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South Asia Co-operative Environment Programme

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PART I
ENVIRONMENTAL CONDITIONS AND TRENDS

CHAPTER 1

LAND

Land availability and landuse

Land is the most important natural resource vital for the survival of predominantly agricultural SACEP countries. Where country like **Bangladesh** is a deltaic flood plain (0.94 million hectares are rivers and other inland waterbodies out of a total area of 14.4 million hectares), **Bhutan** is mountainous, **Maldives** a chain of coral atolls and **Pakistan** is a land of great geographic diversity, which includes some of the worlds highest mountains, vast alluvial plains, deserts and coastal areas.

Major land use by area and land utilisation ratios of selected SACEP countries have been presented in Table-1 and Table-2 respectively.

Table 1

Major Landuse by Area of Selected SACEP Countries.

	Pakistan	Bangladesh	Bhutan	Srilanka	India	Nepal
Total area (in million hectares)	88.2	14.4	46500 (sq.Km.)	62335.7 (sq.Km.)	329	
Agricultural use (in million hectares)	20.7	9.25	16%			
Forests (in million hectares)	4.2	2.22	57%	17598.4 (sq.km)		
Housing and settlement(urban)	0.138	1.1				
Inland water area	0.913	0.94		2509.2 (sq.km.)		

Table - 2

Land Utilisation Ratios of Selected SACEP Countries

Item (ratio)	Unit	Referen -ce year	Srilan -ka	Bangla -desh	India	Pakis -tan	Nepal
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	15.4	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	0.2	0.18	0.14

There has been a noticeable change in landuse pattern in practically all the countries with growth of population which is fast in most of the countries. Increased land use for settlements, industries, infrastructure development including embankment, roads etc. is a common trend for, more and more employment opportunities, poverty alleviation, peoples migration and for increased economic activities to improve upon the socioeconomic conditions of the general mass.

But still there is wide variation in terms of land availability and their uses among SACEP countries.

Maldives is not just a chain of coral atolls, but also is very small (only 300 sq km), whereas **India** is the seventh largest country in the world in terms of landmass (land area spanning 329 million hectares).

In **Maldives** most islands are extremely flat and lowlying and approximately 80% of the land area is less than a meter above mean sea-level. The majority of land is government owned and uninhabited islands are leased by the government to individuals for various purposes. The lack of private ownership and extended tenure are potential constraints to investment. Islands are designated by the government for specific purpose, e.g. tourist resort islands, agricultural leases and industrial islands. Practically there is no forest in the **Maldives** as most of the natural woodland has been cleared and replaced by grassland and coconut.

In **Bangladesh** population pressure on land is the most crucial factor in the management of land resources. With the present population level, persons per hectare is calculated to be 9.6 for all cropped land including forests and plantation crops and 12.4 for land under agricultural crops only. Land tenancy laws are very complicated and land records in many cases are not uptodate leading to lengthy disputes. The existing inheritance law contributes to fragmentation of already small units. Such fragmentation reduces effective crop area. Landlessness is increasing every year with the growth of population, and absolute landless people (according to **Bangladesh** Agricultural census 1983-84) number to 1.2 million (8.7 percent of rural house hold) and those possessing only homestead land but no cultivable land number to 2.71 million (19.6 percent of rural household).

In **Nepal** there is sharp contrast in elevation giving peculiarities in types of landuse. More than a third of the country's land surface lies between 305 m and 1524 m and another 22.6 percent lies between 1524 m and 3048 m. Land over 3048 m covers 27.5 percent while lowlands below 305 m are only 11.3 percent of the total land surface. Consequently there is attitudinal zonation with distinctive climatic types of natural vegetation and cultivated crops.

Major landuse categories in Nepal are forest 42 percent, agriculture (including noncultivated inclusion) 27 percent, grassland 12 percent and others 18 percent. Land varies considerably in terms of its potential and capability for different uses as a result of the wide variation in the topography, soil composition and climate. On an average, there are 5.7 persons per net cultivated hectare. More than 90 percent of the people depend on subsistence farming and about 91 percent of the economically active population are engaged in agriculture.

Srilanka has a landcover of about 6.5 million hectares of which 5.5 million hectares have good soil suitable for agricultural use. With a population of 17.4 million (1992), which is ever increasing the total land man ratio is about 0.3 ha per person and cropped land per capita is 0.11 ha, second lowest figure only to **Bangladesh** in South east Asia. The major land use trends during the period from 1960 to 1980 are - i) decrease of extent by 24 percent and 65

percent respectively in the open forest and dense forest extent, at a rate of 2 percent and 1 percent per annum respectively, under open and dense forest ii) Marked decrease of 22 percent in grassland (233706 hectares in extent) and iii) notable decrease under plantation crops, namely tea - 21 percent and rubber - 12 percent, while large extents coming under other cropland shows the highest increase (83%) per annum.

In **Iran**, the country has 18.5 million hectares of croplands, 18.04 million hectares of forest and woodlands, 90 million hectares of rangelands, National parks and protected areas 8 million hectares.

In **Bhutan** according to land use preliminary survey of 1991, 25 percent of land is grass, river and alpine, 57 percent forests and 16 percent cultivated. **Bhutan's** mid montane zone is characterised by lower density of population and lesser pressure on land.

