussion in this chapter, mainly relates to domestic agriculture. Rice continues to be the staple crop of Sri Lanka, occupying a major proportion of the land in the peasant sector.

11.2. Changes in agriculture sectors and activities: trends and prospects

- Food production

Paddy production has recorded a steady increase through the last three decades. There appears to be a slight set-back in production during the last decade, due to ethnic disturbances in the North and East. In 1983, the paddy production recorded 2.48 million mt, whilst in 1991, the production stood at 2.38 million mt. There is a mixed pattern of production in respect of other field crops. (It is difficult to get a clear picture of food production patterns, as the food production figures in a number of districts in the North and East were not available for analysis).

-Livestock production

Livestock production appears to be stagnant during the last decade, the meat cattle population having dwindled from 1,699,800 in 1983, to 1.6 million in 1992. The only significant increase appears to be in respect of pigs (swine), where the population has increased from 77,000 in 1983, to 91,200 in 1992.

- Fish production

The production of fish has increased progressively during the last eight years. In 1986, the total production was 144,266 mt. In 1987, the production had increased to 149,278 mt, the bulk of which, Small shore seine fish amounted to 86,674 mt. In 1991, the fish production increased to 159,151 mt (source: Ministry of Fisheries). Small shore seine fish continue to form a large component of the total catch. Credit schemes for fishing equipment, including fishing boats, offered much incentives to fishermen. There are special programmes to assist small-scale fishermen through, provision of training, insurance, etc.

The Government has withdrawn its support to the inland fisheries programme. However, there is a continued private sector activity in this area. Prawn farming has become very popular, as the export potential is very high.

Agriculture, livestock and fisheries development was largely influenced by the free economic policies adopted by the Government of Sri Lanka, since 1977. Open policies offered both advantages and disadvantages for the development of the respective sectors. On the one hand, the free imports of agricultural, livestock and fisheries products, removed the monopolies enjoyed by these producers and compelled them to compete with the importers of these products in the open market. On the other hand, the open economy helped them to build up the infra-structure facilities needed for production purposes. They also had access to better equipment and to modern technologies, which helped them with effective improvements in the production process. The removal of monopolies and the competitive atmosphere compelled them to improve on the quality of their products.

- Agro-forestry activities

Agro-forestry is an important activity identified in the Forestry Master Plan of the Government of Sri Lanka. It is now clear that the traditional approaches and techniques of forestry production are not yielding the desired results. The major part of forest lands belong to the Government and the inhabitants living around these forests do not have a sense of responsibility to protect these national assets. This attitude of the people is partly a result of the traditional approach of forestry planners, who do not provide for inhabitants around the forests to share the benefits that the forests yield.

Community forestry and agro-forestry are now receiving the attention of forestry planners. A number of community forestry and agro-forestry programmes have been implemented with a high degree of success.

The forest lands, particularly in the dry zone which have been depleted both by the illicit timber merchants, as well as by shifting (slash and burn) cultivators, are being ear-marked for agro-forestry programmes. Participatory agro-forestry programmes will be launched to increase the productivity of abandoned and sparsely cropped areas.

- Major structural changes

Few structural changes that took place in the agricultural sector appears to have a lasting impact on the developments in this sector. Upto the early Eighties, much of the support services for agricultural development, was provided by the Government. It was felt that provision of major inputs for agricultural purposes such as water, seeds, fertilizers, agro-pesticides, as well as marketing, storage, and processing of grains, in addition to the research on development activities, were the responsibility of the Government. Major structural changes have been introduced in this sector, during the last decade.

The Government continues to take the full responsibility for research and development, as well as for the provision of irrigation water. However, most other activities are now being shared with the private sector. The Government is playing a low profile in respect of purchase and marketing, as also, for the storage and processing of grains. Although management of major irrigation works and main channels continue to be handled by the technical personnel of the Department of Irrigation, the field channels in major irrigation schemes, are now managed by the farmer organisations. The supply of seeds and fertilizers are undertaken by the Government, in open competition with private sector agencies. The import and distribution of pesticides continues to be a responsibility of the private sector, although some controls are enforced to maintain quality, through a Government Agency, namely, the 'Registrar of Pesticides'.

The Government is no more playing a predominant role in respect of fertilizer import and distribution, grain storage, marketing and processing. The fertilizer subsidies administered through the Ceylon Fertilizer Corporation (CFC), has been withdrawn. A number of private companies are importing and distributing fertilizers. The Government also administered a food subsidy, through the Department of Food. This subsidy too, has been withdrawn. However, target groups from low-income groups are being offered a different kind of production assistance, called 'Janasaviya'. This enables them to use the assistance for productive employment.

The Marketing Department which used to compete with the private sector in the purchase of vegetables for marketing, has totally withdrawn from that operation. The Paddy Marketing Board, which formerly served as the largest buyer of paddy from the farmers, under a guaranteed price scheme, has a much less active role. Today this Board serves as the purchaser of the last resort, as all marketing, storage and distribution activities, have been taken over by the private sector.

Fertilizer imports was a virtual monopoly of the Ceylon Fertilizer Corporation, upto the mid Eighties. The fertilizer subsidy was administered by the CFC and the Fertilizer Secretariat. However, after the subsidy was removed by the Government, the CFC had to play a different role, and has had to compete with the private sector. The consumption of paddy fertilizer shows an erratic trend. The share of the CFC in fertilizer handling, has gone down considerably.

Farmers have shown a preference to straight fertilizers, rather than to mixtures. A distinct preference is shown to nitrogeous fertilizers. Mixtures were introduced on the recommendation of the Department of Agriculture, to ensure that the correct balance and proportions of NPK are being used by farmers.

The total irrigated area, in 1982, under major schemes was 229,305 ha, and under minor schemes 120,838 ha. The rainfed area was 217,103 ha. The corresponding figures for 1990, were 240,758 ha, 114,640 ha and 175,328 ha. There seems to be an upward trend in major irrigation works. These increases possibly came in the major irrigation works of the Mahaweli project. The cultivation under major schemes is more stable, and the productivity itself is distinctly higher than minor and rainfed areas. This is evident from a comparison of production figures of major irrigation districts with the rest. Only irrigated districts recorded a harvest of over 4000 kg per ha, during the period 1982-1991.

Machines are used mainly in the dry zone districts under major irrigation for purposes of ploughing, harvestins, and threshing. The water buffalo was used widely for ploughing and threshing, three decades ago. Farmers are gradually getting used to machinery for their agricultural operations. Heavy dependence on petroleum based energy leads to high cost of production. The two-wheel tractor has become the most popular agricultural machine, as it is used for a wide range of purposes, including transport in the rural areas. In the wet zone districts, farmers continue to depend on traditional practices. The record of production of highland crops is not impressive during the period 1982-1990. Barring green gram which increased from 10,000 mt to 26,500 mt; potatoes from 66,000 mt to 87,200 mt; and, chillies from 37,500 mt to 95,000 mt, during the above-mentioned period, the production in respect of others was virtually stagnant.

11.3. Environmental impacts of agricultural activities and changes

- Effects on soil and land

During the last 8 decades large extents of forest cover has been cleared for agricultural purposes. With the expansion of population, the Government followed a policy of extensive cultivation. The policy towards self-sufficiency resulted in the opening up of large irrigation schemes, for agricultural purposes. Multi-purpose irrigation schemes were started in recent years, both for irrigation purposes as well as for the generation of hydro-based electrical power. All these have led to the clearance of forest cover on a large scale. The highland cultivation of domestic crops like maize, green gram, as well as commercial crops like tobacco, and potato have led to widespread soil erosion. Similarly, the opening up of hilly lands for tea cultivation, has led to soil erosion. Although the Soil Conservation Act was enacted in 1951, the enforcement was weak.

The land degradation and soil erosion resulting from shifting cultivation, is a cause for great concern. Attempts are being made to introduce these to settled forms of farming.

Similarly, dependence on timber fuel for cooking purposes makes heavy demands on existing forest land.

New techniques such as Sloping Areas Land Technology (SALT), are being introduced, under which, soil conservation measures are being carried out.

- Impact on water bodies (surface and underground)

The Green Revolution promoted widespread use of fertilizers and agro-pesticides. The traditional forms of fertilizers with organic manures, have been virtually dispensed with, although in certain areas, people continue to use them. The Ministry of Environment is in the process of studying the extent of pollution of surface water through point surfaces, as well as through non-point surfaces such as agricultural operations. Regular water quality tests are being undertaken for this purpose by specialized agencies. The Central Environment Authority (CEA) has prescribed acceptable standards of surface water for drinking and irrigation purposes etc.

Serious studies have not been undertaken so far, to ascertain the extent of pollution of underground water bodies, since over 65% of the population depend on wells and underground supplies for their purposes. Tests on underground water has become an urgent necessity.

- Effects on Flora and Fauna

The Flora and Fauna Protection Ordinance was enacted in 1937, for the purpose of protecting the endangered species of flora and fauna. A large variety of such flora and fauna were adversely affected by land clearing for agricultural purposes. To prevent further damage, protected areas such as wild life parks and forest reserves have been declared. Presently any large scale clearance of land for agricultural purposes require the permission of Environment Impact Assessment. This is an excellent instrument which also allows for people to participate in the process of environmental protection.

- Consequences of Agro-forestry

Agro-forestry is an old concept which was practised by farmers of Sri Lanka for thousands of years. Organised agro-forestry with the involvement of Government Agencies like the Department of Forests is, however, a new phenomenon. The impact of this programme is not strongly felt as yet.

- Agricultural and agro-industrial residues

Since agricultural and agro-industrial residues are mainly bio-degradable, the damage to environment from this source is negligible. The agricultural residues which are generated on a large scale are paddy straw and sugarcane bagasse. In some parts of the country, straw is fed into paper manufacturing plants. The effluence of these plants pollute waterways etc. However, much of the straw is re-cycled and used again in paddy fields for mulching purposes.

Paddy husks of the paddy mills tend to pollute the environment, as no proper uses have been developed for this residue. Very often paddy husk is dumped by roadsides which tend to clog streams and drains.

11.4. Impact of pollution from other sources on agriculture

- Air pollution, global warming

No major environmental impacts have been observed through livestock production. Cattle rearing has been practised for thousands of years, and it was an integrated farming system. Cattle owners manage the cattle in a manner that there is no over-ranching. Furthermore, the cattle enrich the soil through their dung, maintaining an excellent harmony with the environment. Sometimes pigs serve as vector of diseases such as Japanese Encephalitis.

Increases in the production of agricultural crops have been achieved mainly through extensive cultivation. The Government is making a strong effort to increase the productivity of crops through research and extension activities.

The contribution of agricultural and livestock products to air pollution and global warming is very marginal. The agricultural practice of impounding water to kill the waste leads to the emission of methane gas, and the Department of Agriculture is discouraging this practice.

11.5. Agricultural Policy

The Sri Lanka Government, since independence, was pursuing a policy towards self-sufficiency in rice and other staple crops. Large investments were made in this area, during the last three to four decades. The emphasis on intensive cultivation started only two decades ago, as the arable area was diminishing fast. Presently there is emphasis on increasing the productivity. However, greater inputs are needed in research and development for productivity.

With the expansion of irrigated lands under major schemes, such as the Mahaweli, the scope for crop diversification is increasing, and the need for a more rational use of land and water is becoming evident. Research has shown that a variety of field crops would be better suited than rice in the irrigated areas of the dry and intermediate zones where the soils are highly permeable.

The Government has regularised large extents of chena lands, which are cultivated on a shifting basis.

The Government has always offered the infra-structure services for agricultural development. Some of the protection measures offered to the farming communities have been gradually withdrawn. The fertilizer subsidy was withdrawn 5 years ago. However, the Guaranteed Price had been increased progressively during the last 2-3 decades. Whereas the Government purchased paddy on a monopoly basis during the early years, it has now withdrawn itself to the position of a buyer of last resort.

11.6. Conclusion

The export agricultural sector which includes coffee, pepper, cinnamon, cloves, cardamom, cocoa, etc., has gained prominence in recent years. There is potential to increase the output by adapting better management practices.

There is scope for expansion of the animal husbandry sub-sector, particularly in relation to milk production. Pig and poultry production are considered important, in view of the self-employment opportunities they provide for the poor and the unemployed.

Sri Lanka has not entered into the agro-processing stage as yet. The bulk of the agricultural exports are sent out in unprocessed form. The profits off agricultural exports would increase substantially, if the steps are taken to add value.

The prospects of exports of major agricultural commodities like rice appears to be poor, even if Sri Lanka can produce a surplus. However, since large sums of money are spent on the import of food items such as rice and wheat flour, a strong import substitution programme can be extremely helpful to conserve foreign exchange.

CHAPTER 12

INDUSTRY

12.1. Introduction

The Manufacturing Industry in Sri Lanka comprises of a few large scale operated industries including petroleum, cement, and paper, which are established outside the main cities, and the small and medium scale industries which are established in or near cities. There are several industrial estates, mostly focused on export oriented products.

As a result of liberalisation of the economy in 1977, there was a growth of 6% per annum in the industrial sector, during the period 1980-87, including significant growth in the textiles, food processing and leather sub-sectors. The New Industrialisation Policy (NIP), was formulated in 1989, and was complemented by the issuance of the Industrial Promotion Act No. 40 (1990). NIP prescribes deregulation and devolution of the public sector enterprises to foster a more competitive atmosphere and allows for provision of infrastructure assistance in management improvement along with incentives to reduce production costs. The contribution of Industry to the Gross National Product (GNP), in 1992 was 18.8 per cent. (Ref: Annual Report 1992 - Central Bank of Sri Lanka).

The Government's overall development strategy is to achieve Newly Industrialised Country (NIC) status by the year 2000, and, in this context, there is likely to be a proliferation of industries in the next few years.

12.2. The industry - environment relationship

Industrial processes produce a number of by-products which are treated as waste, unless reprocessed and channelled into further industrial productions. But eventually, there will be a final stage at which by-products cannot be efficiently utilized any further, but can only be disposed of through waste disposal systems. Improper waste disposal systems create inevitable pollution of the environment, resulting in the destruction of eco-systems and damage to human health. With regard to pollution prevention, unless the costs and benefits are internalised, the polluter may not be induced to take steps to control pollution, particularly if one person or institution has to bear the full costs and benefits spread to others or future generations.

12.3. Main Development in the Industrial Sector

- Sector Trends

In the private sector, the industrial sub-sectors which recorded large increases in production are textile and wearing apparel; chemicals, rubber and plastic; non-metallic minerals, and paper and paper products. To attract investments in less developed areas, a new incentive package was also introduced in 1992.

A number of major public sector industries were converted into limited liability companies on the government policy of privatisation.

- Regional trends of Industrialisation

Regional Industry Service Committees were set up in 1992, to promote, facilitate and coordinate industrial and related activities in the provinces under the Industrial Promotion Act (1990). The Central Environment Authority (CEA), is represented in these committees so as to address the environmental issues.

- Technological changes and related environmental significance

Many of the point sources polluting the environment are industries. The need for an effective industrial pollution managed strategy has been recognised. While providing adequate effluent treatment plants to mitigate the ill-effects of pollution, it is very important to introduce new clean technologies or to improve the manufacturing process to generate less pollution. In this context, technologies for recycling or recovery are of vital importance.

- Internationalisation of industrial production and markets

Although there are incentive packages to attract foreign investments, so far Sri Lanka has not been able to exploit this advantage fully, due to the lack, till recently, of an effective and aggressive marketing strategy; our share of the total inflow of foreign direct investments into developing countries has been minimal.

12.4. The Environmental Impact of Industry

- Consumption of non-renewable resources

Many industries in Sri Lanka are dependant on imported raw materials, but some use non-renewable local resources. For years coral reefs have been subject to large scale mining for the manufacture of lime required in the building industry. Mining coral for lime manufacture also occurs inland, where large deposits can be found along the southwest coast. Mining reduces the coral reef barriers against wave erosion, destroys the habitat of a large number of marine fauna and flora, including economically important fish species. The coast Conservation Amendment Act (1988), imposed severe restrictions for coral mining, but due to political pressures arising from socio-economic conditions, there has been very little enforcement.

Sedimentary limestone deposits in the Jaffna peninsula and the northwestern coastal belt are also used as raw material in cement manufacturing.

- Air Pollution

Air pollution in Sri Lanka is yet at a moderate level, compared to that in many other countries, and compared to the pollution of water bodies and soil in Sri Lanka. It is envisaged, however, that air pollution will become a major cause for concern, within the next decade.

Some industrial activities contribute to air pollution by emissions into the atmosphere at low elevations. These emissions include combustion of waste in the open, fumes and vapours from reactors and incinerators, solvents and acid fumes from extraction systems, and dust emissions, especially from cement factories.

One of the major causes of air pollution in Sri Lanka is vehicle emissions. This will be discussed in Chapter 14.

Air pollution could also arise from air currents bringing in pollutants from neighbouring countries. Regional agreements between countries will help to prevent trans-boundary air pollution, which may occur if nuclear power plants and thermal power plants are established in South India.

– Water Pollution

In Sri Lanka water pollution is one of the chronic problems, caused mainly by sewage, fertilizers, pesticide, and industrial effluent.

Most of the small and medium industries are concentrated in Colombo and the neighbouring Gampaha district, and their main impact is on the quality of water. Many of the textile, dyeing and printing industries have caused widespread pollution, especially in the Moratuwa-Ratmalana area, south of Colombo. Paper, Rubber, Distilleries, and Tannery industries, also cause severe pollution to water bodies in Sri Lanka. The industrial estates at Katunayake and Biyagama in the Gampaha district are equipped with treatment plants, but, most of the other industrial estates have no proper waste treatment facilities. Arrangements are being made under World Bank assistance, to establish common treatment plants at Ekala-Ja Ela Industrial estate in the Gampaha district and the Ratmalana industrial estates.

To mitigate the water pollution of the Kelani river, which is one of the largest rivers in Sri Lanka, and which supplies most of Colombo's potable water, the Government recently took a decision to declare the Kelani river basin as a environmentally sensitive area.

The economic, social, health and biological impacts of water pollution, interlink with each other. Although all these impacts cannot be quantified, efforts can be made to measure long-term and short-term economic costs of water degradation. Such evaluation will help in the environmental impact assessments of projects, which impact on the quality of water.

– Solid Wastes

In Sri Lanka, most of the solid wastes generated by industry ends at on-site disposal. The combustible solid wastes are mostly disposed of by burning on-site, or, occasionally, in low technology, simple fixed hearth incinerators, with limited or no control facilities. The non-combustible wastes are generally disposed of by dumping on or off sites. Some solid wastes are collected by third parties paid to take them away. Most of the dumps are open.

There are serious detrimental features of the open dump. The fires, if uncontrolled, may cause excess smoke, and contribute to pollution. Rain and flood water may enter the dump and remove a quantity of dissolved and suspended matter, including pathogenic micro-organisms, into water bodies.

Some industries that have invested in effluent treatment systems are at present considering modifications of these systems, or, planning in favour of new and improved systems. In this context, industrialists require assistance with regard to specifications and technology for the modified/new systems to comply with the standards laid down by the Central Environment Authority (CEA).

– Toxic and hazardous wastes

Cleaning and surface treatment and preparation processes generate most common hazardous waste in Sri Lanka. Wastes identified from these processes include solvent wastes (cleaners and thinners), alkaline digressers, alkaline phenolic digressers, and acid surface treatment chemicals. Hazardous wastes are also generated by some textile industries, especially those that operate bleaching, dyeing, and printing processes.

Some of the hazardous wastes are generated in a relatively dilute form which requires periodic emptying, de-sludging, and cleaning. Such discharges can have major consequences for industries that have biological waste treatment plants, killing all or part of the bacteria population.

The common disposal methods of cleaning solvents are:

- (i) collection by contractors, or, removal by employees for various purposes;
- (ii) disposal to land and local water bodies via effluent discharge, or, via soakaway pits, or, in some cases directly; and
- (iii) evaporation on-site, followed by the disposal of residual solids on or off site.

The on-site storage of hazardous wastes could cause significant environmental pollution rapidly, if the storage area is subject to flooding, or possesses a high water table, but eventually, even if otherwise. Even the hazardous waste taken away by contractors or employees, may be disposed of as per (ii) or (iii) above, and cause damage to health and the environment. The highest priority should therefore be given to minimize the generation of hazardous wastes.

– Environmental health for workers

The environmental health for workers is covered by the Factory Ordinance on control of hazards caused by toxic chemicals to workers. Increasingly, export orders are subject to environment safeguards being taken to protect the health of the workforce.

12.5. Policies for Environmental Impacts from Industry

The enactment by Parliament of the National Environment Act (NEA) of 1980, the establishment of the Central Environment Authority (CEA) in 1981, under this Act, and the creation of a Ministry of Cabinet rank to be primarily in charge of the subject of environment on 1990, are major national initiatives taken by the Government to protect the environment.

An environmental protection licensing scheme was introduced in 1990, under which, existing industries must obtain a licence from the CEA.

The Environmental Impact Assessment (EIA) regulations (1993), under NEA, are now part of the law. Under these regulations, an Initial Environmental Examination (IEE), or EIA report, as the case may be, will have to be submitted to the relevant project approving agency, as a condition of clearance of polluting projects.

A new Government initiative relates to the location of high and medium polluting industries. In terms of this decision, the industries classified as high polluting as well as medium polluting industries, which generate large quantities of solid/liquid waste effluent should be located only in designated Export Processing Zones (EPZ), or Industrial Estates/Parks. Any deviation from this rule, will be considered only on technical and economic considerations, under exceptional circumstances, to be determined by a special committee.

New strategies are being worked out in respect of least cost pollution abatement and control, policy guidance and criteria for grouping new industries by waste type and location, reliable pollution monitoring and testing systems, including a laboratory accreditation scheme, development of hazardous waste treatment and disposal systems, alternate funding mechanisms for pollution monitoring and control functions, framing of additional legislation and regulations, establishing an organizational framework at the national, provincial and local levels for industrial pollution monitoring and control, and developing training programmes for pollution control for the relevant organizations.

At present, US\$ 5 million is available for waste minimization and pollution control purposes. Existing industries are able to obtain upto US\$ 10,000/–, as a grant for hiring consultants to develop a waste minimization and end-of-pipe treatment programme for the industry. Upon acceptance of the pollution prevention and control plan, the industry would be eligible for upto US\$ 50,000/–, as a soft loan.

12.6. Conclusion

The Government's overall development strategy is to achieve Newly Industrialized Country (NIC) status by the year 2000. In keeping with this national development target, the Government is in the process of institutionalizing environmental appraisal in the economic evaluation of development projects. It has been recognised that an Industrial Pollution Management Strategy will also be an important component of the overall Environment Management Strategy.

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CHAPTER 13

ENERGY

13.1 Introduction

Sri Lanka's per capita energy consumption, both commercial and total, is much less than that for Asia and the World (1). Even among the South Asian countries, it ranks only above Nepal and Bangladesh for commercial energy and above Bangladesh for total energy (see Table 13.1). With about 80% of the people living in rural areas, their life-style is such that energy is utilized only to meet the essential needs of day-to-day living, cooking, lighting and transport, which account for nearly 80% of the total energy consumed.

Sri Lanka's indigenous sources of primary energy are hydro-electricity and bio-mass, including fuelwood. Crude petroleum oil together with some refined products and small quantities of coal are imported.

With hydro-electric sources approaching the limits for economic development, the future expansion of electricity generation will have to depend on diesel or coal fired thermal power. However, such a shift in generation sources will have to be at the expense of air pollution, caused by the emission of sulphur and nitrogen oxides, which hitherto have remained at tolerable levels.

13.2 Status and Trends

- Total Energy Scenario

The country's total energy supply during the period 1990-92 is shown in Table 13.2 (2,3,4). The fossil fuels shown include imported crude petroleum oil and refined products imported to supplement locally refined products as well as coal.

Biomass sources include firewood and bagasse. A calorific value of 3800 kca/kg for firewood and for hydro-electricity a conversion factor of 10.0 GJ/MWh were used in expressing the energy values in one common unit. During the period 1990-92, on an average, hydro-electricity has contributed 11%, petroleum 30%, and biomass 59% to the primary energy supply.

- Hydro-electricity

Though hydro-electricity contributes only about 11% to the total energy supply, it is the predominant source of electric energy, contributing 80-100% depending on rainfall. The total installed capacity of hydro power plants is 1115 MW, which could generate about 3785 GWh annually, under average hydrological conditions (6). Additional potential for hydro power development in the country has been identified as 870 MW, all of which may however, not be economical to develop (7).

- Thermal Power

The existing thermal power generation is limited to three plants having a total installed capacity of 216 MW. These are used to supplement hydro power plants during lean rainfall periods. During 1986 and 1990, they were hardly used, while in 1987 and 1992, contributed nearly 20% of the total electricity generated. These plants operate on heavy diesel or residual oil, having a high sulphur content (2.5-3.5%).

- Petroleum Products

Sri Lanka imports a substantial amount of refined petroleum products, in addition to the bulk of crude oil. These include diesel, kerosene, LPG, and aviation fuel. The transport sector is totally dependent on petroleum products, which consumes more than half of all petroleum imported. The balance is shared between the domestic and industry sectors. Table 13.3. shows the consumption of petroleum products in the different sectors, during 1990-92.

- Biomass

Biomass including fuelwood, bagasse and charcoal constitute around 60% of the total energy supply. In rural areas, it is available as a non-tradeable commodity, and hence records of its supply are not maintained. Over 80% of biomass is consumed in households for cooking purposes and the balance in industry, particularly the rural industries. The average estimated quantities consumed during the period 1990-92, in the different sectors are 8600 kt in households, 1700 kt in industry, and 290 kt in the commercial sector. A detailed field study carried out on the consumption of biomass in the country has shown a per capita consumption of 1.36 kg per day (8). According to the same study, 18% of the firewood consumed in the domestic sector came from uprooted rubber plantations, 29% from crop wastes, and the balance from scrub and forest trees as well as home garden and estate trees.

13.3 Efficiency of Utilization

- Cooking

The majority of households use 3-stone open fire places or built-in mud stoves for cooking purposes. The efficiency of these traditional devices is not more than 10%. The recently introduced fuel efficient stoves are found to have efficiencies about 30% better than the traditional devices (9). Since 75-80% of the total biomass consumed, or 45-48% of the entire energy consumed is utilized for domestic cooking, a 30% saving of fuelwood will contribute significantly in conserving the total energy consumed in the country.

- Lighting

The dominant load on our electricity system is lighting, which is indicated by the fact that the system demand peaks between 6 and 9 p.m. The majority of the lighting systems use traditional incandescent lamps, which have a very low lighting efficiency. A significant improvement can be obtained by replacing these lamps with energy efficient compact fluorescent lamps. The electricity consumption can be reduced by a factor of about 3/4 by using these lamps, which also claim to have a much longer life time. The only snag, however, is their high cost, which is presently about a factor of 25-30 more than that of an incandescent lamp.

13.4 Future Demand and Supply

- Energy Sector

The electricity generation over the last twenty years has shown an average growth rate of 6.8% annually (6). With the Government's policy of rapid industrialization and rural electrification, an annual growth rate of 8.3% has been assumed in forecasting the electricity load upto the year 2013, which is shown in Fig. 13.1 (6).

Seven hydro power sites have been identified, and pre-feasibility or feasibility studies have been carried out for development in the future. Their total installed capacity is 476 MW, and the estimated generation capacity is 1838 GWh/year (6). Due to the environmental considerations, some of these sites are limited to the run-of-the-river operation.

Options for the thermal power generation is a mix of coal, diesel and gas-turbine plants including one combined cycle plant. The total installed capacity planned upto the year 2000, is 556MW. This is to be increased by another 720 MW by the 2008. Two of the power plants, one 40 MW diesel and the other 300MW coal power plant, are to be built and operated by the private sector, on a guaranteed buy-back agreement at a rate which is above the cost of generation in the public sector. With the proposed expansion of thermal power generation capacity, the estimated consumption of fossil fuel during the years 2003 and 2013 in the energy sector, would be 33.85 PJ and 133.89 PJ respectively (6).

- Industry Sector

The consumption pattern of petroleum and biomass in industry during the period 1980-1990, does not indicate any consistent trend, perhaps due to the closure of several industries during the time of the civil disturbances in 1988 and 1989. Hence, forecasts are made using the 1990 values as the base, and adopting an annual growth rate of 8% for industry as given in long-term energy demand forecasts (3). The resulting demand for the years 2003 and 2013 would be 79 PJ and 159 PJ, respectively.

- Domestic Sector

The consumption of LPG, kerosene and biomass in the domestic sector would grow along with the growth of the population, which is 1.5% annually. Estimates made on the basis of 'business-as-usual' scenario, for the consumption of kerosene, LPG and biomass in the domestic sector are given in Table 13.4. These estimates do not take into account any possible shift from biomass to LPG for cooking, or from kerosene to electricity for lighting, during the forecast period, due to changes in income levels of people.

13.5 Energy and the Environment

- Thermal Power Plants

With the introduction of coal and diesel fired thermal power plants, emissions of CO_2 , SO_x , and NO_x , are expected to increase after the year 2000. The emission of CO_2 will surpass CO_2 emissions from all other sectors after the year 2005, and other emissions even before. Details are shown in Fig. 13.2 and 13.3 (6).

- Renewable Sources

The construction of large water reservoirs could affect the micro-climate of the country. However, no study has been done in this area. Hydro reservoirs are also expected to generate emission of Methane, a greenhouse gas. Even in this sector, no studies have been done.

Biomass combustion for energy purposes is estimated to emit 9200 Gg of CO_2 , 1680 Gg of CO, 10 Gg of CH_4 , and 30 Gg of NO_x , annually (10). The use of fuel efficient stoves in the domestic sector, and gasification in the industrial sector, could reduce these emissions considerably.

13.6. Integration of Environmental Concerns in Energy Policies and Plans

Hitherto, environmental costs have not been included in the feasibility studies of power projects. This situation has now changed. For hydro power plants, the value of inundated land, forest, crops, and relocation of people are taken into consideration. This still excludes the cost of any long-term environmental damage, such as that done to the ecology of the area, extinction of rare species of flora and fauna, and changes in the micro-climate. For thermal power plants, the cost of short-term effects are included, but again not the long-term effects, such as the possible effects of acid rain. Environmental Impact Assessment Studies on any major power project are now mandatory, and these are incorporated at the preliminary stage. However, the Ceylon Electricity Board is not geared to undertake these studies themselves, and it has to depend on external resources.

13.7. Conclusion

Sri Lanka's per capita energy consumption being very low by world standards, damage to the environment by the energy sector is still not a serious problem. However, a shift from hydro-electricity to thermal power in the future, could bring about the emission of polluting gases beyond safe levels, unless suitable mitigating measures are incorporated into the system, though at extra cost to the consumer.

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Reference

1. The World Resources Institute, World Resources 1992-93, A L Hammond Ed. Oxford Press, New York, 1992, p.317
2. International Energy Agency, Energy Statistics and Balance of Non-OECD Countries 1989-1990, OECD, Paris p.251
3. Report on Sectoral Energy Demand in Sri Lanka, Regional Energy Development Programme, ESCAP/UNDP, 1992
4. Sri Lanka Energy Balance and Energy Data, 1991, Ceylon Electricity Board, 1993
5. Sri Lanka Energy Balance and Energy Data, 1992, Ceylon Electricity Board, 1994
6. Report on Long Term Generation Expansion Planning Studies 1994-2008, Ceylon Electricity Board, August 1993
7. Master Plan for the Electricity Supply of Sri Lanka, GTZ/CECB, 1989
8. Wijesinghe, L C A de S, A Sample study of biomass fuel consumption in Sri Lanka households, Biomass 5 (1984), 261-282
9. Herath, M B and Atapattu, A M M, Monitoring field performance of four types of improved fuel wood stoves developed in Sri Lanka, The Sri Lanka Forester 18, (3/4), 109-114
10. Ratnasiri, P A J, Greenhouse Gas Inventory for Sri Lanka (1990), in Proceedings of Latin American Regional Workshop for Estimating National GHG Emissions, Sao Jose dos Campos, Brazil, March 1993

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Table 13.1

Per Capita Energy Consumption during 1989

Source	Electric Energy GJ	Commercial Energy GJ	Total Energy GJ
World		57	67
Asia		23	28
Bangladesh	71	2.5	5
India	337	8.8	13
Nepal	39	0.4	12
Pakistan	386	8.4	12
Sri Lanka	153	4.2	9

Source: World Resources 1992/93, World Resources Institute New York, 1992

Table 13.2

Primary Sources of Energy during 1990-1992

Source	1990		1991		1992	
	PJ	%	PJ	%	PJ	%
Hydro Electricity	31.5	11.2	31.3	11.2	29.1	10.2
Fossil Fuel	83.5	29.9	80.9	29.0	86.6	30.2
Biomass	164.1	58.9	166.2	59.8	170.8	59.6
Total	279.1	100.0	278.4	100.0	265.5	100.0

Table 13.3

Consumption of Petroleum Products

Sector	1990		1991		1992	
	PJ	%	PJ	%	PJ	%
Transport	33.60	64.6	32.1	60.3	37.13	56.6
Industry	7.27	14.0	6.62	12.5	7.53	11.6
Household	7.45	14.3	8.07	15.2	9.12	13.9
Agriculture	1.76	3.4	1.70	3.2	1.68	2.5
Commercial & other	0.72	1.4	0.35	0.6	0.40	0.6
Energy Generation	0.09	0.2	2.90	5.4	8.59	13.0
Non-Energy Use	1.13	2.1	1.50	2.8	1.19	1.8
Total	52.02	100.0	53.20	100.0	65.64	100.0

Table 13.4

Forecast of energy consumption in the
Domestic Sector

Fuel	Consumption in PJ		
	1991	2003	2013
Kerosene	6.32	7.55	8.63
LPG	1.24	1.49	1.71
Biomass	138.78	165.85	189.66
Total	146.34	174.89	200.00

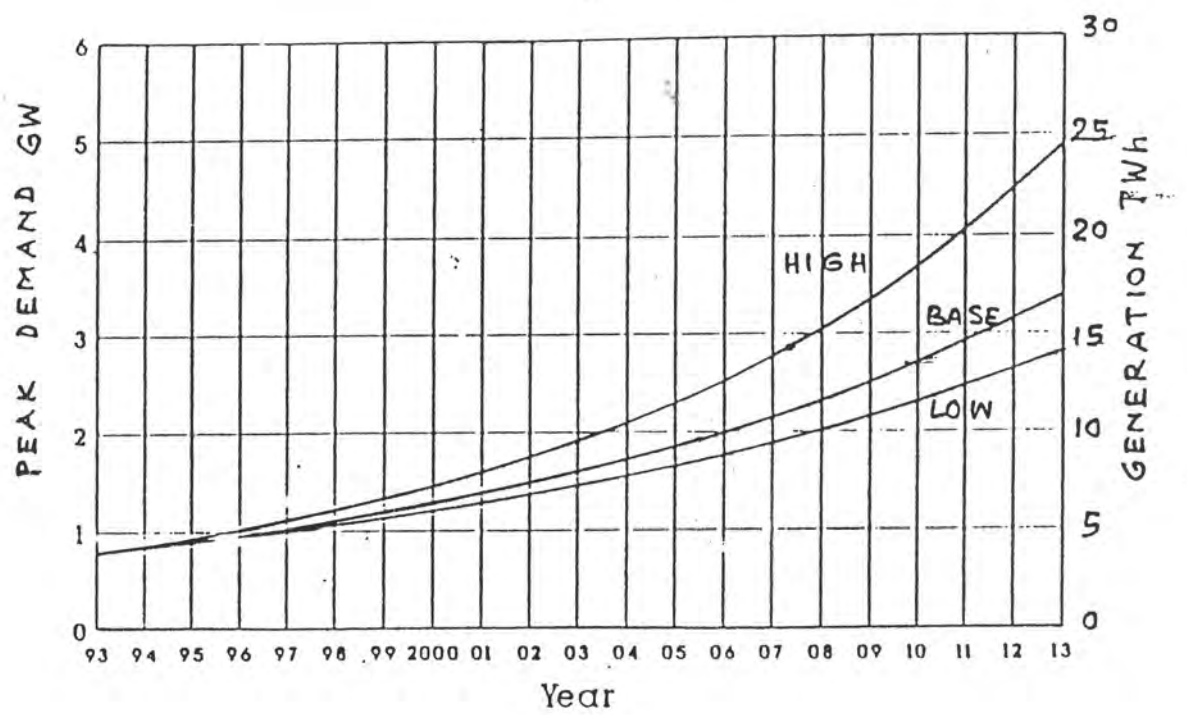


Figure 13.1 - Energy and Peak Demand Forecasts

Fig 13.2(a) Expected power sector CO2 emissions

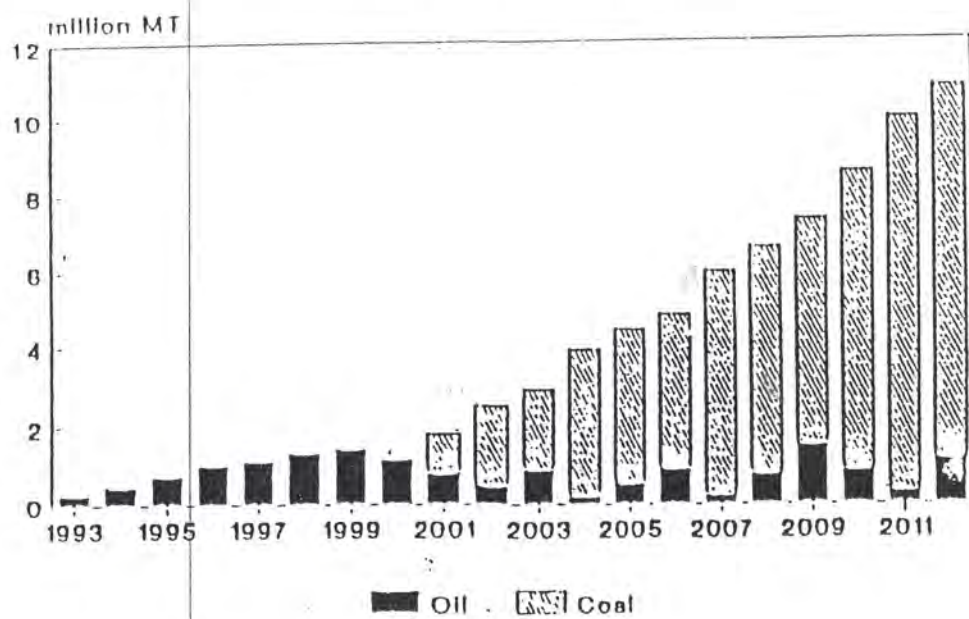


Fig 13.2(b)- CO2 emissions by sector

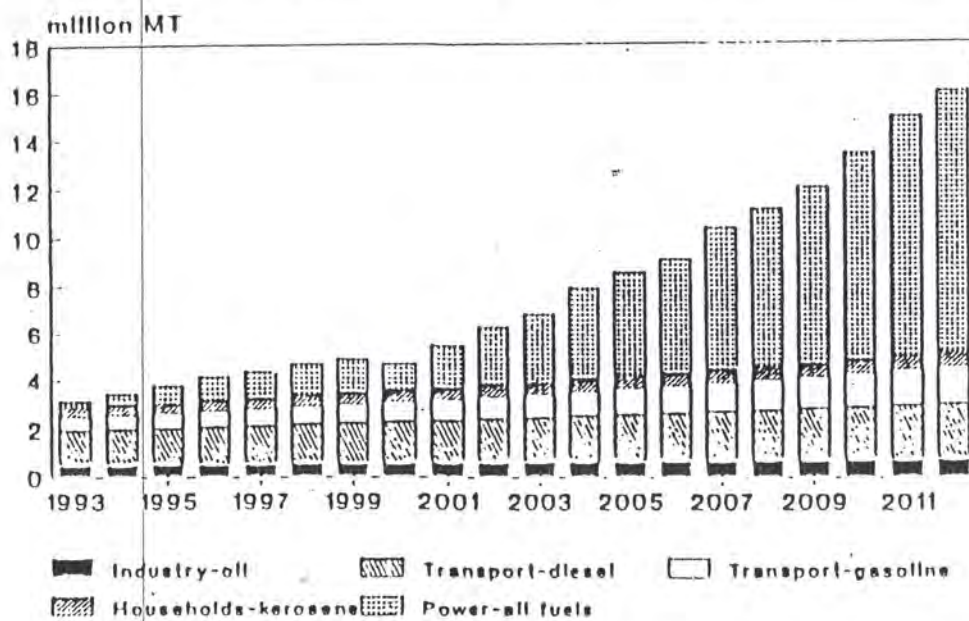


Fig 13.2(a) Expected power sector CO2 emissions

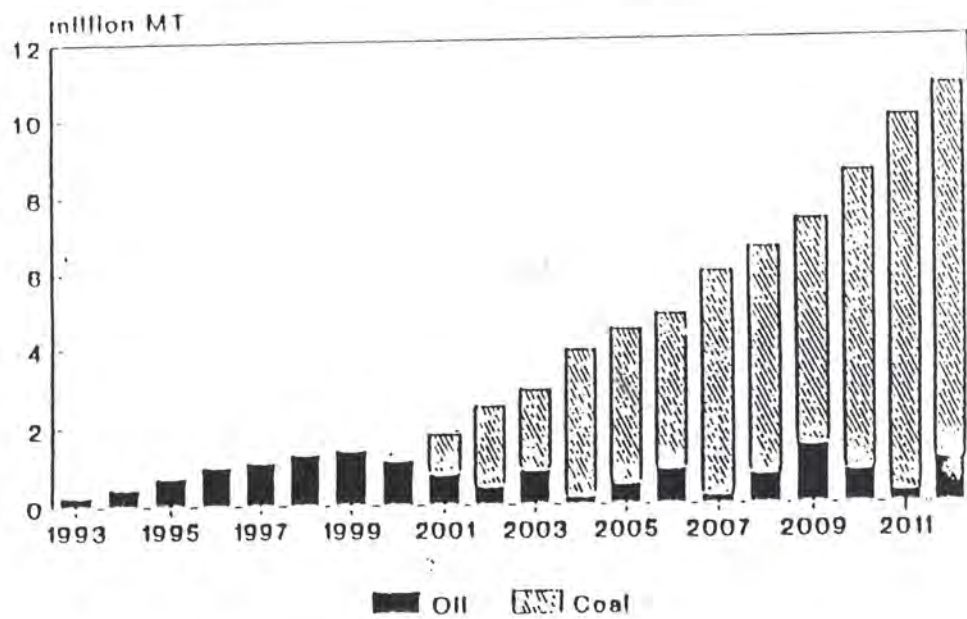
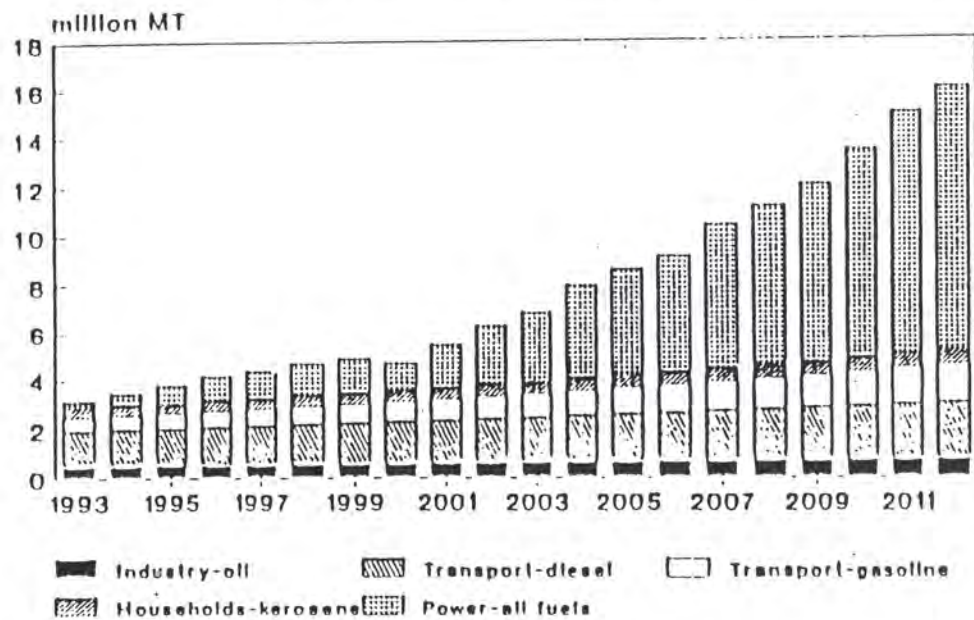


Fig 13.2(b)- CO2 emissions by sector



CHAPTER 14

TRANSPORT

14.1. Introduction

People in Sri Lanka depend largely on public transport as a mode of conveyance, the most popular being bus transport. It caters to more than 80% of the total passenger traffic in Sri Lanka. With the average per capita income in the country being about US\$ 500, the use of a private motor car is beyond the means of an average Sri Lankan. The average population of motor cars in use is about 5 per thousand people.

Even for the more affluent, the purchase of a motor car had been restricted, as the import of private vehicles was limited, up to recent times, to those who have foreign exchange overseas.

The transport operations are controlled by the Department of the Commissioner of Motor Traffic (CMT), acting under the Motor Traffic Act. The Highway Code is enforced by the Traffic Division of the Police Department.

14.2. Vehicle Fleet

– Registration of Vehicles

Under the Motor Traffic Act all vehicles have to be registered. The issue of the annual revenue licence has now been decentralized and is operated at the District level by the District Secretariats. In order to avoid the rush for licences at the beginning of the calendar year, which was the system in operation up to a few years ago, licences are now issued on the basis of the year commencing from the date of first registration. The annual revenue licence has to be displayed on the front windscreen of the vehicle.

The registration number is displayed on the number plates of the vehicle, and is issued once in the lifetime of a vehicle, unless the engine is changed, when a new registration number is issued. The registration number comprises of two sets of numbers separated by a dash. The first set of numbers describes the type of vehicle and the fuel used. The second set is a four digit serial number. Apart from the type of vehicle such as a private motor car or motor cycle or lorry, the registration number also identifies special user categories such as the diplomatic corps and the armed services. It has been observed that annual revenue licences are only renewed only by about 60–65% of the total number of vehicles registered. It is presumed that this is partly due to some vehicles being taken off the road, due to age, and partly due to some vehicles operating on the road without obtaining licences every year.

– Vehicle population

The total vehicle population as recorded in the CMT Department databank, is given in Table 14.1 (1). The private motor car population has doubled during the period 1975–1992. Its annual growth rate has been about 6%. However the highest growth rate was in respect of motor-cycles, which indicated a growth of more than a factor of 20 over the same period. The annual growth rate has been about 27%.

A new class of dual-purpose vehicles has been introduced in recent years to accommodate vans manufactured for cargo transport, but actually carry passengers with seats added locally. The import duty and other tax structures are such that it is very much cheaper to convert cargo vehicles for passenger transport, rather than import vehicles designed and constructed for passenger transport, which have the necessary safety features for passenger comfort.

In view of the Government's policy of allowing private companies or individuals to operate bus services for public transport, the public sector bus population showed a slight decline during the last decade, while the private bus population has grown to a level exceeding the public sector bus population by a factor of more than 2. However, most of the vehicles added by private operators are 15/25 seater capacity vehicles, which operate mainly on short distance routes in the cities and rural areas. Long distance travel on main highways are however served by normal size buses.

The lorry or truck population has grown by a factor of 3 since 1975, with an annual growth rate of about 3%. The hauling of goods is done by lorries, which are mostly individually owned, except for a few owned by transport firms. One noteworthy feature in Sri Lanka's vehicle population, is the high proportion of re-conditioned vehicles imported into the country, both private motor cars and commercial vehicles, which is around 70-80%.

- Fuel pricing

Almost all vehicles are operated only with gasoline or diesel. The amount of diesel sold exceeds that of gasoline by a factor of about 3. In 1992, 420,000 tons of refined diesel was imported to supplement the locally refined stocks. Since diesel operated vehicles such as buses and lorries serve the needs of the masses, diesel is sold at cost which is around Rs. 12/- per litre, while gasoline is sold at Rs. 35/- per litre. In view of this price difference, it has been found that there is a shift towards importation of diesel vehicles even for other uses, including motor cars and vans for family transport and commercial uses in recent years. To arrest this shift, a Committee has been appointed to study the diesel fleet make-up, and propose an alternative pricing structure, to achieve a lower diesel share, with minimal social cost.

14.3. Vehicle Operation

- Vehicle - Kilometres

Based on a survey carried out by the Transport Study and Planning Centre, the annual vehicle-km operated by each category of vehicles has been estimated, and is shown in Table 14.2., for the year 1992 (2). The highest value is in respect of motor-cycles. Vans have recorded the next highest figure. The same table also gives the estimated population of different types of vehicles in actual use. The study has also estimated the amount of fuel used by each category of vehicles for 1992. This information is useful in working out the amount of pollutants emitted from vehicles, the specific rate of which depends on the category of vehicle.

- Passenger Traffic

Passenger traffic carried by public transport for the years 1990-92, is shown in Table 14.3 (1). The average load factor for the public sector bus service has been high - 85% for 1988, and 92% for 1989. Yet, the bus services operate only with marginal profits, mainly because of the very low passenger fares, perhaps the cheapest in the region. The minimum fare for one section of a route, which is a distance of 1-2 km, is Rs. 1.50, while the average long distance fare is less than Rs. 0.20 per km. It is not unusual therefore, to see, during peak hours, buses carrying passengers almost twice their capacity.

- Transport infra-structure

Sri Lanka has a total of 25,750 km of metalled and bitumen surfaced highways. These are maintained by the Road Development Authority, except in municipal council areas, where the councils maintain the roads. The island is well covered by the network of highways, except in

the rugged mountainous and forest reserve areas. The total length of railway lines is 1400 kms. A new railway line of a length of 80 kms is under construction in the southernmost part of the country.

Sri Lanka's highways are limited to two-lane paved roads. Though some parts of the major highways have dual carriageways, they cannot be considered as four lanes. With the high population of low power motor-cycles, three-wheelers, bicycles, and even bullock carts, the outer lanes are always occupied by such slow traffic, that only the two centre lanes are available for regular motor traffic. Even the recently rehabilitated major highways, with IBRD funds, remain as two-lane highways. No fly-overs exist or are even planned at major inter-sections, or at railway crossings, except for a few built when the roads were originally constructed.

14.4. Environmental Issues

- Land consumption

With the high density of population in the urban areas, and the scarcity of land, widening the existing highways, and construction of new ones, poses a problem. Litigations over acquisitions of property, payment of compensation, and re-settling of people who lost property, are some of the socio-economic problems encountered, when attempts are made to widen or construct new highways.

Blueprints have been prepared for a 25 km expressway, from the city to the airport with limited access. The proposal is however facing stiff opposition from the public who are displaced, due to acquisition of land.

- Energy consumption

The transport sector is totally dependent on imported petroleum. The amounts consumed during the years 1990-92, are shown in Table 14.4 (1). The average energy consumed in the transport sector during this period has been 42.5% of the total commercial energy consumed, and 14% of the total energy consumed. Another noteworthy feature is that while the gasoline consumption has dropped by 9.1%, the diesel consumption has increased by 21%, reflecting the shift from gasoline vehicles to diesel vehicles, due to their price difference.

- Air Pollution

The main emission from vehicles is CO_2 . Partial combustion of carbon in the fuels emits CO. The reaction between oxygen and nitrogen in the air inside the cylinder yields NO_x . Any sulphur in the fuel yields SO_2 . Both methane and non-methane hydrocarbons are also emitted. The addition of lead into gasoline causes lead pollution. The emission factors other than CO_2 depend on the type of vehicles, emission controls incorporated and the fuel efficiency. One problem encountered in determining the emission from different classes of vehicles is the lack of direct data on the distribution of fuel consumption among them. Hence this quantity has to be determined through indirect means. Based on sample surveys, the annual average of vehicle-km has been determined. Using this data and assumed values for emission factors and fuel efficiencies, the emission levels of each pollutant has been estimated (3). These are shown in Table 14.5. The gasoline engines emit the highest amount of CO, and significant amounts of nitrogen oxides and hydrocarbons, while diesel vehicles emit high amounts of particulates and SO_2 , particularly from heavy vehicles.

14.5. Environment Concerns in Transport Policies

- Energy saving

Energy conservation has been accepted as a priority activity by the Government. Recently an Energy Conservation Week was held as a public awareness programme. Vehicles were checked for their fuel efficiency and general performance. The Government has also introduced an upper limit for the engine size for motor vehicles to be imported by public servants and members of the legislature.

- Plans for Urban Transport

Several plans have been prepared to build new highways to relieve the traffic congestion in and around the city during peak hours. In one case a 25 km expressway has been designed and preliminary work such as land acquisition has commenced. An EIA study has been completed and is awaiting public scrutiny. There are two other plans, one for a marine drive on land to be reclaimed from the sea, and the other for an extension of an existing highway. No rapid mass transit systems have been planned.

- Emissions Controls

At present no emission controls are in force. The Motor Traffic Act is being amended to make provision to introduce regulations for this purpose. To begin with, regulations will be introduced to limit smoke emissions from diesel vehicles, for which a consignment of smokemeters has already been purchased. The introduction of non-leaded petrol to the market is being considered with a view to enable vehicles to have catalytic converters to limit emissions from gasoline vehicles.

14.6. Conclusion

The owning and operation of private motor cars is beyond the means of the average Sri Lankan. The duty structure for vehicles is such that Sri Lankans are denied the opportunity to travel in comfort in vehicles designed for passenger transport. Overcrowding of buses is the rule rather than the exception. Highways development is hampered by scarcity of funds and land. Measures are just being taken, to control pollution by vehicles.

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Reference

1. Report on 'Transport Statistics in Sri Lanka, 1992'. Transport Studies and Planning Centre, Ministry of Transport and Highways, 1994
2. Report on 'Sri Lanka Road User Charge Study', Transport Studies and Planning Centre, Ministry of Transport and Highways, 1992
3. Report on 'Clean Air 2000 Action Plan for Air Quality Management in the Colombo Metropolitan Area', Metropolitan Environmental Improvement Programme, Battaramulla 1992

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Table 14.1

Registered Vehicle Population 1990-1992

Vehicle Type	1990	1991	1992
Motor Cars ¹	173,519	180,135	189,477
Motor Cycle	391,732	450,327	516,205
Private Buses	26,104	29,362	32,235
Public Buses	13,708	13,897	13,927
DP Vehicles ²	19,622	28,078	38,909
Lorries	100,400	103,540	107,583
Prime mover	1,271	1,281	1,281
Trailers	3,666	3,709	3,810
Ambulances & Hearses	855	931	1,065
Tractors	66,407	70,076	75,010
Total	797,7284	881,336	979,502

1. Motor cars include 3-wheelers

2. DP (Dual Purpose) Vehicles means cargo vans fitted with seats for passengers

Table 14.2

Vehicle operation data for 1992

Vehicle type	Estimated Operational population	Estimated Annual Vehicle-km (million)	Average Fuel Efficiency (km/litre)	Calculated Fuel Consumption (million litres)
Gasolene				
Motor cars	88,817	1,245	10.5	118.6
Motor Cycles	325,099	2,345	40.0	58.6
Challys	54,395	176	45.0	3.9
3 Wheeler	10,679	244	35.0	7.0
Van	17,083	210	8.0	26.3
Sub total		4,221		214.4
Diesel				
Motor car	4,872	138	12.0	11.5
Van	52,893	1,501	10.0	150.1
Lorry	28,576	1,034	4.9	211.0
Bus	19,680	1,099	5.0	219.8
Tractors	35,376	94	15.0	6.3
Sub total		3,867		598.8

Source : Sri Lanka Road User Charger Study 1992

Table 14.3

**Passenger Traffic carried by
Public Transport System**

Conveyance	Passenger Kilometers (millions)		
	1990	1991	1992
Public Owned Buses	13,614	14,327	16,098
Private Owned Buses	22,565	23,747	26,682
Trains	2,780	2,653	2,754
Total	38,959	40,727	45,534

Table 14.4

Consumption of fuel in Transport Sector

Fuel	Fuel consumed kt		
	1990	1991	1992
Road			
Gasolene	181.1	159.3	162.4
Diesel	511.1	538.0	604.5
Marine			
Fuel Oil	0.08	1.61	0.09
Gas Oil	1.79	1.85	1.79
Aviation			
Av-tur	61.92	72.71	81.40
Av-gasolene	0.24	0.21	0.18

Table 14.5

Estimated emission from vehicles

Pollutant	Emission t/Year
Carbon monoxide	199,700
Hydro carbons	38,360
Nitrogen oxides	5,930
Suspended Particulate matter	3,453
Sulphur dioxide	455

Source: Clean Air 2000 Action Plan Report

CHAPTER 15

TOURISM

15.1. Introduction: The Interfaces between Tourism and the Environment

Sri Lanka's diverse eco-systems, biological and cultural richness, and pleasant climatic condition, have attracted tourists from almost every part of the world, since the pre-independent period.

Sri Lanka experienced fifteen years of rapid expansion of the tourism sector, from the inception of organised tourism trade in 1967, upto 1982. Tourist arrivals increased at an average annual rate of over 20%, reaching a level of 407,230, which is the highest in the history of tourism in Sri Lanka. The ethnic violence in 1983, severely affected the tourism trade in Sri Lanka. Consequently, international tourist arrivals fell each year from 1983 to 1987. In 1987, 1988 and 1989, the tourist arrivals remained at between 182,620 and 184,732. A major recovery of tourist arrivals were observed in 1990 and 1991, with an increase to 297,888 and 317,703 respectively. The Gulf war and the global economic recession affected the tourism trade in Sri Lanka, severely limiting the increase registered, which was, nevertheless, the highest in the South Asia region.

As in any country in the world, interfaces exist between the tourism industry and the environment in Sri Lanka. The varied natural resources and the man-made attractions play a major role in attracting tourists to Sri Lanka. The development of natural resources for the tourism industry, has to be carefully undertaken in an organised manner. The success of environment dependant tourism can only be obtained through sustainable levels of development, and coordinated environmental management efforts, aimed at these natural resources.

Two unplanned tourism developed areas in Sri Lanka, i.e., Hikkaduwa and Negombo, led to socio-cultural and environmental problems affecting the whole community and the tourism industry. The beach is polluted to a great extent by domestic and hotel sewage, plastic waste used by tourists, and through other activities developed by people involved in tourism. Coastal erosion and beach pollution were also created by the construction of unauthorised structures catering for tourists, either on the beach itself, or close to the beach. These unplanned tourist structures, being built very close to each other, prevent public access to the beach and the sea. Varieties of nature hunts for the souvenir industry, such as corals, ebony timber, ivory, etc., will have negative impacts on the environment. Tourist may come and go, but the land, its people and the environment will remain, the very factors that attracted the tourists. If the tourism industry continues to develop in an unplanned manner, there will be a disastrous situation of tourism destroying tourism. Therefore, the natural resources and the man-made attractions should only be developed for tourism development, only in a planned manner, and at a sustainable level.

15.2. Trends in Tourism: state and changes

It is very evident that there is a significant domestic tourist and excursion activity in Sri Lanka. The domestic demand in the registered tourist hotels, show an increase of over five-fold, from 1982 to 1991, when it was 363,624 guest nights. The major location for domestic demand was Colombo City, which included the business demand. The coastal areas of the West and the South Coast, Kandy other Ancient Cities, and the Hill Country, all attracted significant demand, as shown in Table 15.1,

Table 15.1: Domestic Tourist Nights in Registered Tourist Hotels by Region

Region	1982	1988	1991
Colombo City	6,593	74,139	110,130
Greater Colombo	5,769	67,473	61,159
West & South Coast	19,421	67,417	80,703
East Coast	6,959	--	--
Hill Country	2,731	18,089	25,087
Kandy	2,567	46,754	46,452
Other Ancient Cities	17,418	24,271	40,036
North	4,292	--	--
TOTAL	70,750	298,143	363,624

Source: Ceylon Tourist Board

The domestic demand for registered supplementary accommodation increased almost four-fold, from 1983 to 130,096 bed nights in 1991, when domestic residents generated more bed nights than foreign tourists. Aggregating registered hotels and supplementary accommodation, domestic bed nights increased almost five-fold from 1982 to 1991, when they accounted for 16.2% of the total demand. It is evident that the registered accommodation accounts for only a minority of domestic demand. Unregistered units, pilgrim halls, and private homes account for a significant domestic demand.

Revised provisional estimates prepared by the World Tourism Organisation (WTO), indicate that the total international tourist arrivals declined by 1.4% in 1991, to 448.5 million. The average annual rate of growth in the international tourist activity in the period 1980 to 1991, was 4.1%. The WTO estimates that the world receipts from international tourism, at US\$ 261 billion in 1991, an increase of 2.3% over 1990. This produces an average rate of growth in receipts of 8.9% per year since 1980, at current price levels.

The WTO has made trend projections for international tourism in the 1990, at approximately 4% per annum, with 637 million arrivals expected in the year 2000. International tourism receipts, excluding fares, expressed in terms of constant relative prices, are expected to grow by around 4.5%. The major regional trends are expected to be:

- above average expansion in foreign travel from the main countries of South-East and East Asia; close to average growth in foreign travel by Europeans; below average expansion in overseas travel from North American countries;
- East Asia and Pacific is likely to resume its position as the fastest growing region, both in tourist generating and receiving terms;
- North America is well placed to achieve good growth in arrivals; Latin America will suffer from the slow down in North American markets, but will "hold its own", in other generating regions;
- Africa and South Asian regions have moderately promising prospects, much depending on the internal situations in the countries, and the pace of tourism infra-structure and facility development;
- Europe's main momentum will be provided later in the decade, by East European destinations, but some erosion of its dominant share of world tourist arrivals is anticipated;
- Inter-regional tourism will be the most prominent growth trend throughout the decade; within Asia, by the residents of Japan, Korea, Singapore, Malaysia, Hong Kong, India, and Taiwan; also within Europe, Latin America and Africa.

Western Europe is the main source region for Sri Lanka's tourists, accounting for almost two-thirds of the arrivals in the early 1980s, and still comprising over 60%. Asia is the second largest regional market. Its share is growing, and now exceeds 30%. The market share of North America, has been declining in recent years, as is shown in Table 15.2.

Table 15.2: Source of Arrivals by Residence 1971 - 1991

Region	1971 %	1976 %	1981 %	1986 %	1991 %
Western Europe	57.1	61.0	66.3	62.2	60.5
Asia	27.8	21.4	23.9	28.7	30.4
North America	8.9	5.3	3.8	4.0	3.0
Australia	2.9	3.5	2.6	2.5	3.1
Others	3.3	8.8	3.4	2.6	3.0
TOTAL	100.0	100.0	100.0	100.0	100.0

Source: Ceylon Tourist Board

The nine leading tourist generating markets share of the total tourist arrivals in Sri Lanka is declining, from 74.8% in 1981 to 71.2% in 1991. As shown in Table 15.3, Germany remains the largest tourist market. A notable feature over the decade, is the more than doubling of the market share of Japan.

Table 15.3: Leading Tourist Markets to Sri Lanka 1981 - 1991

Generating Market	1981 %	1986 %	1991 %
Europe:			
Germany	23.1	21.2	20.0
France	10.2	8.7	11.1
United Kingdom	9.7	9.2	9.9
Italy	5.4	6.7	7.3
Netherlands	2.7	2.6	3.8
Scandinavia	5.4	6.5	1.8
Asia:			
Japan	3.2	5.5	6.9
India	12.9	11.7	6.9
Australia	2.2	2.2	3.5
Leading Markets	74.8	74.3	71.2
TOTAL ARRIVALS	100.0	100.0	100.0

Source: Ceylon Tourist Board

The purpose of visit of the foreign tourists to Sri Lanka, is predominantly "pleasure" (holiday). The Table 15.4 gives the purpose of visit for 1991, based on the Ceylon Tourist Board data, and the estimates based on market research.

Table 15.4: Purpose of Visit of Tourists 1991

Purpose	CTB Data %	Estimates %
Pleasure	93.1	74.6
Business	3.8	13.0
Other	3.1	12.4
TOTAL	100.0	100.0

In Sri Lanka, 14 zones can be identified, considering the varying tourism characteristics and activity (figure 15.1).

Colombo City

Colombo being the capital, it holds major business activities, conferences, and major sports events. It is also a gateway and stop-over point for international tourists. The attractions include, the Mount Lavinia beach, the Dehiwela zoological gardens, the Bandaranaike Memorial International Conference Hall, Museums, and a number of festivals, historic monuments, and religious sites. The area lacks quality tourist shopping, night life and animation focus in Colombo, and the tourist attractions are limited. The general environment and the character are not "Tourist friendly".

Colombo region

The only major tourism centre in this region is the Colombo Katunayake International Airport, which is situated 32 kms from the city centre. The only other tourist attractions are, the Henarathgoda Botanical Gardens at Campaha, and the Bolgoda lake, for water sports.

West Coast: North of Colombo

The international beach tourism facilities are located in this area, with the major concentration in the Negombo resort. The infra-structure and the environment around them need upgrading. The fishing catamarans, sea food, the Dutch canal, and lagoon can be considered as the major tourist attractions in this region.

West Coast: Colombo to Galle

The interesting coastline, with long beaches, and marine activities, are the major attractions in this region. Among the other attractions are the pilgrimage sites, such as the Kalutara Buddhist Temple; Mask and Puppet making at Ambalangoda; Low-country dancing; and, Turtle hatcheries. The coast is heavily populated, including many fishing villages. Most existing hotels need upgrading, and the environment around these tourist hotels and resorts also need upgrading. With the exception of the planned resort of Bentota, many parts of the coastline suffer from sporadic, unplanned tourism and general development.

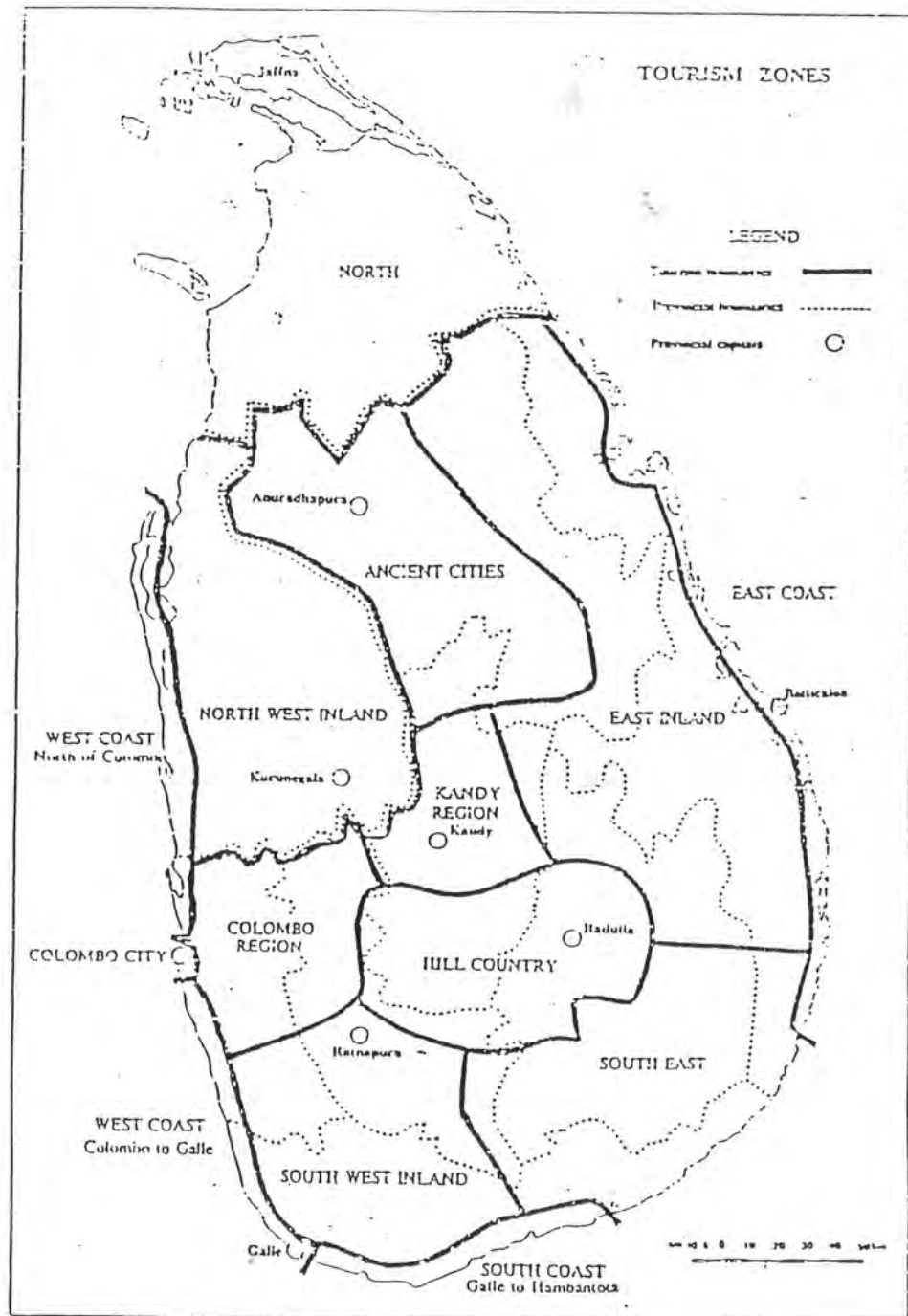
South Coast: Galle to Hambantota

The coastline is varied, with bays, lagoons sand banks, and rocky headlands. The major attractions include, beaches and marine activities, including scuba diving; Galle and Matara Forts; pilgrimage locations, concentrations of traditional arts and crafts. Unawatuna was a major tourist attraction, due to the beautiful beach, but is now suffering from environmental damage, due to unauthorized infra-structure developments.

South-West Inland

It is located between the coast and the hill country. The Ratnapura area in this zone, is the centre for gem mining. The Sinharaja Rain Forest situated in this region, is a World Heritage Site

Figure 15.1: Tourism Zones in Sri Lanka



which is environmentally highly sensitive. The zone has very limited tourist accommodation facilities, and does not attract significant tourist activity.

South-East

This zone is a major centre for domestic tourism. Many pilgrimage sites, including Kataragama, are located in this zone. The Ruhunu National Park, and the Bundala sanctuary, are the major tourist attractions in this region. The zone has no safe tourist beaches, and is remote from Colombo and the major established tourist areas.

East Coast

This area has numerous bays with sandy beaches and shallow sea, and is ideal for swimming and water sports. The East coast is a major potential asset, for both domestic and international tourism.

East Inland

The attractions in this area include four National Parks, pilgrimage sites, and rock formations. The attractions are limited and are largely undeveloped.

Hill Country

This zone comprises mountain ranges rising to 2,525 metres above sea level, and valleys. The Hakgala Botanical Gardens; the Tea estates; several water falls; natural reserves; scenic passes; and Golf courses, are the major tourist attractions in this region. It is a major area for domestic tourism, and is an overnight-stop for many international tourist circuits.

Kandy Region

Kandy, is a World Heritage Site, and is a major focus for international and domestic tourism. There are several tourist attractions in this region, including many religious sites, headed by the Temple of the Sacred Relics of the Lord Buddha, and cultural activities, like the Esala Perahera and Kandyan dancing; the Kandy lake; the Elephant bathing places; the Peradeniya Botanical Gardens, etc. The high volume of tourist activity in Kandy, has created congestion, development pressure, and environmental pollution. There is inadequate standard and capacity for tourist accommodation, as also the lack of night activities and animation focus in the city.

Ancient Cities

This zone is important for both domestic and international tourism. It includes four of Sri Lanka's, World Heritage Sites, namely, Anuradhapura, Polonnaruwa, Dambulla, and Sigiriya. The major festival is the Posa celebration at Anuradhapura and Mihintale. The tourist experience at the attractions is adversely affected by the lack of orientation, information, and interpretation. There is also a need for adequate stopping and service facilities for tours, and safety needs, particularly at the ascents at Mihintale and Sigiriya.

North-West Inland

This area is flat and rural with coconut and paddy cultivation. The area has ruins of many old capital cities, and the Wilpattu National Park, which has been closed down, due to terrorist activities. Even though there is domestic tourism linked with religious and historical sites, the only international tourism activity, is the stopping point on the way to the ancient cities.

North zone

The North zone has been affected by the civil unrest, and terrorist activities, since 1983. Even though there are many attractions, the area has been and will be inaccessible, until normalcy is restored.

When considering the economic role of tourism, it is important to remember that International tourism is an export industry, which generates foreign exchange earnings for the country. The available data demonstrates that from 1966 to 1979, foreign exchange earnings from tourism showed the most rapid growth of all the export sectors, and the contribution of tourism to the total foreign exchange earnings increased from 0.3% to 6.6%, over the period. The contribution further increased to a peak of 10.9% in 1982. The foreign exchange earnings from tourism in 1991, was 6,434 million Rupees (US\$ 155.5 million).

The average expenditure per tourist per night, was US\$ 42.80 in 1991, up from US\$ 41.05 in 1990, and US\$ 31.20 in 1980. The Table 15.5 indicates the high spending of the Japanese, and the relatively modest spending of other markets.

Table 15.5: Average Daily Foreign Tourist Expenditure by Category in US\$ in 1991

	Western Europe	Japan	Other	Average
Accommodation	11.4	23.6	8.5	10.9
Food and Beverages	10.9	15.3	5.9	9.5
Transport	5.8	13.9	10.5	7.6
Shopping	9.6	55.2	7.7	10.5
Miscellaneous	4.6	9.6	3.1	4.3
TOTAL	42.3	117.6	35.7	42.8

Source: Ceylon Tourist Board

The gross output of the tourism sector in 1990, is estimated at Rupees 10,590 million, representing 1.96% of the gross national output. The contribution to the Gross National Product of the tourism sector, was calculated at 1.93%, which compares favourably, with the calculation of the International Development Research Centre of Canada, at 1.13%, for 1979.

15.3. Environmental Impacts of Tourism

The tourists are becoming increasingly more conscious of the environment, and the environmental aspects in selecting tourist destinations. Sri Lanka's natural attractions, are valuable resources for tourism, and include –

- beaches and coastal features;
- wildlife in National Parks, Reserves, and other areas;
- forests, including the Sinharaja Rain Forest;
- tanks, lakes, lagoons, and rivers;
- marine features, including coral reefs and pearls;
- waterfalls and scenic features;
- tea plantations, and other agricultural activities;
- gem stones.

Poorly managed and unplanned tourist development results in damage to the natural environment on which the tourism industry depends for its survival.

Some tourist hotel developments have not given sufficient regard to architectural, aesthetic, environmental and operating aspects. The consequences have been adverse, resulting in a number of problems. The worst examples are, Unawatuna and Hikkaduwa, and to a lesser degree, the other

tourist resorts. The significant problems include –

- beach pollution from sewage;
- pollution of the water table from inadequately constructed and serviced septic tanks;
- pollution of beach from debris washed along inadequately maintained storm water channels, some of which are illegally used as waste water channels;
- over-extraction of water from tube wells, resulting in salination of the coastal water table;
- solid waste accumulation, particularly non bio-degradable plastic;
- illegal construction of some tourist hotels, guest houses, and tourist restaurants close to the beach, resulting in beach pollution, visual degradation, and coastal erosion;
- uncontrolled development in general, resulting in loss of visual amenity, particularly sea views.

The forest and wildlife areas, including botanical gardens, are popular with both domestic and foreign tourists. However, unsustainable numbers of visitors, most of whom arrive in vehicles, may damage the habitat and threaten the viability of the flora and fauna. The major sources of damage include –

- high levels of vehicle exhaust, which kills vegetation, and in wildlife areas, deprive the wildlife of food;
- solid waste and pollution left by the visitors;
- noise disturbance of wildlife, by people and vehicles.

The coral reefs are subjected to damage by tourists, consequent to –

- the illegal mooring, of glass bottomed and other boats, on the coral reefs;
- the oil discharge from boats;
- the illegal removal of live coral and shells for sale to tourists as souvenirs;
- the illegal removal of live coral by the tourists.

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CHAPTER 16

HUMAN HEALTH AND THE ENVIRONMENT

16.1. Introduction

Sri Lanka is an island approximately 65,610 sq. kms in area. In the north-south direction it extends for 445 kms and the greatest breadth east-west is 225.3 kms. From the central mountain peaks originate rivers which flow towards the sea. The mean temperature ranges from 23°C to 26°C in the low-country, and from 14° to 24°C in the hill country.

The estimated mid-year population for 1992 was approximately 17.41 million. There is an uneven distribution of population. Those areas remote from the major urban areas record very low densities. Life expectation is shown in Table 1 below.

Table 1: Expectation of Life at Birth

Gender	1920-22	1946	1953	1962	1967	1971	1981
Male	32.7	43.9	58.8	61.9	64.8	64.2	67.8
Female	30.7	41.6	57.5	61.4	66.9	67.1	71.7

Source: Department of Census and Statistics

The literacy rate defined as the percentage of the population aged 10 years and over who are able to read at least one language has risen to 90%. In most parts of the country people have achieved uniformly high levels of literacy.

Water supply and sanitary facilities affects the health of the population, and has a direct bearing on the environment. The 1981 statistics revealed that 1 out of 3 houses in the country has no toilet facilities.

As a result of the provision of health services to the remotest periphery, the statistics for maternal and infant mortality has improved over the years. The maternal mortality rate, for the year 1992, according to hospital statistics is 0.5 per thousand hospital live births, and the infant mortality rate 19.3 per thousand live births.

The socio/economic situation in the country has improved with an economic growth rate of 4.3%. A sharp expansion in industrial exports are seen.

- Morbidity and Mortality

In Sri Lanka, the morbidity data is available only of in-patients treated in Hospitals. It is therefore difficult to relate illness to hazards in the environment accurately. Hospital indoor morbidity will give only an indication of the morbidity pattern in the country.

Table 2: Hospital Morbidity and Mortality by Broad Disease Groups - 1970 compared with 1992

Broad Disease Groups	Cases per 100,000 population		Deaths per 100,000 population	
	1970	1992	1970	1992
1. Infectious and parasitic diseases	3,206.1	2,426.8	43.3	15.4
2. Diseases of the Respiratory System	3,035.7	2,008.3	30.3	13.8
3. Diseases of the Digestive System	883.0	625.1	11.6	8.2
4. Injury and Poisoning	1,815.3	1,799.8	17.8	24.1
5. Mental Disorders	176.8	215.3	0.6	0.4

Source: Medical Statistics Unit

Only some of the diseases are tabulated, which have relevance to the Human Health and the Environment.

Due to the changes in life styles and socio/economic development and also the change of demographic profile, the diseases of the older age groups seem to be on the increase. The increase in injuries and poisoning observed can be attributed to the development of modern industries, agricultural methods and transport. In Sri Lanka, certain leading diseases, such as malaria, filaria and infectious hepatitis, are deeply rooted in the environment.

The subject matter presented so far, is relevant to the disease pattern in Sri Lanka, and only those diseases that have a direct bearing on Human Health and the Environment highlighted. The health and well-being of the human race should be central in whatever activity human beings indulge in and perform. Good health depends to a large extent on a good environment. Health concerns are integral to environment and development, and it is prudent that they be addressed adequately. The first principle in the Rio Declaration on Environment and Development focuses the issues on Human Health: "Human beings are at the centre for sustainable development. They are entitled to a healthy and productive life in harmony with nature."

Health, environment and development are inextricably woven and interdependent. Factors in the physical and social environment that humans are exposed to, and interact with, are important in the assessment of their impact on Human Health. Numerous diseases are caused as a direct result of human beings creating adverse environmental conditions, by neglect, ignorance, deliberate disregard, or, due to economic reasons. The global environment should be free of hazards to health and have all the essentials to sustain life. Rapid population growth and increasing poverty are critical to the current environmental development and health situation of the world. For the alleviation of poverty, sustainable development and correct environmental management should be closely linked. Development projects should conform to Environmental Hazards and Environment Impact Assessments to prevent environmental degradation and pollution, which affects human health directly or indirectly. Environmental degradation as a result of depletion and exploitation of resources should be evaluated when calculating the growth of the total economy. When designing economic policies, environmental health concerns must be assigned its rightful place in the planning, implementation, evaluation and auditing process. It is evident that some countries in order to increase their quality and quantity of material accessories, have harnessed scarce resources in an unscrupulous manner, descending to vulgar levels of exploitation of man and natural resources. Those in the Government and political hierarchy should not be insensitive to the pollution and destruction of the environment as a result of misguided and ill-planned industrial expansion. Policy decisions from whatever level it comes, which would be detrimental to human health and well-being should be condemned.

Human beings can agree on some basic needs, such as freedom from hunger, repression, disease, an environment with safe air, water, and food, and an eco-system that supports bio diversity. All efforts should be made to create a society, that can afford the essentials of food, shelter, health care and education, which by itself will generate the resources necessary for a better quality of life towards preservation of the environment, which means promotion of good health.

Insufficient development leads to poverty, and it is imperative that developing nations industrialize with safeguards to Human Health and the Environment. The developing world should not re-create the problems and mistakes that industrialized nations made in the past. It is vital that a balance be struck between achieving economic progress and improving environmental quality. Economic progress and creation of wealth need not be antagonistic to Human Health and the Environment. What is needed is the ability to direct and manage the forces within the environment wisely.

The importance of conservation has to be stressed and the deployment of eco-efficient technologies adopted by the developing countries. In Sri Lanka, serious health problems may arise, due to the pollution of the ground, waterways, and air, as a result of industries being sited in heavily populated zones close to the capital. The Lunawa lagoon is polluted by chemicals from surrounding factories. The lagoon that was once a haven for aquatic life is totally dead. The Beira lake close to the capital city which might be a water-shed for the growing population of the capital, shows severe pollution. The Bolgoda Lake is presently of concern to the Environmentalist. In most factories, recycling of wastes have not been looked into in the construction process. The new Ministry of Environment with the assistance of the Central Environmental Authority, does an Environmental Impact Assessment before giving clearance for any new venture. Regulations are there, but enforcement is a problem yet. The Sevenagala Sugar Factory in the Hambantota District, and the Paper Factory, also in the same District, are both burdened with wastes, which keep on polluting the waterways and land, disturbing the eco-system and affecting human health. Since the Newly Industrialised Countries in the Asian region are facing this same problem, all efforts should be directed to recycle waste and prevent environmental degradation.

The poor of Sri Lanka are exposed to health risks, as funding is insufficient to supply the basic health needs of the growing population. In Sri Lanka too, poor sanitation, insufficient and unsafe water supplies, poor personal and food hygiene, inadequate garbage disposal, indoor and outdoor air pollution, crowded and inferior housing, and the control of pests and disease vectors, are common problems in the slums and shanties, as in those of the Asian countries.

In planning human health in relation to the Environment, it is vital to take into account, the changing demographic patterns and the socio/economic realities of the years 2000. In planning human settlements, the capacity of the infrastructure to absorb, support, and supply basic needs, the availability of resources, disturbances to the eco-system, physical and socio/economic impacts, and how the community interacts with them, are some of the important factors to be analysed. Any imbalance could disturb the natural environment and bring about health problems.

It is unfortunate that the last census in Sri Lanka was in 1981. It is time that up to date census is available, which will greatly facilitate the development of a more realistic infrastructure for locating appropriate areas for intervention.

16.2. Relationship between Environment and Health

- Urban Dimensions

In most Asian countries there is a shift of population from the rural areas to the urban and peri-urban areas. The cost of living in urban areas is beyond the means of most, and

thus, the new settlements are in the outer fringes of the large towns. The distinction between the urban and the peri-urban, where basic services are required, is hard to differentiate. Local authorities are not able to cope with demands and needs of the community. This is evident in the satellite towns such as Maharagama, Nugegoda, Boralesgamuwa, Ja Ela, Wattala, and Talangama. There is now a spill over to adjacent areas further away. This migration may be the result of the open economy pursued by the Government, where there is an apparent change in production and marketing practices, search for employment and probably great expectations for a better future. It is difficult to estimate correctly, the migration trend without a proper census, but in most Asian countries, the estimate is between 20 and 30%.

In Sri Lanka, taking the physical and socio-economic factors into consideration together with the climate, settlements should be phased out separately and not the monolith type seen in the developed countries. Environmental pollution and health risks could be mitigated by the recycling of wastes, for which facilities should be provided, within the bounds of the settlement. A central playground for recreation, marketing, postal and other services such as transport are essential pre-requisites.

In the urban slums of the Capital City of Sri Lanka, which is a mirror image of most shanty towns in India and other Eastern Countries, severe environmental pollution resulting in ill-health are caused by -

- i Unhygienic and unsuitable dwellings in squalid surroundings with poor surface drainage. A haven for fly breeding;
- ii Overcrowding and congestion in ill-ventilated huts where living and cooking is done. This promotes respiratory infections due to air-pollution;
- iii Settlements on canal banks, hill slopes, coastal areas and sites vulnerable to floods and other hazards. Loss of life and property;
- iv Inadequate water and sanitary facilities. Worm and bowel infections;
- v. Physical violence, as also sexual assaults, resulting in injury, especially to women;
- vi Alcohol, drug abuse, and mental health problems, resulting in poverty and violence.

- Diseases Encountered in Urban Settlements

Water Pollution	-	Diseases affecting the alimentary system such as typhoid, dysentery, cholera, and worm infestation. Non specific gastro-intestinal diarrhoeas, and Infective hepatitis.
Inadequate sanitation	-	Gastro-intestinal disorders and parasitic infestation. In Sri Lanka, round worm, hook worm and whip worm infestations are common. Amoebic dysentery and shigellosis, as a result of contaminated faeces infecting food and water.
Waste disposal	-	Disposal of solid wastes, health care wastes, and hazardous wastes need special mention, as proper disposal methods and techniques are lacking, even in the Capital City of Colombo.
		Waste disposal is a special subject by itself. Wastes if not suitably disposed would lead to environmental pollution, and human ill-health. Organic wastes support rodents and insect vectors. Rats are responsible for the spread of Leptospirosis, which is a potentially fatal disease, caused by bacterium <i>Leptospira Ictiohaemorrhagica</i> .
		Utensils in wastes encourage the breeding of mosquitoes.

The most important vectors in Sri Lanka causing disease, belong to the genera Culex, Anopheles and Aedes. The diseases caused include, Dengue, Dengue Haemorrhagic fever, Filariasis, Japanese Encephalitis, and Malaria.

Risk wastes from Hospitals could cause various diseases including fatal Aids, and Hepatitis B.

– Indoor and outdoor Air Pollution

In Sri Lanka, there are no studies done to determine the impact of the burning of bio-mass fuel in poorly ill-ventilated houses in the slums and shanties of the cities. Acute respiratory infections like bronchitis and broncho-pneumonia, are the main causes of deaths among infants and children in Sri Lanka.

Acute and chronic respiratory diseases amongst women and children in the urban setting are caused by tobacco, smoke and combustion products. This includes passive smoking. Outdoor pollution is due to natural dust, together with black, particulate laden smoke from diesel fuelled vehicles.

In 1992, the Medical Statistics Unit of Sri Lanka stated that the data on Diseases of the Respiratory System excluding diseases of the Upper Respiratory Tract, Pneumonia, Broncho-pneumonia, and influenza, is as follows:

Table 3

No. of Cases	Percentage of total cases	Cases per 100,000 population
255,802	10.1	1,469.7

Source: Medical Statistics Unit

– Human health and occupational environment

Most Asian countries including Sri Lanka need to pay more attention to ill health due to the hazards in the Occupational Environment. Little information is available in this field. Exposure to toxic gases and chemicals, noise stress, and physically debilitating work patterns have to be worked out. Poisonous agro-chemicals to which agricultural workers are exposed, occupational injuries among construction workers, inhalation of lead fumes and toxic vapours by factory workers are hazards reported. In 1992, pesticide poisoning accounted for 6.6% of analysed deaths, giving a rate of 9.8 per 100,000 population. These deaths were reported mainly from agricultural areas. (Source: Medical Statistics Unit). Most of the work force live in new satellite towns near their work place in congested dwellings adding to their misery.

– Rural Dimensions

The rural setting in most Asian countries is Agro-based. The 1981 census revealed that only 5% of the rural population had access to piped water. Recently, tube wells have been constructed. Latrine facilities are inadequate, and the 1981 census showed that nearly one-third of the population, especially those in the coastal region, had no latrine facilities whatsoever. The same type of worm infestation and other diseases associated with the non-availability of pure water and sanitation is prevalent.

Indoor Air Pollution affecting children and women due to use of bio-mass fuel is reported.

The indiscriminate and excessive use of pesticides and fertilisers by farmers is not only a hazard to their health, but also to consumers. Wash-out from paddy fields, pollute the waterways. Cases of leptospirosis in the farmer community are common. Many of the diseases prevalent in urban areas is reflected in rural areas due to the change in life styles and commuting to the capital for employment.

The Human Environment is affected by climatic change and ozone depletion. Global warming as a result of the Greenhouse Effect, has still to be worked out for Asia and Sri Lanka. New diseases are predicted in regions devoid of these diseases. The eco-system of vectors will be altered. The physiological mechanisms of the human body, (especially infants and elderly), may find it difficult to adjust to occasional extremes of temperature and they may succumb.

- The Fluoride Problem

In the Anuradhapura and Polonnoruwa Districts, there is an excessive concentration of fluorides in many deep wells. Embilipitiya and other dry zones have reported several cases of dental fluorosis. Several cases of skeletal fluorosis have also been reported. In many deep wells in the dry zone, the fluoride concentration exceeds 1.5 Mg/L, and poses a health hazard to the consumers. Some research is being done to reduce the fluoride content. The seeds of a well known Ayurvedic plant known as Ingini (*Strychnos Potatorum*), has been used for years in Sri Lanka. The seeds of the Ingini plant is applied on the inside of the pot as a paste, and water is allowed to stand in it for about 5 to 6 hours. This process results in the water being cleared of its impurities and the fluoride content reduced. The Ozone depletion leads to an increase in the intensity of ultra-violet (UV-B), radiation reaching the earth's surface. This will result in the suppression of the human immune system. The decrease in the effectiveness of vaccination programmes, the increase in the incidence of Cataracts, and an increase in the incidence of skin cancers, especially malignant Melanoma.

- Water Pollution and Impacts

Due to the non-availability of treatment facilities in most industries, domestic garbage, animal and human waste, most of the urban Lagoons, Lakes and Rivers, are polluted.

Especially in the Western Province, the industrial areas such as Ekala, Ja Ela, Moratuwa, Ratmalana, the Colombo Metropolitan Area, Kolonnawa, Campaha and Awissawela, have been identified as having highly polluted waterways.

The main diseases due to water pollution are -

- Diarrhoea,
- Hepatitis A and B,
- Worm diseases,
- Cholera,
- Polio Myelitis, and
- Amoebiasis.

Table 4: Costs Due to Pollution of Inland Water Bodies

Data from Metropolitan Environment Improvement Programme / Canadian International Development Agency.

	1992	1997	2002
Affected Area Population			
(a) Low income	86,536	93,244	100,790
(b) Other	96,074	101,252	105,658
Percentage of (a) affected by water borne illnesses and contaminated fish	25%	25%	25%
Number affected	21,600	23,300	25,200
Cost of treatment (million Rs)	15	16.2	17.5
Wages lost (million Rs)	6.5	7.0	7.6
Percentage of (a) affected by illness and contaminated fish	5%	10%	15%
Number affected	4,804	10,125	15,849
Cost of treatment (million Rs)	3.3	7.0	11.0
Wages lost (million Rs)	1.4	3.0	4.8
Total cost of pollution	26.2m	33.2m	40.9m

Table 5: Estimated Cost of Pollution of the Kelani Ganga (Rs million)

	1992	1997	2002
Affected area population	14,915	31,912	61,101
Percentage affected by water borne/wash illness and contaminated fish	0.8%	0.8%	0.8%
- number affected	119	255	489
- average monthly cost of treatment	Rs 174	Rs 174	Rs 174
- total cost of treatment (million Rs)	0.08	0.18	0.35
- unit value loss of one day's wages	Rs 150	Rs 150	Rs 150
- total wage loss (million Rs)	0.04	0.08	0.15
Total cost of pollution (million Rs)	0.12	0.26	0.50

16.3. Conclusion

Environmental health is a broad concept. It pervades, and is intimate with all aspects of human behaviour in the natural and anthropogenic environment. Human needs, be they physical, socio/economic, biological, or spiritual, have to be satisfied, and, in the effort to do so, serious and far reaching consequences to the balance of the eco-system may arise. Humanity has to adjust its lifestyles and consumption patterns, for which trade offs and sacrifices have to be made. For, the protection of the Environment, which means the protection of Human Health, the pressing need is the concept of a single global strategy, with mandatory sanctions, for which the Developed and Industrial world must take the initiative, and be actively in the forefront of assisting developing countries to achieve their developmental goals, in an environmentally friendly manner.

As was said, in 1854, by a Red Indian Chief, in response to demands that he sells his people's land to the Great Chief in Washington:-

"The Earth does not belong to Man. Man belongs to the Earth. All things are connected. Whatever befalls the Earth, befalls the sons of the Earth. Love the Earth, as a new-born loves his mother's heart beats. With all your strength, with all your mind, with all your heart, preserve it for your children".

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PART III

RESPONSE

RESPONSES FROM INDUSTRY AND PRIVATE ACTIVITIES

17.1. Introduction

The pattern of development in Sri Lanka has been changing from an agricultural to an industrial based economy over the last few decades. This development has been the result of the Government of Sri Lanka's (GOSL) thrust on a strategy of industrialisation to raise income levels and further economic development of the country. Through the process of industrial liberalisation started in 1977, the GOSL has been making a concentrated effort to promote economic growth through industrialisation. The Government is set on achieving the status of "Newly Industrialised Country" (NIC), by the turn of the century. Industrialisation is planned to be achieved through the facilitation of private sector activity within a favourable policy environment that would promote savings, foreign investment and exports and would streamline the administrative process and institutional structure.

However, there has been little attention paid to ensuring environmentally sustainable development. The past development activities have left behind several environmental scars in areas of industry concentrations, especially in the Colombo Metropolitan Area (CMA), which has 70% of the urban population and 80% of the industries in the country. The adverse effects of rapid industrialisation with little or no environmental planning, require immediate remedial action. The CMA has not yet reached the stage of deterioration of other sister Asian cities, but there is clear evidence that the rate or pattern of growth are vast exceeding the assimilative capacity of natural systems and the ability of the urban sector to provide infrastructure and service to support the expanded development.

Most apparent are, the degradation caused to the region's water resources, the rivers, coastal lakes and lagoons, drainage and canals, wetlands and near-shore waters, caused by untreated domestic and industrial waste waters, uncontrolled dumping of solid wastes, unplanned river-bank and lakeside residential construction and filling up of low lying areas for development. The prognosis, in the absence of a strategy based on maintaining the natural eco-systems in a state in which they can continue to provide both benefits and services, is for further deterioration, eventually irreversible without immense expenditure of public funds.

The environmental impacts of urban and industrial development derive mainly from the concentration of growth in the Colombo area. The metropolis has been the focus of industrialisation due to the accessibility of infra-structure and services required to support industrial development. While the aggregate urban growth rate hovered around 1.2% in the 1970s, localities in the CMA recorded 10-14% growth in the same period. Pockets of development in the suburbs of the city could be attributed to the fact that the City of Colombo is already getting saturated with all the buildable land extensively built up and only a marginal increase in population could be accommodated without major re-development and reclamation programmes. Therefore, the shortage of land and the high prices within the City of Colombo compel people to move into the suburban areas, where land is available at comparatively reasonable prices. However, this urban sprawl could result in urban problems, long commuting distances and densification of semi-urban areas without the supporting infra-structure. Additionally, 80% of the manufacturing enterprises and over 60% of the registered vehicles are located in Colombo, adding further to the already deteriorating environmental situation.

Concentrated population and industrial growth have overwhelmed the capacity of municipal institutions as well as the regulatory agencies. This has had a detrimental effect on the ability of these institutions to protect the waterways, low-lying lands and marshes in the Colombo area, essential for regulating the surface and groundwater supplies, controlling flooding and maintaining soil bearing capacity.

The manufacturing industry accounts for less than 20% of Sri Lanka's GDP. The manufacturing industry in Sri Lanka is comprised of:-

- (a) a few large-scale heavy industries, including petroleum, cement and paper, most of which are publicly owned, using outdated technology; and
- (b) small and medium scale industries, which are largely privately owned and newer than public sector enterprises.

The Government's overall development strategy lays emphasis on rapid expansion of the manufacturing sector as the main engine for economic growth.

17.2. Industrial Pollution Management Strategy

The COSL has realised the urgency of having a comprehensive programme to adequately address the low priority given to the adverse environmental aspects of development. Against this backdrop, the COSL has developed an Industrial Pollution Management Strategy aimed at reversing the current trend of environmental degradation due to industrialisation. The strategy takes a progressive approach to industrial pollution management. Alternative options have been developed to induce industry compliance and practicable to implement. The strategy looks at preventive as well as remedial actions with a balance between enforcement measures and incentives to industry. The success of the strategy hinges upon active participation of the industrial sector.

The strategy has evolved around ideas aimed at assisting industries to comply with the National Environmental Standards rather than strict enforcement or the "stick" approach. The success rate of purely the "stick" approach has not found to be sustainable when compared with the "carrot and stick" – incentives and enforcement – approach to environmental management. With this in mind, the COSL developed an industrial pollution management strategy which included the following:

- least cost pollution abatement and control;
- mechanisms to promote environmentally sound decisions regarding industrial development;
- policy guidance and criteria for grouping new industries by waste type and location;
- measures to promote compliance with effluent standards and to minimize waste generation;
- reliable pollution monitoring and testing systems with industry participation in self regulation;
- alternative funding mechanisms for pollution monitoring and control functions;
- the development of a Pollution Control and Abatement Fund for existing industries;
- mechanisms to promote pollution control as a pioneering industry;
- the need for additional legislation or regulations; and
- the need for well developed training programmes for pollution control agencies and awareness programmes for the Chambers of Commerce and Industry, Non-Governmental Organisations, and professional associations on industrial pollution management.

The strategy developed envisages an integrated approach to industrial wastewater pollution control with actions based on technological, economic and institutional support measures. The cornerstone of the strategy is the institutionalisation of the concepts of waste minimisation and pollution prevention within the industrial sector. Recommendations for the relocation of "offensive" trades to designated areas with low population densities and central treatment plants would result in lower pollution loads into the environment, serving existing industry concentrations by central industrial wastewater treatment facilities, establishment of industrial estates with a proper mix of industries to minimize environmental costs and special provision for small scale industries through a centralized collection scheme coupled with common wastewater treatment and recovery centre have been made under the proposed programme.

The strategy removes the responsibility of effluent treatment from many individual industries and transfers it to central treatment or disposal facilities which provide not only benefits of scale,

but also the dilution of the more difficult wastewaters. This immediately relieves a large number of individual industries of the capital cost of installation of major pollution control equipment and any associated problems of land availability. More importantly it allows the central plants to invest in properly trained dedicated personnel. In addition, the monitoring of effluent discharges for compliance with standards for discharge to water courses will be greatly simplified. The amortised capital and operating costs of the treatment processes would have to be borne by discharging industries on a cost per metered unit volume basis. The underlying theme of the strategy is a participatory process between the regulatory authority and the industry sector in addressing current and future industrial development in an environmentally sustainable manner to reverse the on-going trend of environmental degradation in Sri Lanka.

17.3. Response from Industry

The mere fact that the success of the Industrial Pollution Strategy developed by the COSL is dependent upon close cooperation with industry, calls for pro-activity in environmental related issues rather than the reactive nature usually adopted by industry. Environmental awareness in the industrial sector is high compared to a decade ago, yet there is significant room for improvement. Industry, en masse, is yet to perceive environmental protection as a necessary requirement in industrialisation. Most feel that environmental protection is a "dead investment" that they could do without. The feeling that adhering to environmental standards set by the Central Environmental Authority (CEA) would make industry less competitive in the international market, is commonplace. The Ministry of Environment and Parliamentary Affairs (MEPA), with the assistance of donor agencies, is making a concerted effort to make industry realise that environmental protection and industrial productivity are not conflicting objectives, but could be complementary.

To this end, the COSL is pursuing an active policy of pollution prevention or waste minimization. The objective of the programme is to minimize generation of wastes at the source. The programme advocates manufacturing process modifications which would result in more efficient less polluting industries. Most industrial enterprises in Sri Lanka are considered small or medium scale industries. These industries operate on traditional technologies with little attention paid to research and development (R & D). In fact, a majority of the industries do not have a R & D budget. The larger industrial enterprises, especially those with international links, either have a R & D section or contract such work to the limited number of R & D laboratories in the country. A popular myth in industry appears to be that R & D is also a "dead investment" rather than investments for the future. Probably due to the lack of demand from within the industrial sector, the development of R & D laboratories involved in industrial processes appears weak in Sri Lanka. A potential source of untapped talent in this area lies within the University system in Sri Lanka. The establishment of close ties with Industry and University could be mutually beneficial.

In order to encourage such interactions the COSL is in the process of establishing a National Waste Minimization Programme. The objective is to assist industries in developing pollution prevention plans and enact suitable process modifications to minimize waste generation. The programme would call for coordinated action on the part of all the main actors: Government agencies, industry, research and development institutions, industry and professional associations, educational institutions and non-governmental organisations. On the part of industry, the plan calls for the adoption of a culture of waste minimization and the implementation of new managerial procedures to achieve cost effective pollution control. The procedures that need to be adopted by industries include the following:

- development of environmental awareness
- development of cost-benefit awareness
- management commitment
- reorganisation of management structure
- undertaking of environmental audits
- constant evaluation of pollution prevention measures
- implementation of such measures
- training at all staff levels
- constant monitoring of results
- periodic review audits

"The basic concept of Ecologically Sustainable Industrial Development (ESID) requires industrial activity to mimic eco-systems in a closed loop, where waste becomes a resource for the new link in the loop. Nature teaches that ecological balance is only achieved by a high level of inherent process efficiency and integration between the different organisms or links in the eco-system. Similarly ESID will be achieved when our processes become inherently efficient, and the economic actors "connect" with the next actors in the loop. Clean technology and cleaner production – the "hardware" – are the main practical and technical goals to be achieved. Better environmental management, including training and environmental audits, – the "software" – is equally important".

The proposed National Waste Minimization Programme is yet in the process of evolution, aiming at achieving Ecologically Sustainable Industrial Development. Industry, Trade and Industry Associations, as well as professional organisations have been involved with the GOSL, in a preparatory process that has led to the development of the programme. The Federation of Chambers of Commerce and Industry has decided to establish an Environmental Unit (EU), which will inter alia, promote waste minimization and pollution prevention and will provide advisory services to its members.

The GOSL also plans on upgrading applied research laboratories that serve specific industrial sectors, to develop capability in the area of waste minimization and pollution prevention. These laboratories will serve as a resource base to industry in this area. Several such laboratories exist currently, catering to the industrial process research. Laboratories in the Ceylon Institute for Scientific and Industrial Research (CISIR), the Universities, and the Tea, Rubber, and Coconut Research Institutes, are some applied research organisations that conduct process research. Such research institutions will be provided with technical assistance to focus specifically on waste minimization research.

In addition to providing technical assistance in the area of waste minimization, the GOSL industrial pollution management programme reaches out to assist industries in an area perceived as the greatest constraint to compliance with environmental regulations, finances for implementation. Studies have been conducted to assess the costs of compliance to environmental standards. It has been determined that if each industry would be responsible for treating its own effluent in individual treatment plants, firstly to interim (phase 1) and then to existing (Phase 2) standards, the capital costs of this programme would be approximately US\$ 66.7 Million. The capital costs of this programme is summarised below:

Table 1 – Capital Cost of Wastewater Treatment by Sector (US\$M)

Sector	Phase 1	Phase 2	Total
Textiles	7.4	7.2	14.6
Tanning	2.4	2.3	4.7
Metal Finishing	7.4	0.0	7.4
Paints and Chemicals	2.1	0.0	2.1
Food and Beverage	4.4	4.5	8.9
Dessicated Coconut	2.2	2.3	4.5
Rubber	8.4	8.2	16.6
Miscellaneous Industries in Greater Colombo	7.3	2.6	9.9
TOTAL	41.6	25.9	66.7

If however, the integrated approach to industrial waste management is pursued as recommended in the strategy, with centralised waste treatment wherever feasible, the capital costs of the industrial component would be US\$ 53 Million. The GOSL, with the assistance of the World Bank and the Government of Germany, is in the process of establishing a Pollution Control and Abatement Fund (PCAF), to assist existing industries to address environmental concerns. This Fund is to provide incentives for industries to conform to environmental regulations. One method of facilitating this activity is to provide industry access to concessional financing. The PCAF is being established for this purpose. The Fund will be administered by the National Development Bank. The current allocation to the Fund is US\$ 5 Million. It is anticipated that the Fund will be operation by October 1994. The Fund would be disbursed on the following basis:

1. The Credit Component (US\$ 3.75 million), will be available for existing enterprises to finance investments in pollution control equipment in order to obtain an Environmental Protection Licence. Participatory Credit Institutions (PCIs), will be required to satisfy the Administrative Unit that end-use of all investments financed from this component only relate to addressing environmental concerns. The interest rate on sub-loans from the Fund will be equal to the inflation rate (real interest rate to be set at zero), and will be fixed for the duration of the sub-loan. The repayment period would be five years, inclusive of a 6-month grace period. The maximum contribution the fund would make to an enterprise is US\$ 120,000/-. It is proposed that these funds be lent from the GOSL to the PCIs at the interest rates equal to the inflation rate minus 3% (2% as a spread for the PCIs and 1% for the administrative costs to manage the Fund). The investment in pollution control equipment required by new enterprises may be funded through the regular credit component of the project, at the normal PCI terms.
2. The TA Component (US\$ 1.25 million) is to be used mainly for the environmental assessment and to identify improvements to plant and machinery needed to comply with SCOPE and CEA regulations and receive an EPL. Existing enterprises will receive 75% of the costs of such a study, while new enterprises will receive 50% of the costs. The maximum contribution for any one enterprise would be limited to US\$ 12,000/-.

The Industry response to the initiatives taken by the GOSL has been very positive. None of the initiatives have been developed in isolation from the industrial sector. It has rather been an on-going consultative process with industry. Industry has indicated a willingness to reorganize its management and outlook in order to institutionalize environmental issues. The advantages of waste minimization in increasing process efficiency and reducing costs have served as a catalyst in driving industry to change its outlook towards environmental issues.

Environmental awareness among the public is yet insufficient to drive product marketing techniques to incorporate more environmentally friendly goods and services. Product economy still dictates consumer decisions in the marketplace. Therefore it will still be a few years before the consumer is sufficiently environmentally aware to become a driving force to enact significantly, changes in product definition and marketing strategies. Although industries are aware of the environmental implications of their activities and products, it is unrealistic to expect major modifications in product definition and marketing strategies, unless the consumer demands it.

17.4. Response from Other Private Activities

The GOSL is actively encouraging private sector participation in infra-structure development. The commitment of the Government to this end is exemplified by the establishment of a Secretariat for Infra-structure Development and Investment (SIDI) to facilitate private sector involvement in areas traditionally managed by the public sector. The National Environment Act (NEA) mandates that all development projects be subjected to an Environmental Impact Assessment (EIA), which requires approval from the GOSL, after a 30-day public comment period. The Government's commitment to environment is demonstrated by the recent establishment of an Environmental Infra-structure Unit (EIU) at SIDI to assist potential investors in addressing environmental concerns at the project feasibility stage. It is encouraging to note that potential investors are aware of the Environmental requirements as stipulated in the NEA and cooperate to a significant degree to achieve the required standards.

Further steps are being taken by the GOSL to institutionalize environmental issues in all phases of project development. It has been accepted by the GOSL, in principle, that Commercial Banks should play a role in environmental assessment. The Commercial Banks in general and the Development Banks in particular would be involved in conducting an environmental appraisal of a venture during the economic evaluation. Environmental appraisal is simplified form of environmental assessment. The aim of the process is to determine whether a proposed project has significant environmental concerns and identify appropriate courses of action in response to these. Environmental units are being established in certain Banks for this purpose. Therefore, the investor would be aware of the potential costs incurred in environmental protection prior to commencement of the project. While this scheme has just been developed, initial reactions from industry have been extremely positive.

17.5. The Environmental Sector Industry and Services: State and Trends

Although the environmental goods and services sector in Sri Lanka is in its infancy, there seems to be virtually unlimited potential for growth. The key areas with such potential are the environmental consulting field, laboratory services and the provision of environmental services.

The CEA is currently evaluating the feasibility of self regulation by industry, with the CEA conducting surprise checks to assure compliance. In order to facilitate self regulation, the private and public sector laboratories were assessed for capability and quality assurance. None of the laboratories in the country were in a position to accredited to international standards. Subsequently the GOSL provided a series of incentives especially to the private sector laboratories to upgrade their capability and instrumentation. The laboratories would be able to import analytical equipment without being subject to import duty and business turnover tax as well as be eligible for cash grants for environmental services. It is hoped that the private sector laboratories would take advantage of the incentive scheme and be in a position to be accredited to international standards.

The private sector of Sri Lanka has expressed a great deal of interest in participating in environmental goods and services. This interest is harmonious with the GOSL policy of encouraging private sector participation in infrastructure projects as well as public-private partnerships in waste

management services. Municipal solid waste management has been an area in which the private sector has expressed significant interest. A waste characterization study conducted in 1993 has revealed that the composition of municipal solid waste in the Colombo Municipal Council area is predominantly organic with over 85% of the waste stream being organic waste. This lends itself to be an ideal substrate for biological treatment processes such as composting or anaerobic digestion. A recently concluded survey on the demand for compost in the plantation sector of the country has determined that there is a potential demand of approximately 180,000 tons of compost per annum, making the organic fraction of municipal solid waste a lucrative commodity. Private sector partnership to develop innovative solutions to the existing waste disposal problem has been a result of this. A pilot scale composting facility is currently under construction to demonstrate the feasibility of the process. If feasible, it is anticipated that private sector involvement in solid waste management, which has been exclusively in the public domain, will become a reality.

Several expressions of interest in other areas of municipal solid waste management, such as waste collection and management of waste disposal sites have been expressed by the private sector. The COSL proposes to assess the feasibility of private sector participation in solid waste collection services by conducting a pilot scale demonstration study in selected areas of the Colombo Metropolitan Area. If successful, there would be potential for expanding the programme to the entire CMA and eventually islandwide. The private sector management of the sanitary landfill site and waste transfer station in the CMA have been explored in order to provide a better and more efficient service to the public in the CMA.

Other areas of private sector interest in the provision of environmental services is in centralized industrial wastewater treatment. Studies have been conducted in two industry concentrations in the north and south of the City of Colombo, with regard to the feasibility of establishing centralized industrial wastewater treatment. These studies have established that central treatment is more economical than individual treatment. While promoting the establishment of central wastewater treatment plants, the COSL has not indicated a willingness to fund the construction of the plant. The current opinion on this within the COSL is that the polluter pays principle should prevail. The private sector, either an association of industries or an entrepreneur is expected to own and operate the central treatment plant on a fee basis from participating industries. The fee would be levied on the basis of quality and quantity of the effluents discharged.

The environmental engineering consulting services available in the country is yet immature. Industry has expressed concern at several fora about the feasibility of the local consulting firms to adequately assist industry in the design of pollution control measures. In fairness to the environmental consulting industry, the basic data used for treatment plant designs may be inaccurate due to potential inconsistencies in analytical techniques. In an attempt to upgrade the environmental laboratory and consultancy services in the country, the COSL has developed an environmental laboratory and consultancy accreditation scheme. Both schemes were developed in consultation with environmental laboratories and consulting firms. Both groups were in agreement that a problem exists and accreditation would be a step in the proper direction.

A phased-in accreditation programme has been developed for the laboratories where initial compliance with an interim accreditation programme is envisioned. This would eventually lead to laboratories being accredited to international standards, ISO/IEC Guide 58. In the case of environmental consulting firms, an accreditation programme has been developed to accredit consultants in the areas of Environmental Assessments and Pollution Control Technology.

17.6. Conclusion

The measures initiated by the GOSL, to ensure ecologically sustainable industrial development with particular reference to waste minimization, have been discussed at length. It is however the industries, and not the Government agencies, who would have to take advantage of the incentives provided by the GOSL, in an evolving programme of pollution control, where compliance to national environmental standards is mandatory. The role of Industrial Federations and Chambers of Commerce, is critical as a channel of industry cooperation with the Government in creating motivation. Such organisations which have often been defensive on environmental issues in the past, have now been slowly influenced by the volume of new research and data, which has resulted in a very positive contribution in Sri Lanka. The proposed environmental unit to be established at the Federation of Chambers of Commerce and Industry in Sri Lanka (FCCI SL), should become actively involved in industrial pollution management through the development and adoption of industry-wide codes of conduct. While industry response has been quite positive towards environmental concerns, heightened awareness among the public and industrialists alike, would catalyse compliance to environmental standards and norms.

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CHAPTER 18

ENVIRONMENTAL MANAGEMENT: POLICIES, INSTITUTIONS, AND MONITORING MECHANISMS

18.1. Introduction – Institutions and Legislations

– Environmental Institutions

During the 1970s, with the wake of world-wide awareness on environment, a need for a central agency to deal with environmental matters had been increasingly stressed at various seminars, as also by foreign missions and NGOs. As a result, the Central Environmental Authority (CEA), was established in 1981, under the National Environmental Act No. 47 of 1980. However, the actual implementation of the environmental programmes and the enforcement of legislation pertaining to environment, would be done by each of the implementing agencies, since the CEA was not given any regulatory powers. Therefore, the CEA remained as a policy making, coordinating and catalytic body, focusing on activities, more towards research, awareness programmes, and the formulation of correct perspectives on environmental issues, in the planning and development process. After several years, having observed the operation of the Act, together with the prevailing trends in environmental degradation, the Government decided to amend the National Environmental Act, to meet the existing needs. As a result, the CEA was empowered with stringent legal provisions, to control environmental pollution, and mitigate the adverse impacts of development activities by introducing a legally binding Environment Impact Assessment (EIA) procedure.

Under the provisions in the National Environmental Act, the National Environmental Council was established, as an advisory body to the CEA. The Council comprises of senior officers of the development Ministries, the Non-Governmental Organisation (NGO) representatives, and environmental experts. The linkages and coordination with the other implementing Ministries and Agencies are being maintained, mainly through the Council.

The National Environmental Act, has provided for the establishment of District Environmental Agencies (DEAs), in each Administrative District, with the Government Agent, who is the principal Administrator of the District, as Chairman of the Agency. Each DEA consists of 12–14 members representing agencies involved in environmental activities and leading NGOs of the District.

A policy decision was taken to decentralize certain functions of administration, at the Divisional level. Along with this policy initiative, some of the regulatory functions of the CEA were decentralized, establishing new institutions such as the Divisional Environmental Steering Committee (DESC), at the Divisional level, and the Pradeshia Parishad Sabha, at Local Government level.

– Inter-Governmental Institutions

The National Environment Steering Committee (NESC) was established at the National level with the Secretary, Ministry of Policy Planning and Implementation, as Chairman. The NESC represents key development Ministries, Corporations, major Donor Agencies, and leading National level NGOs. The linkages between environment and development are being coordinated, mainly through NESC, by conflict resolution.

– Non-Governmental Institutions

Most of the National and Local level Non-Governmental Organisations (NGOs) are being registered at the CEA. The NGOs play a vital role, not only in mobilising people to participate with the protection and the management of the environment, but also, to act as "watch dogs" and "change agents", in this field. The NGOs have a proven history of notable achievements, such as the stopping of logging of the Singharaja Forest, which has one of the richest eco-systems in the world;

the setting up of a Tiger-top Lodge in Udawalawa National Park; cessation of the construction of the thermal plant at Trincomalee; and, the blind implementation of the Forestry Master Plan. Further, the most important contribution from the NGOs has been that made towards the creation of environmental awareness among people, and mobilizing their active participation, for the protection and management of the environment. In addition, NGOs have participated in the preparation of the EIA Regulations, and the National Environmental Action Plan (NEAP), which serve as key instruments for environmental management in Sri Lanka.

The National NGOs, have now got together and formed an umbrella organisation called the Sri Lanka Environmental Congress (SLEC). Apart from the National NGOs, the Local and Rural-level NGOs in the field of environment, are rapidly increasing. It is recorded that there are about 200 Local and Rural NGOs, established so far.

The lack of financial and other resources, have limited the role of NGOs, to some specific areas. They are criticised for being urban based, especially Colombo-based tendencies, and resulting in the reflection of views and attitudes of urban intelligentsia. Generally Government institutions are of the view that NGOs are biased on conservation, and unnecessarily critical of development activities.

The NGOs have now actively initiated the implementation of environmental projects, in close cooperation with the CEA, and with financial assistance from donor agencies.

18.2. Environmental Legislation at National Level

- Constitutional provisions

In Sri Lanka, before the 1980s, there was no explicit Constitutional provisions on the protection and management of the environment. However, the enhancement of environmental awareness, and the increasing interest of the Government in environmental issues during the 1970s, paved the way towards the integration of the environmental concerns, into the Constitution. Recognising the importance of environmental conservation, the Constitution of 1978 highlighted the responsibility for environmental protection and management as a fundamental right, obligation, and responsibility of the State and the People.

- Environment Framework Legislation

Sri Lanka has a number of laws dealing with various aspects of environmental protection and management. However, in the present context of development taking place in the country, most of these laws have, time and again, proved inadequate to address the environmental challenges brought on, by this very same development. The National Law on environment, entitled - "National Environmental Act No. 47 of 1980", came into operation in 1981. This Act created the Central Environmental Authority (CEA), as a policy making and coordinating agency, for the protection, conservation and management of the environment, and filled a long standing void, caused by the absence of an institutional framework to coordinate environmental policy making and programming in Sri Lanka.

The Environmental Act was amended in 1988, to introduce a licensing procedure; give legislative backing to an environmental impact assessment procedure for development projects; and incorporated the notion of popular participation. The amendment also required new pollution control standards for water, soil, air, and noise.

Under the amendment to the National Environmental Act, the CEA has become the sole authority for assessing and developing Sri Lanka's environmental pollution control strategy. In

addition, the CEA is primarily responsible for developing the national environmental and natural resources policies; pollution control by way of issuing waste emission licences; and, the overall administration of EIA procedure.

– Occupational Safety and Health Risk Legislation

Sri Lanka has a number of Laws, Acts, Regulations, and Bye-Laws, forming together, an Occupational Safety and Health Risk Legislation. These include –

1. Nuisance Ordinance No. 15 of 1862

Contains legal provisions against the pollution of any waterway, tank, reservoir, well, drain, as also against offensive smells;

2. Colombo Municipal Council Water Works Ordinance No. 18 of 1907

Deals with the supply of drinking water within the Colombo Municipality, and contains provisions on the misuse and contamination of water.

3. Control of Pesticides Act No. 33 of 1980

Provides for the licensing of pesticides, regulates the import, packing, labelling, storage, formulation, transport, sale and use, as also, for the appointment of a Pesticides Formulary Committee.

4. Malathion Control Act No. 22 of 1985

Prohibits the possession, transport, sale and use of Malathion, by unauthorised individuals.

5. Poisons, Opium and Dangerous Drugs Ordinance No. 17 of 1929

Restricts the sale and dispensing of poisons; its use in agriculture; prohibits the cultivation, export and import of Coca and Indian Hemp plants; and the manufacture of dangerous drugs.

6. Cosmetics, Devices and Drugs Act No. 27 of 1980

Provides for the licensing of persons and premises for the manufacturing of Cosmetics, devices and drugs; prohibits the manufacture, preparation, packing, or storing of any cosmetics or drugs, under insanitary conditions.

7. Pradeshiya Sabha Act No. 15 of 1987

Contains provisions on the detection and abatement of nuisances; the control and administration of all matters relating to public health, public utility services; and, the abatement of industrial pollution.

– Resource Conservation Legislation

A considerable amount of legislation pertaining to resource conservation is already in the Statute books. The different aspects of resource conservation are governed by separate Legal Enactments and administered by different Government agencies. The resource conservation legislation includes the following Legal Enactments on soil, water, energy, forests, fauna and flora, aquatic resources, and minerals.

SOIL

There are many Laws on soils. The Soil Conservation Act of 1951, provides legal authority to identify and declare erodible areas, and the Crown Lands Ordinance of 1935, provides for the reservation of belts of lands on stream banks, with widths varying according to the size of the streams. There is a separate Ministry established recently to deal with land matters.

WATER

Several Legal Enactments prevail to deal with Water resources, namely –

- * Irrigation Ordinance No. 32 of 1946

Provides for the construction and maintenance of irrigation works, protection of irrigation works, and conservation of water.

- * Water Resources Board Act No. 29 of 1964

Deals with the conservation of Water resources of the country; the construction of irrigation schemes, drainage and flood control; and provides for the prevention of pollution of rivers, streams and other water-courses.

- * National Water Supply and Drainage Board Law No. 2 of 1974

Enacted to provide an efficient water supply system for public, domestic and industrial purposes; to establish an efficient, coordinated sewerage system; and to deal with misuse of water.

- * National Environmental Act No. 47 of 1980

Prohibits the pollution of inland waters, as also, the coastal and off-shore waters of Sri Lanka.

- * Agrarian Services Act No. 58 of 1979

For the efficient management of irrigation and water, water conservation and drainage.

– Legislation on Forests, Wildlife and Nature Protection

- * Fauna and Flora Protection Ordinance No. 2 of 1937

Provides for the protection of animals, plants and their management; prohibits certain acts in protected areas; establishes protected areas.

- * National Environmental Act No. 47 of 1980

Preservation of wildlife; management policy for forestry.

- * National Heritage Wilderness Areas Act No. 7 of 1988

Preservation of wildlife, and preservation of protected areas.

- * Plant Protection Ordinance No. 10 of 1950

Protection of plants from pests.

- * Forest Ordinance Protection of Forest Reserves.

– Fisheries and Other Marine Life

- * Fisheries Ordinance No. 24 of 1940
For the protection of fish in Sri Lankan waters, and the better regulation of the fishing industry.
- * Pearl Fisheries Ordinance No. 2 of 1925
Licensing procedure for pearl and oyster collection.
- * Whaling Ordinance No. 2 of 1936
Protection of certain species of whales.
- * Regulation of Foreign Fishing Boats Act No. 59 of 1979
Regulating, managing and controlling fishing and related activities, by foreign boats in Sri Lankan waters.

– Coast Conservation

- * Coast Conservation Act No. 57 of 1981
Prohibits coral and sand mining.
- * State Land Ordinance Act No. 8 of 1947
For the management, protection, and control of the foreshore.
- * Tourist Development Act No. 14 of 1968
Tourist Board to administrate, control, and manage the foreshore.

– Minerals

- * Mines and Minerals Law No. 4 of 1973
Provides for the vesting of the absolute ownership of certain minerals in the Republic; regulates the mining of, and prospecting for, collection, processing, sale and export of minerals.

– Energy

- * Electricity Act No. 19 of 1950
Regulates the generation, transmission, transformation, distribution, supply, and use of electrical energy.
- * Ceylon Electricity Board Act No. 17 of 1969
Provides for the establishment of an Electricity Board for the development and coordination of the generation, supply, and distribution of electrical energy; the development of a sound, adequate, and uniform electricity policy, and the control and utilisation of the national power resources.

18.3 Environmental Concern in Specific Sectoral Policies

An attempt was made in the preparation of a National Environmental Action Plan (1992–96) to up-date, and integrate environmental considerations in different sectors such as land and water resources; forest and bio-diversity; urban and industrial; energy and minerals; policy; institutions; education; and, culture. In addition, initial attempts are being made to incorporate environmental accounts, into the National Accounts.

18.4. Environmental Planning

Environmental planning is generally defined as strategies, methods and programmes and plans, etc., through which the environmental dimension is incorporated into the socio-economic process, since environmental planning is a tool to reach goals and targets of environmental policy.

- Environmental Protection Licensing Scheme (EPL)

Consequent to the establishment of the Industrial Processing Zones (IPZ), under the Greater Colombo Economic Commission (GCEC), treatment plants were constructed in order to provide treatment facilities. However, lack of pollution control facilities have created a series of acute environmental problems in all industrial areas, such as, Ratmalana, Moratuwa, and Ekala, which is the oldest industrial agglomeration in Sri Lanka, as well as in various rural areas, where large scale industries are located. Along with the amendment of the National Environmental Act in 1988, the CEA introduced Environmental Protection Licensing in 1990, to control industrial pollution. According to the new legislation, it is forbidden to discharge effluents or wastes, without obtaining a licence from the CEA, which stipulates the standards and criteria. Thus, new industries are keenly searching for ways and means to minimize the generation of wastes which cause pollution.

End-pipe treatment technology is being considered mainly for the existing industries. Industrial counselling programmes which attempt to change production processes, in order to generate less pollution wastes, have been implemented on a pilot basis, in rubber, textile industries and tanneries. Clean technology for new industries are being proposed.

- Environmental Impact Assessment (EIA)

EIA is both a tool and a procedure, for decision makers. It is a procedure for decision makers to take into account the possible effects of development investments, on environmental quality and natural resource productivity, which ensures that potential problems are foreseen and addressed, at an early stage in the planning and design stage of a project.

The rules and regulations necessary for the implementation of a National Environmental Impact Assessment System, were published by Notification No. 772/22, in the Government Gazette of the 24th June 1993, and approved by Parliament on the 9th September '93. Under the National Environmental Impact Assessment System, 14 Agencies (eight Ministries, one Department, and five Corporations/Boards), have been named as "Project Approving Agencies", and 51 prescribed projects/undertakings have been identified to be subject to environmental assessment. These projects/undertakings which are prescribed, are further grouped into three categories, namely -

- (a) 31 projects with specific capacity located outside industrial estates;
- (b) 10 projects located within industrial estates; and
- (c) 51 projects if located within environmentally sensitive areas, irrespective of their magnitude.

The procedure to be followed in approving the projects/undertakings has also been described in the same Gazette notification. In order to implement the EIA process, "Environmental Cells" and EIA oversight committees were established in all Project Approving Agencies (PAA). In addition, the "PAA-Inter Agency Committee", was established at the Ministry of Environment, under the Chairmanship of the Secretary Environment, with the participation of all PAAs.

- Environmental Audit

Under the Five Year Natural Resources and Environmental Policy Project (NAREP), of USAID, a programme on Environmental Audits was conducted for Consultants and Industry in Sri Lanka. The objective of this programme is to establish and pilot an approach to environmental audits, which is appropriate for Sri Lanka. This approach accounts for – the minimal, albeit evolving body of environmental regulations; the scale and scope of industrial operations; the concern of industry for equal enforcement of regulations among competitors; and, the balance which must be struck between economic development, industrial and environmental management. The initial phases of this programme were conducted over five weeks, during March–April 1993.

18.5. Economic Instruments for Promoting Environmental Policies

- Charges

The Government of Sri Lanka has agreed in principle that Polluters would be charged according to the pollution load and discharge. This requires the Industries to reduce the pollution load discharged, and also encourages them to participate in the Environmental Protection Licensing Scheme. The CEA is preparing a scheme for the introduction of effluent charges, by December 1994.

- Subsidies and Other Instruments

The Government of Sri Lanka has approved the granting of incentives to industries in the form of a duty waiver, exemption from turn-over tax, and suitable grants. The same package of incentives would be extended to the laboratories accredited by the Sri Lanka Standards Institute (SLSI), according to the standards set by the CEA. Further, the Cabinet has approved a scheme for the control of pollution from existing Industry, as an interim relief to existing industries in the efforts to meet the waste water standards required by the regulations. A proposal has been approved, to establish a rolling fund for pollution control at the National Development Bank (NDB), in order to finance pollution control measures by industrialists.

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COMMUNICATION FOR THE ENVIRONMENT: EDUCATION AND AWARENESS

19.1. The Broad Goal

Education and public awareness creation is basic to all development activities. This is especially so where public cooperation is vital to the attainment of objectives, and because the environment sphere encompasses the broadest area as regards coverage, development sector-wise, as well as, human population-wise. As recognised in Agenda 21, the programme proposed by the United Nations on the recommendations of the Review Conference on Environment and Development in 1992 (Chapter 36).

'There is still a considerable lack of awareness of the interrelated nature of all human activities, and the environment, due to inaccurate or insufficient information. Developing countries in particular lack relevant technologies and expertise. There is a need to increase public sensitivity to environment and development problems and involvement in their solutions and foster a sense of personal environmental responsibility and greater motivation and commitment towards sustainable development.'

The overall objective as regards increasing public awareness is given in Agenda 21 as:

'The objective is to promote broad public awareness as an essential part of a global education effort to strengthen attitudes, values and actions which are compatible with sustainable development. It is important to stress the principle of devolving authority, accountability and resources to the most appropriate level with preference given to local responsibility and control over awareness-building activities.'

Education regarding re-orienting education towards sustainable development in Agenda 21 notes that:

'Education, including formal education, public awareness and training should be recognised as a process by which human beings and societies can reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues. While basic education provides the underpinning for any environmental and development education, the latter needs to be incorporated as an essential part of learning. Both formal and non-formal education are indispensable to changing people's attitudes so that they have the capacity to assess and address their sustainable development concerns. It is also critical for achieving environmental and ethical awareness, values and attitudes, skills and behaviour consistent with sustainable development and for effective public participation in decision-making. To be effective, environment and development education should deal with the dynamics of both the physical biological and socio-economic environment and human (which may include spiritual) development, should be integrated in all disciplines, and should employ formal and non-formal methods and effective means of communication.'

Education encompasses the entire range of human life, in which children who will survive into the next century, have a special place in future action on sustainable development. In terms of the basis of action recommended by Agenda 21: (Chapter 25) -

'Children not only will inherit the responsibility of looking after the Earth, but in many developing countries they comprise nearly half the population. Furthermore, children in both developing and industrialised countries are highly vulnerable to the effects of environmental degradation. They are also highly aware supporters of environmental thinking. The specific interests of children need to be taken fully into account in the participatory process on environment and development in order to safeguard the future sustainability of any actions taken to improve the environment.'

As a part of sensitising the population to the need for conservation of the environment, the concept of conserving environment as an endowment to the next generation was evolved. But now, there is an emerging recognition that the present generation is not the custodian of the environment of the future generations, but actually living from environmental assets borrowed from future generations. In the context of the young population of today, as indicated in the Report of the UNESCO Round Table on Environment Education of 1992, New Frontiers of Environmental Education –

'Apart from the size of the young population in the countries of the region, environmental degradation would compromise first their ability to meet their own future needs well before the effects are felt later by later generations. Today's young people, as the leaders of tomorrow, bear special obligations to their natural heritage.'

Further the landmark document "Our Common Future" of the World Commission on Environment and Development, otherwise known as Brundtland Report, indicated that:

'Securing our common future will require new energy and openness, fresh insights and an ability to look beyond the narrow bounds of national frontiers and separate scientific disciplines.'

19.2. Educational Attainments of the Population of the Region

All the above statements indicate that the improvement of environmental education and awareness especially of the young population is of paramount importance. But, in devising all communications concerning environmental education and awareness, one has to consider the particular status of the region as regards educational attainments of the population.

Table 1 indicates the situation of the region. As seen in the Table with approximate figures for the 80s and 90s, the numbers of adult populations having had no schooling is very high, ranging from 16% in Sri Lanka, to 90% in Afghanistan. Even the percentages who have completed the first and secondary levels of education are low, compared to even the developed countries in the non-South Asian countries, such as the Republic of Korea. Adult literacy is below 50% in countries in the region, except in Sri Lanka, and the mean number of years of schooling in the 25+ population is very low, with the highest being 6.9 for Sri Lanka, while Afghanistan has an extremely low figure of 0.8%.

Table 1: Access to Education – Education Attainment Levels Age 25+ Population

Countries	No Schooling %	Completed 1st Level %	Entered 2nd Level %	Post Second %	Adult Lit. 25+ % 1990	Mean Yrs Schooling
	1	2	3	4	5	6
Afghanistan	90	5	1	2	29	0.8
Bangladesh	70	4	9	1	35	2.0
Bhutan	–	–	–	–	38	0.2
India	72	13	–	3	48	2.4
Maldives	–	–	–	–	–	4.5
Nepal	41	–	23	7	26	2.1
Pakistan	9	–	11	2	35	1.9
Sri Lanka	16	–	34	1	86	6.9
For Comparison Rep. of Korea	15	28	45	12	96	8.8

Source: Col.1–4, UNESCO Year Book 1991; Col.5&6 UNDP, Human Dev. Indicators 1991

Pervasiveness of the media cannot be high in the region, given the low literacy and low schooling attainment of the population, as well as the low income status, which is the lowest as a region in the world.

Table 2 below, gives the situation in the region as regards radio, daily newspaper circulation, and telephones, based on an index where the developed countries in the North have a rating of 100. Here too, the figures are very low, mostly single digit compared to the index of 100 reached by the developed countries. Therefore the region suffers from two interconnected maladies – low literacy and low schooling attainment, as well as low access to media of communication. In considering these low figures one has also to take into account the very rich folklore, story telling and such informal communication means of the region. The tradition of working together at harvest time etc., still prevails especially in the rural areas of the region during which information, skills and attitudes are communicated by the elders to the young. Therefore, there still exists a tradition of communication in a communal participation context (This aspect will be dealt later in this chapter).

Table 2: Media Access Index in Relation to Developed Countries (North = 100) 1988/89

Countries	Radios	Daily Newspaper Circulation	Telephones
Afghanistan	10	–	–
Bangladesh	4	3	–
Bhutan	1	–	–
India	8	8	1
Maldives	11	2	3
Nepal	3	–	–
Pakistan	9	19	2
Sri Lanka	19	10	2
For comparison			
Rep. of Korea	100	–	64

Source: UNDP, Human Development Indicators, 1991

19.3. Environmental Issues Relating to the Population of the Region

As inhabitants of the Earth, the people of this region share the concerns regarding environmental issues from the basic poverty and population based ones, to those caused by high industrial development, such as the depletion of the ozone layer in the atmosphere. However, the major issues have to be identified especially if one concedes that education and awareness creation is mainly to get the cooperation of the general population to take remedial action. The issues have to be identified in the context of those especially pertaining to the region. The overall feature is that of poverty and the scarcity of resources, as indicated in Chapter 9. This region makes the highest contribution to the population increase at present as well as in the future. In 35 years from 1990, South Asia will contribute about a billion more in human population, while the contribution of the developed countries will be less than 150 million. The major challenges are with regard to finding productive employment for large numbers coming into the labour force annually, as well as finding resources for giving even the minimum living requirements. A large proportion of the population in the region do not have access to safe water, or sanitation facilities, while arable land will be scarcer. Deforestation and soil erosion are major environmental issues, the former in the context of more and more fuelwood required for basic needs, and the latter in the context of higher productivity required from agricultural land. Hence, the communication strategies have to lay stress on environmental issues recognised as those which loom large in the context of the countries of the region, as indicated in Chapter 9. To meet the health and nutrition needs of the present population is

is in itself a challenge, while the continued population increase well into the next century further complicates the problem. The continued growth of already crowded large cities is a problem in Bangladesh, India, and Pakistan. Sri Lanka has a low urbanisation rate owed to a deliberate policy of dispersion of the population. Of the 100 largest metropolitan areas listed by the Population Crisis Committee (Washington D.C., 1990), 11 are in the region. Every one of these are in the lowest category (poor) scoring less than 44 in a scale of 100 based on a composite index having components such as food costs, living space, communication, school enrolment, public health and clean air.

19.4. Concepts and Objectives of the Environmental Education and Awareness Creation

In environmental education and special concepts which need to be incorporated in the scheme of communication, the stress on the particular concepts will depend on the context whether it is mere awareness creation or education depending on the level. The basic ecological concepts quoted from 'New Frontiers in Environmental Education' are:—

Balance of Nature	Nature has its own laws and processes to maintain itself.
Diversity and Stability	All forms of life are important. Biotic diversity promotes stability.
Interdependence	Everything is related to everything else.
Change	Everything changes. Some changes enhance the natural state of the environment, others degrade it.
Pollution	Pollution is the undesirable accumulation of substances resulting in diminished utility of a resource.
Finiteness of Resources	Most of the earth's resources are finite. They must, therefore, be used prudently and wisely.
Stewardship	Humans are part of nature. They are not masters, but are stewards of the earth.
Population Growth and Carrying Capacity	An eco-system can support only a limited number of individuals of a given species indefinitely. Beyond the carrying capacity level, an imbalance in the eco-system may occur.
Sustainable Development	Development and environmental protection should be balanced to extend the quality and quantity of resources to the greatest number and the longest time possible.

Special means have to be adopted to communicate concepts such as the finiteness of resources considered, especially carrying capacity and sustainable development. In this context, the countries of the region which still derive their culture from the main stream from Buddhist and Hindu religious beliefs have a particular advantage since these are part of their world view. In the case of others especially in the developed world, these concepts had to be developed in the context of environment degradation caused by a rapacious exploitation of the earth including its animal population.

Special attention is also required for the development of concepts such as doubling time and the cycles in nature, such as the carbon cycle and the nitrogen cycle.

The Objectives of Environmental Education are:-

Awareness :	to help learners acquire an awareness of and sensitivity to the total environment.
Knowledge	to help learners gain a variety of experiences in, and acquire a basic understanding of the total environment.
Attitudes	to help learners acquire a set of values and feelings of concern for the environment and the motivation in activity, participating in environmental improvement and protection.
Skills	to help learners acquire the skills for identifying and understanding environmental issues and participating in environmental improvement and protection.
Evaluation	to help learners acquire ability to evaluate environmental measures and educational programmes in terms of ecological, political, economic, social aesthetic and educational factors.
Participation	to provide learner's with an opportunity to be actively involved at all levels in environmental improvement and protection.

Most of the countries of the region are still plagued by a colonial legacy of an oppressive examination system. This summative examination system is entirely dependent on performance judged by pen and paper tests. This does not provide much scope for enriching teaching-learning, and hardly at all for teaching-learning requiring experimentation, discussion and group work. The school education is limited mainly to pen and paper tests. The very valuable attitudes and skills, as well as participatory learning has to be sacrificed at the altar of a sacred examination system. Sri Lanka made a valiant attempt to escape from this system, first through the use of project work and field study based environmental education, and by the use of continuous assessment. These schemes of education was aborted. Some of the countries of the region, such as Pakistan and India, have now introduced continuous assessment in keeping with the trends of the developed countries.

19.5. Participatory Activities in Environment Awareness and Education

In view of the low educational attainment of the population, the rich tradition of participatory communal work patterns and the intrinsic value of teaching-learning methods, it is necessary to stress such teaching-learning activities which have a high participatory content. In the case of school education, this would mean teaching-learning in a project based field context where teachers and learners actively participate in an environmental conservation activity or an environment improvement activity. In the case of general public awareness, the required concepts could be provided during community participation in environmental conservation or improvement. Sri Lanka has developed this type of field based education, where environmental resources are used as the teaching-learning resources in place of third-hand material obtained from classroom textbooks. Reading material become the mere reference material under such context where problem solving is the focus and teachers are co-learners. Other community improvement programmes using a mode called 'project work', was carried out with success in Sri Lanka, but this programme too had been aborted by the end of the 1970s.

19.5. Education in the Context of Lifelong Education

Issues regarding environment are being re-defined and re-discovered with changed emphasis at a very rapid rate. Therefore, classroom education based on textbooks can no longer serve the cause of an effective environmental education. Moreover, the leaders in environmental education, are those who had the capacity to learn anew. Hence, the ever changing context of environmental education has to be described in the words of Edgar Faure's 'Learning to Be', "for the first time in history, education is now engaged in preparing for a type of society which does not yet exist", or, as Ravindra Dave points out as "the increasing speed of obsolescence of knowledge".

Quoting from the Presidential Address of section F of the 45th Annual Sessions of the Sri Lanka Association for the Advancement of Science -

'It is obvious that the type of school education we now give is becoming increasingly inadequate for the little known challenges ahead. One has to agree with Paul Lengrand that "the notion that a man can accomplish his lifelong span with a given set of intellectual and technical baggages is fast disappearing". What is being proposed is a means of providing an education, which is currently valid, has anticipatory elements and which gives the skills and attitudes for the continued renewal of knowledge, attitudes and skills.'

Further, according to Hugh Hawes, 'the concept of horizontal integration of learning experiences, one mode of learning complementing another; that of vertical articulation of such experiences over the lifetime of a learner from childhood to maturity and beyond. The principle of flexibility as to where and when learning can take place. The re-examination of the role of the school as just one agent of education among many. The redefinition and broadening of the terms "learner" and "teacher", "learning" and "teaching". The concept of a learning society, in which individuals choose their own paths to learning.'

Therefore, in devising communication strategies for environment education and awareness creation, one has to take into account the particular situation in the region, as indicated above, and to the needs which are changing their character and emphases. All the countries in the region have somewhat developed communication and education systems. For main line education the communication has to be through the formal and the developing non-formal system. The media, especially the radio, can provide the required awareness component. But, the urgency and significance of the concerns of the environment require that much more effective modes of communication are devised and deliberately utilised. In this regard, the most effective appears to be communication of concepts, skills and attitudes in a context of actual participation in an environment-related development activity. The end product is some visible improvement capable of instilling self-reliance and above all of engendering hope.

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References

1. Agenda 21 Chapters 25 and 36, United Nations Conference on Environment and Development (Rio de Janeiro, June 1992)
2. Perera W S – Presidential Address – Section F, Sri Lanka Association for the Advancement of Science – 45th Annual Sessions – December 1989. (also for quotations from "Learning to Be", R.H. Dave, Foundation of Lifelong Learning, Hamberg, UNESCO Institute for Education, 1976, and Hugh Hawes, Child to Child, Another Path to Learning, Hamberg, UNESCO Institute for Education 1988)
3. Population Crisis Committee (Chart) Washington D.C., 1990
4. UNESCO, Statistical Year Book 1991, Paris, 1992
5. UNESCO, PROAP, New Frontiers for Designing and Implementing Environmental Education Programmes, Report of a Round Table, Bangkok 1992
6. United Nations, UNDP, Human Development Indicators, New York, 1991

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REGIONAL, SUB-REGIONAL AND GLOBAL RESPONSES

20.1. Global Initiatives

The dominant global event of recent years in the field of environment was the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, in June 1992. This conference was the climax of many years of preparation of various kinds all over the world, including four official meetings of the UNCED Preparatory Committee and numerous other meetings, workshops, seminars, research programmes etc., at the global, regional, national and local levels. There was wide involvement and interaction in these activities on the part of global and international agencies, regional institutions, national governments and a variety of non-governmental organisations, many of which were specifically established in response to or inspired by the UNCED process. Even before that historic meeting, numerous development processes on many aspects of environment and development was set in motion by the preparatory work and the awareness and climate created. Since the Rio Conference, many of these changes have gathered further momentum.

At Rio during UNCED, which was the largest and, arguably, the most momentous international meeting of national leaders ever, the Convention on the Conservation of Biological Diversity and the Framework Convention on Climate Change, two of the most important of the many international agreements in the field of environment, were made available for signature by the national heads and other representatives of the various governments. This became possible because work on the drafting of and on securing consensus on these documents was expedited in the run up to the Rio Conference. Of the documents which emerged from UNCED, the most important is the massive and wide ranging Agenda 21 covering 40 chapters, each devoted to a different aspect of environment and development. As stated in the preamble of that document, "Agenda 21 addresses the pressing problems of today and also aims at preparing the world for the challenges of the next century. It reflects a global consensus and political commitment at the highest level on development and environment cooperation".

These developments, the issues from which they emerged and the concerns they embodied are of great importance to the countries of the South. UNCED provided a dramatic, uniquely valuable forum for the countries of the South to effectively present their concerns in the field of environment and development to the global community. Agenda 21 elaborated and highlighted these issues and secured, at least formally, global acceptance of the legitimacy and urgency of these concerns and a commitment to address them. A key recommendation of Agenda 21 was the establishment of the Commission on Sustainable Development to effectively follow up on the recommendations of Agenda 21. The Commission was charged with the following functions.

- (a) To monitor progress in the implementation of Agenda 21 and activities related to the integration of environmental and developmental goals throughout the United Nations system through analysis and evaluation of reports from all relevant organs, organisations, programmes and institutions of the United Nations system dealing with the various issues of environment and development, including those related to finance.
- (b) To consider information provided by Governments, including, for example, in the form of periodic communications or national reports regarding the activities they undertake, to implement Agenda 21, the problems they face, such problems related to financial resources and technology transfer, and other environment and development issues they find relevant.
- (c) To review the progress in the implementation of the commitments contained in Agenda 21, including those related to provision of financial resources and transfer of technology.
- (d) To receive and analyse relevant input from competent non-governmental organisations, including the scientific and private sector, in the context of the overall implementation of Agenda 21.

- (e) To enhance the dialogue within the framework of the United Nations with non-governmental organisations and the independent sector, as well as, other entities outside the United Nations system.
- (f) To consider where appropriate, information regarding the progress made in the implementation of environmental conventions which could be made available by the relevant Conferences of Parties.
- (g) To provide appropriate recommendations to the General Assembly, through the Economic and Social Council, on the basis of an integrated consideration of the reports and issues related to the implementation of Agenda 21.
- (h) To consider, at an appropriate time, the results of the survey to be conducted expeditiously by the United Nations Secretary-General, of all UNCED recommendations for capacity-building programmes, information networks, task forces and other mechanisms to support the integration of environment and development at regional and sub-regional levels.

The activities and awareness generated and the institutions built up through the UNCED process have infused fresh life and given new direction to international agreements in the field of environment. Globally, most of these agreements are administered under the umbrella of the United Nations Environment Programme (UNEP); ESCAP is also involved regionally.

Among the international agreements which have the greatest impact, currently and potentially, on the environment of Sri Lanka, are the Bonn Convention on Conservation of Migratory Species of Wild Animals, the Convention on International Trade in Endangered Species of Wild Fauna (CITES), the Ramsar Convention on Wetlands, the Convention on Biological Diversity, the Montreal Protocol, the Framework Convention on Climate Change, and the Basel Convention on Transboundary Movements of Hazardous Wastes. The focal point for the first three of these is the Department of Wildlife, and for the the other four, the Ministry of Environment and Parliamentary Affairs.

a. The Bonn Convention on Conservation of Migratory Species of Wild Animals

The Bonn Convention was signed in 1979 and ratified in 1991 with the Department of Wildlife Conservation as the focal point. A major area of concern has been to protect Sea Turtles under the provisions of this Convention with supportive legislation, particularly, the Fauna and Flora Protection Ordinance. The Department of Wildlife Conservation is also engaged in efforts to protect other species, including Dugong, Whale and Migratory Birds.

b. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES was signed in 1973 and ratified in 1979, with the Department of Wildlife Conservation identified as the focal point. A permit system has been introduced for the export, import and re-export of living animals, plants and their products. In the case of endangered species of wild fauna and flora, no permits are issued, i.e., trade in them is prohibited under the Fauna and Flora Protection Ordinance, which has been amended to facilitate implementation of CITES, and also protect more effectively, wild fauna and fauna.

Training programmes have been conducted for officials involved in the implementation of the Convention and a National Workshop conducted on ways and means to control the illegal trade in wildlife products and ensure the successful implementation of CITES.

c. The Ramsar Convention on Wetlands

With the Department of Wildlife Conservation as the focal point, Sri Lanka signed the Ramsar Convention in 1989 and ratified it in 1990. As in many other countries, many wetlands have suffered from pollution or being filled up under 'land reclamation' programmes. The functions and the value of wetlands and flood plains have received increasing international attention and appreciation over the past two decades. The Directory of Asian Wetlands, carries a description of the significance and status of 947 internationally important Asian Wetlands, including 41 in Sri Lanka. There is an ongoing programme, worked out on the initiative of the Central Environmental Authority, of technical and financial assistance from the Government of the Netherlands, in September 1991, to:

- assist in the conservation and management of Sri Lanka's wetlands in a way that safeguards the country's biological diversity and genetic heritage; and
- strengthen capabilities of the authorities involved in wetland conservation and development, in conceptualizing, planning, implementing and monitoring of natural resource management.

d. Convention on Biological Diversity

MEPA established in January 1992, as an Inter-Agency Coordinating Group, to assist in developing a national position in respect of the draft International Convention on Biological Diversity and taking follow up action. In line with the recommendation of this Coordinating Group, the Convention on Biological Diversity was signed during UNCED, at Rio, in June 1992, and ratified in 1994, with the Ministry of Environment and Parliamentary Affairs as the focal point.

MEPA organized a National Workshop on Biological Diversity in May 1993, and followed up with the appointment of a Cabinet approved team of scientists, constituting the National Experts Committee on Biological Diversity, to advise the Government on matters relating to biological diversity. The existing Coordinating Group is being upgraded into a National Committee on Conservation of Biological Diversity with enhanced powers and functions, backed up by a Biodiversity Unit to be established under MEPA, with expertise provided by USAID. In the meantime initiative has been taken to formulate a national strategy for the conservation of Biological Diversity and to identify priority areas for action. The national strategy and related activities will be consistent with the National Environment Action Plan.

e. The Montreal Protocol

Sri Lanka acceded to the original Protocol in 1989. MEPA established an Inter-Agency Coordinating Group to assist in developing a national position on the Montreal Protocol and on follow up action. In line with the recommendations of this Coordinating Group, the 1990 London amendment was ratified in 1993. Sri Lanka's Country Programme for the phase out of ozone depleting substances (ODS) was approved by the Multilateral Fund Executive Committee on March 30, 1994. Under this Programme, an agreement was signed with the UNDP for setting up a separate Montreal Protocol Unit to implement the phase out programme, according to which all ODS are to be phased out by year 2000 for new applications and by year 2005 for servicing existing equipment.

f. Framework Convention on Climate Change

Sri Lanka signed the Climate Change Convention during UNCED at Rio in June 1992 and ratified the Convention in 1993. MEPA established an Inter-Agency Coordinating Group on Climate Change in 1992 to assist in developing national policy in this field.

Sri Lanka prepared a Preliminary Inventory of Greenhouse Gases in 1990 and submitted it to the Intergovernmental Panel on Climate Change.

The Government has taken a policy decision to take measures to conserve energy which will lead to mitigation of greenhouse gas emission.

A proposal has been submitted to the US Government seeking funds to undertake studies to address climatic change, as required by the Convention.

g. The Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal

Sri Lanka signed the Basel Convention in 1989 and ratified it in 1992. MEPA convened in January 1994 an Inter-Agency Coordinating Group to help work out national policy on this subject. As the Chair of the Group of 77, the Sri Lankan delegation took a leading part in steering through the historic decision at the Second Meeting of the Conference of the Parties in Geneva, in March 1994, to ban the shipment of hazardous wastes from industrialized to non-industrialized countries. Sri Lanka is now engaged in preparing a National Definition of Hazardous Wastes, and is formulating national legislation to back up the Basel Convention.

20.2. Regional Cooperation

In addition to promoting global initiatives such as those directed by the Commission on Sustainable Development and those governed by the various international agreements, Agenda 21 also places emphasis on regional cooperation in the field of environment (through institutions such as ESCAP) and sub-regional cooperation (through institutions such as SAARC and SACEP). The governing body of ESCAP has identified three major challenges and established thematic committees for the region on each of these, viz;

1. Committee for Regional Economic Cooperation
2. Committee on Environment and Sustainable Development
3. Committee on Poverty Alleviation through Economic Growth and Social Development

This landmark decision of ESCAP which is a logical development following from UNCED and Agenda 21, sets out clearly the priorities for the region.

1. Committee for Regional Economic Cooperation

The absence of intra-regional economic cooperation is a conspicuous feature of the ESCAP region. Politically, geographically, culturally and in socio-economic development, the countries of the ESCAP region are diverse, perhaps more so than the nations of other regions and other continents. Within the ESCAP region, there are sub-regional pockets, e.g. ASEAN, in which some significant levels of economic cooperation have been achieved, but most countries of the ESCAP region have the bulk of their trade and other forms of economic cooperation with countries outside the region.

The Committee for Regional Economic Cooperation has a catalytic role in promoting regional and sub-regional institutional building and economic cooperation and in developing and implementing regional strategies. ESCAP is a vital link global and international agencies on the one hand, and sub-regional organisations and national Governments on the other. A network of regional and sub-regional environmental and economic policy research institutions and data banks through which there can be a sharing of experiences in respect of economic policies, programmes and performances will help the countries of the region. ESCAP can help to develop such cooperation and also promote the growth scope of activity and effectiveness of sub-regional groups such as ASEAN, SAARC, and SACEP.

2. Committee on Environment and Sustainable Development

This Committee has the task of incorporating environmental considerations into development planning in the economies of the ESCAP region. It has also a responsibility to promote sustainable development and efficient management of the region's natural resources. Since there are close linkages and relationship between the environments of the countries of the sub-regions of ESCAP, the Committee has also a major responsibility to sponsor regional and sub-regional cooperation in all aspects of the environment.

Moreover, because of the many similarities within groups of countries within the region, there is a need to exchange information, share expertise and do joint research. The kind of linkages between environment and sustainable development in most countries of the ESCAP region will be very different to those countries in other regions, particularly in the North. Thus we need to explore and define collectively this relationship in the regional and sub-regional contexts.

As set out in a recent ADB/ESCAP study, estimates of the financial resources needed to be expended to achieve the major environmental objectives of the ESCAP region vary from US\$ 13 billion to US\$ 70 billion per annum, based on the scenarios of policy reforms and environmental services. This study also indicated that over 60% of this investment will need to be in the fields of energy, water resources and pollution control. One factor that clearly emerges is that while much can be done in the environmental field through regional cooperation, a very large input of funds, technologies and other resources from outside the region is also required.

In the field of natural disaster preparedness and management, there is a need not only for cooperation in information gathering and sharing and in joint research, but also in building up preparedness and in providing emergency relief.

3. Committee on Poverty Alleviation through Economic Growth and Social Development

This Committee addresses these issues within the framework of environmentally sound and sustainable development. A major regional effort is underway to achieve these objectives on the basis of close inter-relationship between poverty, human health, population pressure, environmental quality and economic development. Although there has been some economic growth in many countries of the region during the past three decades, distribution has become increasingly skewed and poverty has also increased.

Some of the major factors contributing to poverty have been identified as inadequate property rights, lack of access to education and training, capital, technology, markets and employment. Rural poverty needs to be tackled through the creation of more employment opportunities in the rural areas supplemented by enlightened population policies and programmes.

– Regional Capacity Building Initiatives, Impacts and Achievements

ESCAP has been involved in conducting workshops on awareness creation and an NGO-media Symposium on communication in the field of Environment and in the establishment of an Asia-Pacific Forum of Environmental Journalists. A major initiative was the formulation in 1991, of a Universal Code of Environmental Conduct. Other activities, in recent years, included an exhibition on clean technologies and workshops on global environmental programmes including the Montreal Protocol and depletion of the ozone layer, the Climate Change Convention and sea level rise, the Basel Convention and trafficking in hazardous wastes, and safe handling and use of pesticides and household chemicals.

A strong need exists for institutional capacity building to support policy formulation and implementation of sectoral and cross-sectoral programmes and projects. The achievement of this objective is dependent on enhanced technical assistance from global and international organisations, and on the strengthening of legislation, institutions and planning, monitoring and evaluation procedures. Regional support for capacity building is extended through the development of and improvement in access to funding mechanisms including the UNEP Trust Fund, exchange of technical know how, information and experience, fostering of a regional network policy and research institutions, the conduct of training programmes and assistance in formulating national environmental action plans.

20.3. Sub-Regional Cooperation

The two major sub-regional bodies of South Asia are the South Asian Association for Regional Cooperation (SAARC) and the South Asian Cooperative Environment Programme (SACEP).

– South Asian Cooperative Environmental Programme

SACEP, established in 1981, under the Colombo declaration, with headquarters in Colombo, was among the earliest inter-governmental institutions in the field of environment. Its membership consists of Afghanistan, Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, and Sri Lanka. SACEP has made slow but steady progress and is involved in promoting regional cooperation in environmentally sustainable development. A major objective is to promote and support the protection, management and enhancement of the environment, both natural and human, of the region, and to use natural resources judiciously towards eradication of poverty, reduction of socio-economic disparity and improvement of the quality of life. Among the major SACEP involvements are the development of a Regional Environmental Natural Resources Information Centre (RENRIC) and the South Asia Regional Seas Programme. A number of programmes to promote environmental awareness, a newsletter of success stories on environment in the sub-region, and books for children on the theme of environment are among other SACEP initiatives launched with the assistance of UNEP/ESCAP/ADB and other agencies. Recently SACEP conducted a regional workshop in Colombo on capacity building in the field of planning and management of the coastal areas in the South Asia seas region.

– South Asian Association for Regional Cooperation

SAARC, established in 1983, with headquarters in Kathmandu, include all the countries of SACEP excluding Afghanistan and Iran. But SAARC covers many aspects of regional cooperation with particular focus on economic cooperation. Environment is only one of the many areas of its activities. SAARC has grown steadily and, in the field of environment, its functions overlap with that of SACEP. A new and welcome development is the agreement between SAARC and SACEP, which have hitherto functioned independently with no coordination, to cooperate in activities in the field of environment.

SAARC has set up several technical committees in many fields, one of which is environment. The Committee on Environment was given the status of a Technical Committee in 1992, in which year a special session of this Committee was held in Pakistan to prepare modalities and programmes of action. The implementation of the recommendations of the Regional Study on Greenhouse effects has also been mandated to this Committee. One of the services rendered by the Environmental Division of the SAARC Secretariat is the collection and dissemination of information pertaining to environment.

A distinctive feature of the South Asian Region, in contrast to several others, is that there has been minimal sub-regional inter-governmental cooperation, whether in the field of economic development or in that of environment protection. The countries of South Asia, like those of other regions and sub-regions, are parties to several international agreements, covering many aspects of economic development and environment conservation, but have virtually no involvement of any significance in regional or sub-regional cooperation in environmental matters. Such cooperation is necessary in the interest of the individual States of South Asia, as well as that of the global community.

One of the few major environmental programmes of South Asia is the South Asia Seas Programme in which UNEP, ESCAP and SACEP are involved. Work on this programme is ongoing. There are many international NGOs, such as IUCN, working on similar programmes in several countries. There are numerous areas in which sub-regional cooperation is necessary, but currently lacking or inadequate, e.g., countries of the sub-region have, in recent years, adopted Environmental Impact Assessment Schemes. It will be useful to share information regarding the laws and institutions and practices covering these schemes and to collectively examine their operation in the countries of South Asia. There are also many other fields in which sub-regional cooperation is necessary to share knowledge and expertise and to work together on research and development programmes. Several proposals are being considered by SACEP and SAARC. It is expected that within the next few years, there will be a substantial portfolio of regional environmental programmes underway, which will benefit the individual countries as well as the sub-region and improve the quality of life of the population. These programmes will also yield positive externalities which will spread far beyond the boundaries of South Asia.

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PART IV

CHALLENGES AND OPPORTUNITIES

CHAPTER 21

FOLLOW-UP OF AGENDA 21

CHALLENGES TO SUSTAINABLE DEVELOPMENT:

CONCEPT, POLICIES AND ISSUES WITH REGIONAL AND SUB-REGIONAL FOCUS.

21.1. Introduction

The United Nations Conference on Environment and Development (UNCED), was held in Rio de Janeiro, Brazil, in June 1992. It was the largest Conference ever held by the United Nations, and was attended by an unprecedented number of Heads of States, and Heads of Governments. It was the culmination of several years of preparatory work by the UNCED Secretariat, numerous international, Regional, and National bodies, and Non-Governmental Organisations.

The most important document which emerged from UNCED is Agenda 21. As stated in the preamble, "Agenda 21 addresses the pressing problems of today and also aims at preparing the world for the challenges of the next century. It reflects a global consensus and political commitment at the highest level on development and environment cooperation". This provides a framework for national and international action on environment and development. It is based on an integrated concept of environment and development, covering a large spectrum.

The Agenda 21 which emerged from the Summit represents the beginning of a new consensus recognizing that development and environment are two sides of the same coin. The whole world; in precise terms, the signatories have a strong commitment and involvement in implementing the proposals spelt out in Agenda 21. A new world order which focuses on the well-being of the people and their physical environment has emerged as a result of this world Summit. The ultimate objective of Agenda 21 is to ensure the sustainability of development. That is to curtail the destructive use of resources, especially the non-renewable resources.

Agenda 21 addresses the Governments, Agencies, Organisations and Programmes of the UN system, the other inter-governmental and non-governmental organisations, the constituency groups and the public at large; all of whom, must be involved in various ways, in its implementation.

21.2. Concept

The achievement of sustainable development is at the forefront of development objectives emphasised in Agenda 21. The goal of sustainable development will, no doubt, remain one of the greatest challenges through the next century. The complexity of social, economic and cultural issues of the developing countries will demand a more meaningful and rational definition of sustainable development.

- Definition

By development, a country expects to achieve a relatively high rate of growth and better quality of life for the people. Once this objective is attained, it should sustain for a long period of time. The concept of sustainability rests basically on resource consumption and utilisation.

Although the achievement of sustainable development is the main thrust in Agenda 21, yet, there is no accepted definition of sustainable development. Moreover, the terms: sustainable development, sustainable growth, and sustainable use, have been used interchangeably, although the meanings are not the same.

The World Commission on Environment and Development which put forward this idea of sustainable development, defines it in their report – "Our Common Future" – as,

"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

The World Conservation Union defines sustainable development as,

"Improving the quality of human life while living within the carrying capacity of supporting eco-systems".

As a result of the vagueness of the definitions and absence of common consensus in the concept, it is not easy to define clear policies or strategies in achieving sustainable development by countries in the world. Hence, other than global consensus, if we can at least achieve regional or sub-regional consensus in our common policies and strategies, it will be a great step towards achieving sustainable development.

21.3. Policies

The successful implementation of Agenda 21 depends on the appropriate policy changes in policy formulation and decision making at the national and local levels. To ensure this, it is necessary to strengthen the regional and national capacities of the countries to be able to develop the comprehensive plans and strategies needed for the integration of environment and development.

– Policy Changes

Policy changes are necessary especially in developing countries to integrate environment in all their development activities. The traditional way of measuring growth and development has to be done away with. The introduction of new subjects such as – Environmental Economics, Green Audit, Environmental Impact Assessments, in all development planning processes should be considered as vital. These changes are necessary not only in development planning, but also, in the whole educational system.

– Need of an Integrated Policy

The environment problems cannot be taken in isolation and addressed separately, without taking into account the intertwined problems such as – population explosion, poverty, illiteracy and environmental degradation, which are most deeply rooted. Most people in the world are lacking the most basic human needs. 1.3 billion people still lack safe drinking water. More than 150 million people live on impoverished land, due to desertification.

– Priorities

Not only developmental priorities, but also environmental priorities change at different stages of development. These changes should be taken into account in deciding the policy options.

– Environmental Regulations

Rapid economic growth is an imperative in the developing countries like ours. Yet, it is necessary to set-up clear and effective regulations for environmental protection, as, environment and development are inseparable.

- Transfer of Technology

The adoption of cleaner technologies and the appropriate transfer of appropriate technologies is an essential requirement in implementing Agenda 21. Therefore, there is a need for a policy in facilitating and promoting transfer of environmentally sound technologies, cooperation and capacity building.

21.4. Issues

We may have to focus on a number of issues in implementing Agenda 21.

- Preparation of a National Agenda 21

The most important document that emerged at the Rio Conference is the Agenda 21, which gives the global picture. The main task in the hands of all the Nations, is the preparation of the National Agenda 21, based on the national priorities and international obligations. The broad global strategy for sustainable development identified in Agenda 21, will have to be focused on the national and local level. Therefore, comprehensive plans and strategies at the national level are necessary in integrating both environment and development, in policies, programmes, and in the decision making process. Moreover, the identification of national priorities to facilitate the allocation of domestic and international resources, is also an essential task.

- National Implementation

The preparation of a National Agenda 21 will not end the task. It has to be implemented successfully, harnessing the resources in achieving the expected objectives. Planning for sustainable development essentially needs the establishment of a decision making structure and coordination mechanism to achieve the effective integration of environmentally sound economic policies.

- Financial Resources

One pre-requisite for the successful implementation of Agenda 21 is the availability of resources, especially the financial resources. It is necessary to ensure that new and additional resources will be forthcoming. At the same time it is important to avoid duplication and wastage of resources. The limited resources have to be utilised in optimizing the results.

- Technical Assistance

The developing countries have to undergo enormous difficulties in implementing the actions spelt out in Agenda 21 without sufficient technical assistance, both from the region and internationally. This is required in the process of identifying, acquiring and applying environmentally sound appropriate technologies that minimize the use of non-renewable energy. At the same time, it is important in building stronger relationships between the public and private sectors, in order to facilitate both technical cooperation and the transfer of technology. The lack of financial and technical resources is proving to be a bottle-neck.

- Capacity Building

Trained man-power, especially in the technical fields is a major handicap in developing countries, in the implementation of any kind of development projects. The identification of, and a more detailed assessment of capacities, is a pre-requisite in order to catalogue the existing strengths, prior to planning for the required capacity building.

– Regional Coopération

There is a great need to have regional and sub-regional cooperation and consultation, than at the international level. Agenda 21 has serious implications for the future work of Regional Organisations, as they have to incorporate the plan of action in Agenda 21, into their medium-term plans. They will have to find a fair degree of congruence between their planned activities and the priority areas of Agenda 21. Above all, they will need to increase resources to meet these new requirements, and also help the Member Countries.

It is necessary to have some mechanisms for the strengthening the Regional Coopération through exchanges of ideas, technologies, and expertise, to ensure the successful implementation of Agenda 21.

Thus, the biggest challenge before us is to build a consensus on regional actions to supplement national efforts in implementing a Regional strategy, as there is inter-dependence among the countries in the region. The Government policies, as well as institutional and organisational arrangements should be geared towards achieving this goal. Moreover, it has to ensure the additional flow of resources based on priority needs, in achieving the successful implementation of Agenda 21.

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PROSPECTS FOR THE 21ST CENTURY: A REGIONAL PERSPECTIVE

22.1. Introduction

The Government of Sri Lanka has over the years initiated diverse measures to ensure an ecologically sustainable development. It is apparent that all concerned would have to take advantage of the encouragement and incentives provided, in not only conceptualizing, evolving, motivating, implementing and evaluating plans and projects for pollution control, but also, cooperate unreservedly in areas where compliance to the environmental standards are both imperative and mandatory.

The volume of research undertaken and the data collected allows for the establishment of codes of conduct for pollution management through development. Given the increasing positive response from all sectors towards environmental concerns, it is expected that their heightened consciousness would have a catalytic effect in complying to environmental norms.

22.2. Environmental Conditions and Trends

The land use in Sri Lanka as observed in the past decades shows a definite trend towards a marked degradation of vegetation cover, due mainly to continued shifting cultivation and deforestation. This, despite attempts to arrest the trend. It is significant that there is seemingly, a notable decrease in plantation crops, grassland, dense and open forests.

It would appear that in Sri Lanka, man-induced land degradation is more significant than that caused by nature-induced processes. The high rate of deforestation, soil erosion, siltation, landslides, floods, the emerging problems of increasing salinisation caused by coastal erosion, the unplanned tapping of ground water, poor water management practices, in addition to the liberal use of fertilizers and their consequent detrimental effects on the soil, apparently requires urgent attention.

The underground land resources whilst being a source of export earnings and local employment, does destroy land which is largely confined to paddy cultivation. Gemming activities carried out particularly along river beds, banks and similar upland areas, directly contribute to soil erosion and affects paddy cultivation.

Sri Lanka has a long history in the development of organised forestry and protected area management. Nevertheless, the reduction in forest cover is attributed to population explosion and the consequent need of lebensraum – for shelter, livelihood and fuelwood. This, apart from timber extraction both for local consumption, as also for export earnings – the latter leading to illicit logging. There is hence, the natural consequence of a chain reaction of soil erosion, flooding, siltation of rivers and reservoirs, water and fuelwood scarcities. Further, forest fires also contribute to the widespread deterioration of the eco-systems, diminishing in turn the fauna and flora in the country.

The advantage of Sri Lanka possessing a greater bio-diversity per unit area than any other country in the region, is steadily jeopardised by both direct and indirect habitat destruction. However, the Sri Lanka Nature Conservation Strategy emphasises the need for protection of fauna and flora, as well as the importance of careful management of soil and water. It may be noted that the 5-year Development Plan for Wildlife Conservation and Protected Area Management Sector in Sri Lanka, is directed at the conservation of the bio-diversity of the country.

Sri Lanka is not only endowed with an abundant supply of water through the North-East and South-West monsoons, and rains during the intermonsoonal periods, but also has a radial drainage pattern with river sources in the high elevation water-sheds of the central hills, which receive heavy rains.

As compared to the past when the country depended on irrigation systems, with multi-purpose objectives such as – irrigation, drainage, flood control and conservation, modern projects tend to concentrate on irrigation, flood control, and hydro-power production, with only secondary emphasis on drainage, and an almost complete absence of attention to conservation.

Ground water provides an increasingly important source for the majority of the population, who still depend on water from wells. The right to use, manage and control water of any public lake or stream is vested in the State. The most serious threat to ground water comes from nitrate and bacterial contamination, due to the extensive use of agro-chemicals and the disposal of sewage effluent from pit latrine soakaways. Poor water supply and excreta disposal systems have resulted in the greater part of the population being exposed to water borne diseases.

With the rapid growth of small industries in the urban and suburban areas, the run-off into lakes, streams or canals include every pollutant nutrient, toxic wastes, oils and bacteria. Similarly the agricultural run-offs usually include pesticides, nutrients from fertilizers, organic material and pathogens, whilst there is also acids and heavy metal pollution in the run-offs from mines and sediment from gemming activities. These contribute to the water pollution problems of Sri Lanka. Increasingly important is the disposal of domestic and industrial solid wastes.

Sri Lanka's wetlands are depended upon by many rural communities, to meet their basic needs. Wetland protection and management was handled by many agencies, and of late the constitution of a National Wetland Steering Committee has been approved by Cabinet decision.

The coastal and marine environment having the fishing industry as its mainstay, is also endowed with mangroves, coral reefs, and sea grasses, as part of its eco-system. Nevertheless, the rapid increase in the density of population in the coastal areas of the island has contributed, in no small measure, to the degradation of the environment.

The inhabitants of the coastal zones, being among the most impoverished of the island's communities, are apparently compelled, by reasons of poverty, to exploit the coastal and marine resources in order to meet their daily needs. Hence it would be imperative to combine the programme of poverty alleviation with that of conservation of the coastal and marine environment.

The tropical island that is Sri Lanka, with its topography of central hills with a broad peneplane, has both the distribution of temperature and pattern of rainfall, quite characteristic of this particular natural setting. This accounts for a favourable climate throughout the year, with adequate rainfall in most parts of the country, to permit a sustainable agro-economy.

However, as regards the impact of global warming, following a recent study, it has been identified that the most vulnerable area due to climate change is the sea-level rise and its effects. Next is the impact on agriculture, particularly the reduction in crop yield. Among the other consequences are increased coastal erosion and salt water intrusion into water supply intakes, as also, increases in vector population and inundation of low-lying land.

Several programmes have been launched with a view to mitigate eventually the emission of Green House Gases or the impact of climate change, and, it is proposed to diversify economic activity, through the advocacy of policy initiatives that promote the prospects of economic growth while limiting environmental damage. Other national response strategies include a greater reliance on industrialization and a sound population policy, which hopefully will contribute to the achievement of high economic development and make response to climate change much easier and which would facilitate the process of adaptation to climate change.

Management of toxic and dangerous products, and wastes are presently not governed by any legislation in Sri Lanka, although laws do exist on specific chemicals. Nevertheless, of late, serious attempts have been made to control industrial pollution, particularly through some stringent regulations such as the Environmental Protection Licensing Scheme and the Environmental Impact Assessments.

With industrial development and the problems related to adverse environmental impacts of toxic chemicals, industrial, and hazardous wastes, it is becoming imperative that effective waste management strategies and measures are implemented. Such action will not only ensure improved environmental conservation, but also, eventually contribute to savings in the industrial process, through recovery and recycling activities. In this regard, environmental education and creation of awareness leading to popular participation will induce the community to realise the importance for their own well-being, to reduce wastes and involve themselves actively in the recovery and recycling processes.

The changes in the living patterns of the local population, their migration to urban and coastal areas, the shifting cultivation practices and deforestation, mining and gemming activities, and the excessive exploitation of the natural resources, all contribute to the creation of conditions for the occurrence of natural disasters.

The dramatic increase of natural disasters are in reality the consequence of man's inconsiderate exploitation of the environment. The increase in population also has as a natural effect, the need of land for shelter and sustenance, causing the unplanned use of land and water, and leading to the creation of vulnerable disaster prone situations.

The mitigation of the adverse effects of natural disasters requires concerted efforts at the national, regional and local planes, in undertaking pre-disaster planning and preparedness measures. It also requires a conscious recognition that such planning and preparedness activities are an integral part of the National development process.

The creation of public awareness of their responsibilities at mitigation of natural disasters and their active participation in disaster preparedness exercises, is bound to have a positive impact on the reduction of environmental degradation.

22.3. Causes and Consequences

Poverty has been recognised as a contributory factor of environmental degradation, although it would be rather simplistic to conclude that environmental degradation is the direct result of poverty.

It is evident that the poor are also dependant on land for their habitat and sustenance. It is also evident that those involved in agriculture are not offered alternate forms of farming to avoid continuing harmful agricultural practices detrimental to the environment. For instance, shifting cultivation could be well be avoided through planned systems of settled farming.

Similarly, the poor in the urban areas and around forest land who use fuelwood for all their energy requirements could also be afforded alternate possibilities to depletion of forest cover. Some countries promote the cultivation and growth of fuelwood trees on an organised scale to meet their energy requirements.

A continuous and penetrating educational programme conceived specially for this target group of poor communities, with the precise objective of harnessing their active participation in the arrest of environmental degradation could be accorded serious consideration.

The population growth in Sri Lanka, and in the region, is no doubt quite critical, given the limited space available. It must be recognised that the increase in population continues to grow on earlier growth. Any postponement of action to arrest this phenomena, as a matter of urgency, would quite evidently entail added problems for the future.

Although remarkable progress has been registered, particularly in food production, yet the comparative increase in population has in reality resulted in much lower gains in the quality of life. Despite Sri Lanka conserving a low population growth rate and having a barely satisfactory calorie supply, it is evident that the use of land for food production cannot be increased significantly, except at the cost of further depletion of the already receding forest cover. Hence, it would be unrealistic to aim at lifestyles related to high levels of strain on the environment. While attempts are made at obtaining resource-economic food production to meet the requirements of the increasing population, the release of pollutants into the environment cannot be glossed over.

The development of agriculture, livestock and fisheries has been greatly influenced by the liberal economic policies adopted and practised since the late seventies. This process has had both its advantages and disadvantages.

Under the Forestry Master Plan, agro-forestry has been identified as an important activity. Programmes in this sector have been implemented successfully and based on the experience registered, participatory agro-forestry programmes are to be launched to increase productivity, particularly in the abandoned and sparsely cultivated areas in the dry zone.

During the last decade, apart from research and development and provision of irrigation water facilities, the Government has shared other areas of activity with the private sector, including the management of field channels by farmer's organisations. Fertilizer and pesticide import and distribution is with the private sector, whilst quality control is continued to be exercised by the Government.

During the past decades large extents of forest cover had been cleared for multi-purpose irrigation and production of hydro-electric power. The consequences include widespread soil erosion and land degradation. However, new techniques are being introduced to ensure soil conservation measures, and these are being implemented.

A wide variety of fauna and flora have also been affected by indiscriminate land clearance. Presently, large-scale clearance of land require permits following Environment Impact Assessment. This process also ensures popular participation in conservation activities.

Industrial development has grown as a result of the liberalised economy with the objective of attaining 'Newly Industrialised Country' status by the turn of the century.

The importance of a strategy to effectively manage industrial pollution has been recognised. In this regard, apart from the provision of adequate effluent treatment plants to mitigate the adverse effects, appropriate technology is yet to be developed for the recovery and recycling of industrial wastes. At the moment, most of the solid wastes generated by industry ends in, on-site disposal or in open dumps. As for hazardous wastes, it is expected that the Industrial Pollution Management Strategy will be an important component of the overall Environment Management Strategy.

Severe restrictions regarding coral mining have been imposed through legislation, but, due to the prevailing socio-economic conditions, enforcement has been minimal.

Air pollution due to industrial activities is expected to become a major cause for concern in the foreseeable future. Water pollution, however, is one of the chronic problems, caused mainly by sewage, fertilizers, pesticides and effluents.

The indigenous sources of energy in Sri Lanka include fuel wood and hydro-electricity. This, together with crude petroleum oil and some refined products are used for the day-to-day living by the community, mainly for cooking, lighting and transport.

At present, the consumption of energy being relatively low, compared to other countries in the region, damage to the environment is not considered a serious problem yet. Nevertheless, it is expected that a shift from the use of hydro-electric to thermal power, could bring about the emission of polluting gases beyond safe levels, unless suitable mitigating measures are imposed.

Public transport is the main means of travel of the majority of the population. All transport by road, rail and air, consume fuel that is imported.

The average energy consumed by the transport sector is nearly half the total energy consumed in the country. Given the price structure, there has been a shift to a greater use of diesel powered vehicles.

In the drive to conserve energy, the Government has introduced an upper limit for the size of engines of private motor vehicles. Regulations are to be introduced to limit pollution, through control of vehicle emissions.

The variety in the fauna and flora, the climatic conditions, and the rare geo-physical endowment of the island, continues to be an attractive proposition for tourists, both local and international.

Unfortunately, the development of the tourist industry has also led to socio-cultural and environmental problems, such as the pollution of beaches and tourist resorts. This condition has been created, inter alia, by sewage, plastic wastes, as also, uncontrolled and ill-planned constructions.

Fortunately, tourists are becoming increasingly aware, and more conscious of the environment, and the importance of its conservation. It is certainly more and more evident that all parties concerned in the tourist industry – the public and private sectors, as well as the tourists themselves, are concerned that environment dependent tourism can only be obtained through sustainable levels of development coupled closely with coordinated environmental management, with the objective in view of conserving the natural resources.

The importance and inter-dependence of health, environment and development was highlighted by the First Principle of the Rio Declaration.

Numerous diseases are caused as a result of adverse environmental conditions. The rapid growth of population coupled with the increase in poverty, is critical in this regard. It is now recognised that for the alleviation of poverty, sustainable development and proper environmental management should be closely linked. Environmental Impact Assessments have been foreseen, to ensure that development initiatives avoid creating environmental hazards and prevent degradation and pollution.

Environmental health concerns should imperatively figure in the planning, implementation and evaluation processes, and it is of vital importance to heed changing demographic patterns and the capacity of the infrastructure to absorb and meet the basic requirements of health and sanitation. For, any imbalance could not only disturb the natural environment, but also, bring about health problems.

22.4. Conclusion: Projections for the 21st Century

The developments registered and the environmental issues raised in this report reflect both the general consensus on the environmental conditions and trends along with their causes and consequences, and the political commitment at the highest level on development and environment related actions and cooperation at the national level.

The issues that have been portrayed and the concerns embodied are of tremendous importance as regards projections for the 21st century. The general acceptance, the legitimacy, the recognition of the urgency and commitment to address them has been recognised. This awareness coupled with the activities generated and the institutions and processes created for compliance and implementation of environmental measures have infused new direction and impetus.

The various international agreements and instruments to which Sri Lanka is a party, has also had a real impact both immediate and potential, and the activities so generated does augur well for the conservation of the environment for the future. Training programmes, workshops and similar initiatives on the national and regional planes, have and will contribute to a greater consciousness of the identity and similarity of the issues and concerns, as also the solutions by way of exchange of valuable information on the actions taken and experiences registered.

Similarly, the national strategy and activities, whether it be regarding the conservation of Biological-diversity or the ways and means of control of trade in Endangered Species of Wild Fauna and Flora, the significance and status of Wetlands, the phase out of Ozone Depleting Substances, the measures to conserve energy and the mitigation of Greenhouse Gas emissions, the control of Trans-boundary Movements of Hazardous Wastes and their disposal, must have an impact in enhancing regional cooperation and action, despite the diversity politically and culturally. This may well be achieved through the existing mechanisms, such as the ESCAP, SAARC and SACEP, as also the Committees on Regional Economic Cooperation, Environment and sustainable development, and Poverty alleviation through Economic Growth and Social Development.

These Agencies and Committees have a catalytic role in fostering regional cooperation and coordination, for projection into the next century. It could well be foreseen that a network of regional environmental research and data banks would be instituted for the express purpose of facilitating experiences in respect of policies, strategies, programmes and performances to promote sustainable development and the efficient management of the region's natural resources.

The areas for such regional cooperation and coordination cover all aspects of environment. For example, in the field of disaster preparedness planning and management there is a crying need not only for gathering and sharing information, but also for developing disaster preparedness mechanisms and the provision of emergency relief. Similarly, there is a vast scope for concerted action in the other fields of environmental concerns of the countries in the region, and SACEP constituted with the major objective to promote and support protection, management and enhancement of the environment, both natural and human, of the region, and to use natural resources judiciously towards eradication of poverty, reduction of socio-economic disparity and the improvement of the quality of life, could well play this catalytic role, creating within the foreseeable future, a substantial portfolio of regional environmental programmes to conserve the natural resources of the countries in the region and improve thus, the quality of life of the peoples.

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Appendices

**THE ROLE OF LOCAL AUTHORITIES
IN THE MANAGEMENT AND
PROTECTION OF ENVIRONMENT
IN SRI LANKA**

by

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SRI LANKA

THE ROLE OF LOCAL AUTHORITIES
IN THE MANAGEMENT AND
PROTECTION OF ENVIRONMENT
IN SRI LANKA.

1. Introduction :

Since ancient times, Sri Lanka continues to be a country rich with natural resources. Concern for the environment and for the judicious management of natural resources had characterised the policies of the ancient kings in Sri Lanka.

Serious pre-occupation with environmental problems is a relatively recent phenomenon in this country. Many factors contributed to the environmental degradation in Sri Lanka. One of the principal causes of environmental degradation in Sri Lanka has been the rapid growth of population. Other causes are the uncontrolled urbanization and the spread of unplanned human settlements. The accelerated development efforts undertaken by the government has generated its own environmental disturbances.

2. National Policy on Environment :

The national policy of Sri Lanka on the environment is based on the constitutional provision relating to the subject. Aspects of safeguarding the environment have been embodied in the constitution of the republic. Article 27 (14) states, "The State shall protect, preserve and improve the environment for the benefit of the community". Article 28 (f) states that the "exercise and enjoyment of rights and freedom is inseparable from the performance of duties and obligations and accordingly it is the duty of every person in Sri Lanka to protect nature and ensure its riches".

At the same time, the government is committed to improve the quality of life of the people, through the generation of employment and higher income and provision of better housing and other common amenities. Therefore the task that the government is faced with is one of reconciling environmental protection and management with sustainable growth.

3. Legislation :

Prior to 1980, laws relating to the environment in Sri Lanka were in a sporadic state. There had been over 50 statutes enacted over the past 100 years or so, which have some connection with environmental protection. The British colonial administration in Sri Lanka, introduced many statutes, which contain a wide range of provisions relating to natural resources management and pollution control. However, environmental legislation dealing with environmental management proper is of very recent origin.

A law to integrate and cover all aspects of environment was made for the first time in 1980. It is called the National Environmental Act No. 47 of 1980 (NEA). The scope of this Act has been widened by the National Environmental (Amendment) Act No. 56 of 1988 and Regulations made under the Act.

4. Institutional Arrangement :

The task of steering environmental activities in Sri Lanka at the national level rests on the following institutions.

- Ministry of Environment and Parliamentary Affairs
- Office of the Project Minister for Environment
- Central Environmental Authority

4.1 Ministry of Environment and Parliamentary Affairs :

In March 1990, a separate Ministry of cabinet rank was created for environmental affairs. This is the Ministry of Environment and Parliamentary Affairs. This Ministry is responsible for all policy matters relating to environmental protection and management.

4.2 Office of the Project Minister for Environment :

Along with the creation of a separate Ministry of cabinet rank, a Project Minister was appointed for environment. The function assigned to this office is the closer supervision of the implementation process of environmental activities.

4.3 Central Environmental Authority :

The Central Environmental Authority was created in 1981 under the provisions of the National Environmental Act, as the principal policy making and co-ordinating agency for environmental management in Sri Lanka. Before a separate Ministry was created for environmental affairs, CEA was functioning under the Ministry of Local Government, Housing and Construction. Now the CEA functions under the Ministry of Environment and Parliamentary Affairs. With the establishment of the new Ministry, environmental policy formulation, a function hitherto assigned to the CEA, was transferred to that Ministry. The CEA is the Central Agency for coordination of all aspects relating to the implementation of environmental programmes, on creation of public awareness, control of pollution, conservation of natural resources, determination of standards and criteria for the useful utilization and protection of environment, environmental research and education and so on.

4.4 Other National Level Institutions Concerned with the Environment

There are many institutions at the national level which have something to do with the environment such as the Department of Forest Conservation, Department of Wild Life Conservation, Department of Coast Conservation, Department of Agriculture, Ceylon Institute of Scientific and Industrial Research (CISIR), Natural Resources Energy and Science Authority (NARESA), Urban Development Authority (UDA), National Aquatic Resources Agency (NARA) and so on.

5. Institutional arrangement at the Sub-national Level :

At the Sub-national level the main unit of administration is the Provincial Council. According to the constitutional provision relating to the Provincial Councils, they are empowered to enact their own statutes on the protection of environment.

Below the Provincial Council administration there are Local Authorities and they can play a very wide role with regard to the protection and management of the environment.

5.1 Local Authorities :

Three types of Local Authorities are functioning in Sri Lanka at present. They are: Municipal Councils, Urban Councils and Pradesheeya Sabhas. They are constituted under the Municipal Councils Ordinance, Urban Councils Ordinance and Pradesheeya Sabhas Act respectively. Local Authorities are vested with powers and functions relating to the provision of common amenities, essential for the day to day life of the community; prevention of nuisances and promotion of environmental health and sanitation. Local Authorities are given powers to perform above functions, by the main Ordinances mentioned above as well as by several other Legislative Enactments.

5.2 Environmental Responsibilities vested in the Local Authorities :

Local Authorities in Sri Lanka are vested with the responsibility of performing many environmental functions at the local level. There are two categories of environmental responsibilities assigned to Local Authorities.

- (i) Environmental functions empowered under the Local Government Ordinances
- (ii) Environmental functions delegated by the CEA under the National Environmental Act.

5.3 Environmental Functions Entrusted to Local Authorities Under Local Government Laws :

Municipal Councils Ordinance, Urban Councils Ordinance, Pradesheeya Sabhas Act and several other laws such as Housing and Town Improvement Ordinance, Nuisance Ordinance, Urban Development Authority Act, Food Act and so on, assign responsibilities to Local Authorities in relation to the management and protection of environment, covering a wide range of area. They can be summarised under four main categories.

(a) Regulating the Land Utilization :

- Preparation and implementation of zoning schemes,
- Control of construction activity,
- Control of lotting of lands ,
- Demarcation, construction and maintenance of thoroughfares and streets,
- Establishment and maintenance of parks, esplanades and open spaces.

(b) Protection of Environmental Health and Sanitation :

- Regulating the drainage system,
- Provision of Latrine facilities,

- Provision of scavenging and conservancy services,
- Regulating in-sanitary buildings,
- Prevention of nuisances,
- Control of pollution caused by slaughter of animals, public bathing and washing, stagnation of water, disposal of dead bodies, discharges of factories, stray animals, unwholesome food stuffs.

(c) Maintenance of Public Utility Services :

- Supply of water,
- Supply of electricity,
- Illumination of streets and public places,
- Establishment and maintenance of public markets,
- Provision of housing facilities

(d) Regulation of various Industrial and Commercial Activities :

- Lodging houses and tenaments,
- Loudspeakers, amplifiers and other devices producing sound,
- Bakeries, restaurants, hotels, dairies, etc.
- Meat, fish and vegetable stalls,
- Brewaries and aerated water manufactories,
- Breeding of animals,
- Private markets and fairs,
- Barber saloons,
- Any other activity coming under the perview of Dangerous and Offensive Trades by-laws.

5.4 Environmental Functions Delegated to Local Authorities by the CEA under the National Environmental Act :

The following environmental functions have been delegated to Local Authorities by the CEA under the National Environmental Act.

- (a) Issue of environmental Protection Licences for low polluting industries, such as, Saw Mills, Paddy Mills, Metal Crushers, Bakeries, Grinding Mills, Garment Factories, Livestock Farms, Bricks & Lime Kilns, Welding Workshops, Tea Factories and so on.
- (b) Implementation of programmes for the prevention, abatement and control of pollution in relation to the above activities.
- (c) Monitoring and investigation of complaints about environmental pollution.
- (d) Co-ordination of regulatory activities relating to the discharge of waste and pollutants into the environment.
- (e) Prohibition of unauthorised discharge or disposition of litter waste, garbage and sewage.
- (f) Preventing the discharge of untreated sewage or sub standard industrial effluents or toxic chemicals into the soil, canals or water-ways.
- (g) Prohibition of display of posters or bills on walls or buildings or in any other unauthorised places and regulating the organisation of hoardings.
- (h) Preventing the defacement of scenic places and public property.
- (i) Control of noise pollution.
- (j) Control of storage, transportation or disposal of any material hazardous to health.

6. Creation of Public Awareness and Procurement of Public Participation with regard to the Protection of Environment by Local Authorities :

Local Authorities in Sri Lanka can play a very significant role in relation to the creation of public awareness on the environment and procurement of public participation in the implementation of environmental programmes. As Local Authorities are composed of representatives elected by the people, the mobilization of the masses for the protection of environment can be effected by the Local Authorities more easily. In order to facilitate this aspect in every Local Authority area, a peoples' organisation called the Divisional Environmental Council (Pradesheeya Parisara Sabha) has been established. This organisation consists of all elected representatives of the Local Authority, Members of the voluntary organisations, public servants concerned with environmental matters, village level field officers, school authorities, health authorities and the clergy. This peoples' organization is functioning in an advisory capacity to each Local Authority.

7. Conclusion :

Local Authorities in Sri Lanka are functioning as a sort of Local Environmental Authorities attending to local environmental problems under the powers entrusted to them by Local Government Ordinances as well as under the delegations given by the CEA. Policy guidelines, technical assistance etc., are provided to Local Authorities by the Ministry of Environment and Parliamentary Affairs and the CEA.

COLOMBO ENVIRONMENTAL IMPROVEMENT PROJECT
Summith Pilapitiya – Coordinator
METROPOLITAN ENVIRONMENT PROGRAMME (MEIP)

The Colombo Environmental Improvement Project (CEIP), which is a MEIP investment project, focuses on the Colombo Metropolitan Area (CMA) and is expected to: (a) reverse the process of environmental degradation; and (b) enhance sustainable development. The project would be designed to promote public/private partnership to accelerate the development of infrastructure services, and to facilitate the industrial expansion program of the GOSL.

The specific components of the project are given below with a brief description to follow:

- (a) Restoration of Beira Lake;
- (b) Upgrading Solid Waste Management;
- (c) Industrial Waste Abatement and Waste Minimization;
- (d) Clean Settlements Program;
- (e) Environmental Planning and Mapping; and
- (f) Public Awareness.

The project will be implemented by the relevant GOSL agencies that have been identified for each component. MEIP would provide overall technical co-ordination with the Ministry of Policy Planning and Implementation to oversee the implementation of the project.

(a) Restoration of Beira Lake

The Beira Lake is an urban water body located in the centre of the City of Colombo. This lake, once a picturesque landmark in the city, is now a highly polluted and eutrophied lake. A restoration strategy for Beira Lake has been developed by MEIP consultants with Canadian International Development Agency (CIDA) funding, in collaboration with the Urban Development Authority (UDA). The study identified domestic wastewater as the main pollutant entering the lake. It has been estimated that over 5000 unauthorized sewer connections have been made to the storm water drain network, which is the mode of pollutant entry into the lake. The CEIP would finance the implementation of the restoration strategy. A two phase approach has been suggested in the restoration strategy. The first phase contains two sub-components. A pollution control sub-component which entails the reduction of present sources of pollution into the lake, namely re-connection of the unauthorised sewers into the main sewerage network. The project would include the identification and physical re-connection of the unauthorized sewage discharges. The pollution control sub-component also includes a consultancy component for the preparation of an in-depth study on the long-term technical solutions to restore the lake. This sub-component also includes the design and construction of public recreation areas in selected locations. The project is scheduled to be appraised in September 1994 and the tentative date for commencement for the above activities is November 1994.

The second sub-component in the first phase is an Institutional Organization sub-component. The restoration strategy has identified approximately 70 percent of the land surrounding the Beira Lake as being state property. It is envisioned that this land could be developed and the proceeds applied towards repayment of the cost of restoration of the lake. A business plan is being prepared for the development of the area surrounding the Beira Lake. The implementing agency for this component is the UDA.

The slum and shanty communities that surround certain sections of the Beira Lake would be moved into upgraded housing within the Beira catchment area. The housing will be in the form of three or four floor apartment complexes. It is estimated that approximately 600 families would need upgraded housing. This component will not be financed under CEIP.

(b) Upgrading of Solid Waste Management

The CMA collects municipal solid wastes in the range of approximately 800 tons per day. The waste is currently disposed of in several open dumps, the largest in Wellampitiya, catering to the waste of the City of Colombo. The local authorities surrounding the city dispose of garbage in a series of adhoc sites operated as open dumps. One of the most pressing problems in Metropolitan Colombo is the lack of adequate capacity for final disposition of solid waste, since the site at Wellampitiya would reach capacity by the end of 1994. In order to develop a comprehensive Solid Waste Management Plan, a group of international consultants have been commissioned to undertake a study to address the following components: (a) definition of management and organization structure; (b) Environmental Impact Assessments of 3 potential landfill sites and a transfer station; (c) geotechnical and hydrogeological investigations and conceptual engineering designs of a sanitary landfill and a transfer station; (d) development of solid waste management strategy for Katunayake and Biyagama Free Trade Zones; (e) survey and disposal plan for hospital wastes. The CEIP would finance the implementation of the above components. A potential landfill site in Welisara has been identified for development as a sanitary landfill. This site would also have a large scale compost plant. In view of the fact that approximately 85 percent of the waste is considered to be organic waste, it is proposed that a large scale compost plant will be constructed at the landfill site for treatment of biodegradable wastes. Waste transport to the site will be via one or several transfer stations. The consultants are in the process of identifying suitable locations as transfer stations. There is provision for the purchase of an incinerator for the disposal of medical and infectious wastes. The implementing agency for this component is the Western Provincial Council.

(c) Industrial Waste Abatement and Waste Minimization

The Government of Sri Lanka (GOSL) has set on achieving Newly Industrialized Country status by the turn of the Century. In its drive to industrialize, the GOSL has not lost view of the fact that industrialization generally leads to environmental degradation unless adequate steps are not taken to arrest such a trend. In view of this the GOSL is taking measures to incorporate environmental protection into its program of industrialization. The approach taken is two-fold. A preventive approach of waste minimization and a mitigatory approach of waste treatment. This component of the project would address waste minimization and clean technologies within the industrial environment to reduce the volume of wastes that need end of pipe treatment. International consultants have been commissioned to investigate the feasibility of centralized treatment of effluent in industries/industrial estate in Ekala/Ja-ela, a region that has a concentration of over 125 industries. In addition, another group of consultants have commenced a similar study for industries in Moratuwa/Ratmalana, which has approximately 250 industries intermixed in residential neighbourhood. These studies would determine the potential of waste minimization in a group of representative industries, conduct environmental audits, determine the suitability of centralized treatment, identify appropriate treatment options, the conceptual engineering designs, analysis of options for management and operation of

the facilities and disposal processes for sludge. The subsequent activities to be covered under CEIP would include design and construction of the collection networks in both areas. It is proposed that private sector investment would be required for the construction of the two treatment plants and disposal facilities for sludge. The Secretariat for Infrastructure and Development is exploring possibilities to attract Build-Own-Operate or Build-Own-Transfer (BOO/BOT) investors for the project. The GOSL is in the process of developing the management structure most suited for successful operation of the plant.

(d) Clean Settlements

The CMA has over 70 percent of the total urban population and 80 percent of industrialization. The growth of unplanned spontaneous settlements on public and private lands in Colombo needs serious attention in urban development programs, because the magnitude of the problem is such that 53 percent of the total housing stock of Colombo is within the category of substandard, that is popularly known as slums and shanties. The MEIP-Colombo in collaboration with a NGO "Sevanatha" developed a model program known as the Clean Settlements Program. The Clean Settlement concept was demonstrated in two low income settlements. The objectives of the Clean Settlement Program are to contribute to environmental upgradation of the community through: (a) improving the physical, social and economic conditions of low-income settlements; (b) improving the capabilities of local governments and sector institutions (both governmental and non-governmental) to undertake and sustain the efforts; and (c) establishment of functioning community organizations to manage the assets.

Based on the success experienced in the demonstration projects, a Clean Settlement component has been included in CEIP. This program would provide an enabling environment for the low-income population in the CUA to upgrade their own standards of living. As a departure from previous assistance programs which have failed to achieve long-term sustainability, the concept of a community based approach will be introduced. This approach is designed to shift decision making and management responsibilities directly to the community members.

The community based concept entails a bottom-up approach, i.e., by stimulating the interest in communities to organize themselves and by encouraging their active participation in resolving issues which most directly affect them. These community groups would chose a support organization to assist them and to help overcome barriers--either financial, technical or social. The support organization would be trained by and work in coordination with the CSPU in fulfilling their role as facilitator to individual communities.

In conjunction with the above enabling factors, the program would offer information, guidance and assistance on the range of improvements available to the beneficiaries, the financial obligations involved, and subsequent responsibility to protect their investment with operation and maintenance programs. The program would be designed to make available infrastructure upgrades to benefit approximately 25,000 families living in substandard housing units in low-income settlements in the CUA.

(e) Environmental Planning and Mapping

The Urban Development Authority (UDA) is frequently under pressure to provide information and analysis of services and conditions in urban areas and sub-regions of the country where rapid development is planned. A Geographic Management Information

System (GMIS) would increase UDA's ability to provide this service. The GMIS would be funded under the CEIP for the use of UDA and other relevant agencies. The project would establish a "providers and users group" (PUG) which would: (a) set priorities for the application of GMIS; (b) identify data available and required for the establishment and updating of the system; (c) identify staffing requirements to develop and maintain the system, and options for contracting out some of the work; (d) establish dissemination arrangements and access to the system; and (e) evaluate alternative technologies, costs and user charges.

(f) Public Awareness

Successful environmental management requires all members of the community to be aware of the nature and extent of environmental problems, what needs to be done to address these problems, and their responsibilities in controlling pollution and protecting the environment on an individual and collective basis. This is needed not only to ensure the development of an adequate political basis for necessary government leadership and action, but also to facilitate meaningful input by industry, NGOs and individuals to the development and implementation of solutions. A campaign on public awareness requires a momentum to be generated, and sometimes this momentum is slow to materialize. Therefore, a campaign on public awareness should be initiated prior to project implementation and conceivably the benefits could be higher as the public will be aware of and more willing to co-operate with the program.



CENTRAL ENVIRONMENTAL AUTHORITY

HIGHLIGHTS OF THE 1ST TWELVE YEARS

The Central Environmental Authority (CEA) was established under the National Environmental Act (NEA) No.47 of 1980 to provide an explicit recognition to the pivotal role that the environment must play in sustainable national development. The subject of environment cut across a large number of discipline. This requires the active involvement and proper coordination with various Governmental and Non-Governmental Organisations. The NEA defined the role of the CEA was essentially to co-ordinate and to make policy with respect to the conservation and protection of the environment. The actual regulatory role remained the responsibility of the local authorities and agencies in charge of various natural resources.

As time passed, the experience showed assistance with the regulatory powers of the CEA needed to be strengthened and expanded if the CEA was to play a more decisive role in the protection and management of the environment. This was achieved through the National Environmental (Amendment) Act No. 56 of 1988, which widened the CEA's authority, enabling it to exercise powers to:

- a) Regulate activities relating to the discharge of wastes and pollutants into the environment,
- b) Improve and protect the quality of the environment,
- c) Evaluate environmental impacts of development projects.

After the amendments of the NEA, the CEA in addition to its former role as policy making body, became concurrently a regulatory body as well. However, in March 1990, the cabinet ministry and project ministry on the environment were set up, signifying the high priority Sri Lanka attaches to this important subject. Creation of these two ministries necessitated the CEA to adjust its mandate to fall in line with the general model in the nationalisation of the functions between departments, agencies and ministries. Functions such as policy making, formulation of strategies and making legislation, mobilization of international funds and expertise, implementing of international conventions etc were taken over by the two ministries. The CEA, however, remains the key implementing agency for the two ministries, and these are implemented within the scope of policy laid down by the ministries.



National Conservation Strategy (NCS)

On the recommendation of the Government, the CEA embarked on the task of preparing a National Conservation Strategy for Sri Lanka. The Task Force headed by Mr K H J Wijayadasa, the first Chairman of CEA, completed the National Conservation Strategy document in 1988. This was subsequently accepted by the Cabinet of Ministers, thus becoming a declaration of national policy.

The NCS has now been transformed into an Action Plan, to be implemented by the relevant ministries and other line agencies.

Environmental Protection

With the amendment to the NEA in 1988, the CEA was charged with the responsibility of enforcing regulations pertaining to the pollution of inland waters and atmosphere, noise pollution, soil pollution, disposal of litter and the discharge of emission or deposit of waste into the environment. Regulations required for this purpose were gazetted in February 1990, and included procedure for a licensing scheme for new and existing industries. The Licensing Scheme mandatory that all persons who release wastes into the environment conform to environmental protection standards stipulated by the CEA.

Environmental standards and guidelines which go hand in hand with the licensing scheme have been developed by the CEA for the information of the general public. Further more a comprehensive set of guidelines for the control of pollution arising from the following major polluting industries have been completed:-

1. Natural rubber processing industries
2. Leather tanneries
3. Saw mills
4. Aggro base industries
5. Land coral mining
6. Aqua culture development project
7. Electro plastic industries
8. Textile industries



Control of Imports and news of Toxic chemicals

An approved control system for the import, use and disposal of chemicals was considered an urgent necessity by the CEA in view of the environmental and human health problems caused by the haphazard import and use of toxic chemicals in the country. A Technical Advisory Committee was appointed for this purpose and the committee compile an inventory of all the chemicals that are been imported into the country, at present, including pesticides, pharmaceutical and industrial chemicals. Sri Lanka now has a complete record of all chemicals that are been imported and used within the country.

Air Quality in the Cities

Clean Air is considered a pre requisite for healthy living. CEA initiated action to investigate the Ambient Air Quality specially within the city of Colombo as it has been pointed out that with the increasing number of vehicles, the air quality in the city of Colombo has been deteriorated. CEA carried out a six months programme to measure the air quality in six selected locations in the Colombo City. The parameters measured were carbon monoxide, sulphur dioxide, nitrogen dioxide and total hydrocarbon. The study revealed that the air quality in the city of Colombo is comparatively good and within the limits specified by the World Health Organisation.

CEA also initiated action to check vehicle exhaust emissions. For this purpose a number of smoke meters had been purchased and supplied to the Police Department and to the Motor Traffic Department. The exhaust emissions of the vehicles will be checked with the help of these smoke meters and action will be taken to bring down the emission levels up to the standards stipulated by the CEA.

Noise Pollution

A number of complaints have been received by the CEA with regard to the noise pollution in various localities. CEA with the assistance of other relevant institutions such as Colombo Municipality, Police Department, Attorney General's Department and UDA has prepared the necessary guidelines which will be finalised and incorporated into suitable legislation with the approval of the Government.



Water Quality in major water bodies

CEA has been regularly monitoring the major water bodies in the country such as Beira Lake, Kandy lake and Nuwara Eliya lake. Recently, action has been initiated to protect the water quality of Kelani Ganga which supplies drinking water to the residents of Colombo and suburbs. Action is being taken to declare Kelani Ganga basin as an environmentally sensitive area.

An Environmental Impact Assessment

One of the major achievement of the CEA is the gazetting of Environmental Impact Assessment Regulations in June 1993. With the gazetting of these regulations any project/industry prescribed by the Minister in charge of the subject of environment has to undergo an EIA prior to commencement of any activity. This would facilitate in preventing pollution caused by future projects/industries. Fourteen (14) government agencies have been designated to process applications of projects/industries which should undergo EIA procedure. Ultimate aim of the EIA procedure is to ensure environmentally sound development through a system of predicting environmental consequences of development activities and identifying mitigatory measures to minimise such effects.

National Wetland Conservation Project

On the initiative of the CEA a National Wetland Steering Committee was formed in order to co-ordinate and monitor activities affecting the wetland eco systems. With the assistance of the Netherlands Government, CEA is inventorising the major ecological functions of various wetlands and assess their present status and development potentials. It is envisaged that the project will help in the conservation and management of Sri Lanka's wetlands and ensure the safeguarding of the country's ecological diversity and genetic heritage.

Aqua Culture Project

Aqua culture Projects, specially prawn culture is one of the important activities along the coastal belt of Sri Lanka. CEA has prepared guidelines for aqua culture Projects in order to ensure that environmental aspects are given due consideration in the development of such project. The CEA is constantly assisting the Ministry of Fisheries and Aquatic Resources in the approval of aqua culture project.



Environmental Promotion

While CEA is involved in conservation of natural resources and protecting the existing environment, it has been considered that equal emphasis should be given to environmental education and awareness programmes. With this objectives much work has been done by the CEA with the assistance of the relevant expertise.

Environmental Education

Teacher Guides have been prepared for pre schools and primary schools. These are been tested at selected schools at pilot level before the printing of documents are undertaken to be distributed to all the schools in the island. Fact sheets on selected environmental issues have been printed for secondary schools. Teachers and Master teachers have been trained on environmental education while the parents, school principles and other teachers involving post graduate training courses have been subjected to awareness programmes at the National Institute of Education. A text book titled "**Man and Environment**" has been prepared for tertiary level education. This will be used in the affiliated University Colleges under environmental studies which is one of the five core subjects.

Environmental Awareness

Awareness programmes in schools are carried out by establishing school environmental societies and Environmental Pioneer Brigades. To date around 8000 students have joined the Pioneer Brigades while the number of Environmental Societies have increased to more than 1000. Students involved in the Pioneer Brigade movement will have to show their individual efforts on environmental activities and win awards according to their capabilities. In the case of environmental societies, they are induced to implement environmental projects in their own areas.

Non Governmental Organisation Activities

CEA have so far registered over 130 Non Governmental Agencies (NGOs) for the specific purpose of creating awareness among the public.



Conclusion

Since the amendment of the NEA in 1988, the Central Environmental Authority is concentrating on three main areas, namely,

1. Environmental Protection Licensing Scheme
2. Environmental Impact Assessment Procedure
3. Environmental Education and Awareness Programme.

It is felt that if the CEA could perform effectively in these areas, the environmental protection and the natural resources conservation and management could be implemented effectively. CEA feels that if the awareness is created amongst the school children on the importance of environmental protection and natural resources management in time to come the protection of the environment will be an easy task as today's children will be the decision makers of tomorrow.

G K Amaratunga
Chairman
Central Environmental Authority