With a geographical area, spanning 329 million hectares, **India** is the seventh largest country in the world in terms of land mass. The systems and types of land use have been conditioned by climatic conditions, primarily expressed in terms of precipitation / rainfall received in various parts of the country. The unequal distribution of precipitation and water resource have conditioned agricultural cropping systems and systems of farming, though 'irrigation' has successfully transformed some of the water short states of India into its food bowls. India is also endowed with large areas of non agricultural / non-forest land. These include common grass lands and pastures, lands occupied by inland water regimes and fallow lands. These lands have been the sources of fuel wood and fodder for the large population of people and livestock in India.

Pakistan is a land of great geographic diversity. Area of Pakistan is 88.2 million hectores. Approximately 20.7 million hectares are used for agriculture (out of this 16 million hectares is irrigated). Cultivable land is 23.6% of the total land of **Pakistan**. Culturable waste land is 11.8 million hectares (13.4% of the total land). Only 4.2 million hectares come under forests, non-classified or not reported area is 20 million hectares which constitutes 28.5% of the total land of Pakistan. Urban area occupies about 138 thousand hectares of land and water bodies 0.913 million hectares.

Land Degradation and Soil Erosion

Soil erosion and land degradation is the second major scourge of the terrestrial environment which affects both cultivable and forest lands. On a global basis, only 11 percent of the soils

offer no serious limitation to agriculture. While Europe, Central America and North America have highest proportion of the soils with no serious limitation, North and central Asia have 10 percent, Southeast Asia 14 percent and South Asia 18 percent of the soils with no serious limitation. 44 percent of the south asian soils suffer from drought, 59 percent of the southeast asian soils from mineral stress and 38 percent of North and central Asian soil from shallow depth. In Asia, the annual discharge of sediment by rivers is about 14.5 billion tons which is about 70 percent of the world's total.

Since the slope of the land determines the extent and intensity of the erosion, the foothills of the Himalayas are most vulnerable to rainfall erosion. A classic example of soil erosion is Nepal, Which is reported to be losing some 240 million cubic meters of soil every year, mostly due to rainfall. South Asia has the highest incidence of erosion by wind, occurring extensively in the Islamic Republic of **Iran**, **Afghanistan**, **Pakistan** and the arid parts of **India.**

Soil degradation due to waterlogging and salinity arises mainly out of mismanagement of irrigation systems or drainage problems severely afflicted acreage exceeds 3 million hectares in **Afghanistan**, **Bangladesh**, 10 million hectares in **Pakistan**, 20 million hectares each in India, Islamic Republic of **Iran**.

In **Bangladesh,** land degradation occurs generally by two factors - Human factor and natural causes. Among various human factors, shifting cultivation (traditional one in the southeastern part - slash and burn process), Faulty cultivation practice, use of pesticides, Mining from agricultural land, irrigation, over exploitation of Biomass from the fields etc. are predominant. Due to short supply of organic manure, acute sulphur deficiency has occurred in many places. In the hill tracts areas of the country, 87 percent of the total land has been classified as having severe limitation on crop cultivation and are subject to heavy erosion due to steep slopes.

Among natural causes, river bank erosion is the worst cause of land loss and degradation in **Bangladesh**. Every year large areas along river banks erode mainly during the monsoons taking away good agricultural land, vegetation and human settlements creating acute socioeconomic problems. Another form of land degradation, though occures locally, is deposition of sandy materials on agricultural land, particularly in piedmont areas of north-central and north eastern parts. This phenomenon is the result of deforestation of the hills and faulty cultivation practice in the upper catchment areas. Land degradation by deposition of infertile soil on agricultural land also occur by breach of embankment during floods.

Continual land fragmentation is also regarded as a kind of land degradation factor because total or optimal productivity of land decreases due to segmented land management. There are also various conflicts of land use (as the availability of land is a major constraining factor in the development of **Bangladesh**) which contribute significantly to land degradation. Among these conflicts the major are - Agriculture versus settlements, Agriculture versus fisheries, Forests Versus fisheries, Forest versus agriculture, Agriculture versus Livestock.

The major environmental problems in **Nepal** are land degradation, deforestation and pollution. Poverty is the root cause of environmental degradation as land and forest resources are overexploited because of heavy dependency in the natural resource base.

In **Nepal**, the Siwaliks and Middle Mountain zone are more susceptible to erosion. The former has erodible soil and poor geological formation while the latter has high population pressure with limited productive areas. An increasing rate of soil erosion accompanied by the loss of nutrients, inadequate water management and increased dependence on the monsoons are the primary causes of declining agricultural productivity. A rough estimate of surface soil loss in the Mountains / Hills ranges from 5-10 tons/ha/yr in well-managed land to 40-200 tons/ha/yr in degraded land. Cultivation on sloping land causes high nutrient loss and as a result land degradation is severe.

Also overgrazing, overuse of marginal land followed in the past and shifting cultivation practices are contributing to the loss of fertility. The absence of a national land use policy and programmes, and a narrow sectorial approach have further led to land use conflicts, particularly between forestry and agriculture.

One of the causes of decline in soil fertility is the uneven and inappropriate use of chemical fertilizers which are used without understanding soil fertility status, nutrient availability and crop requirements.

About 20 percent of the cattle population in **Nepal** are unproductive which exert heavy pressure on forest, agriculture and grazing lands. The increasing number of livestock further contributes to accelerate forest degradation, compaction of soil leading to the suppression of vegetation growth, and also to soil erosion.

High erosion rate, landslides and river bank cutting have increased sedimentation and flood hazards in the plains, including river beds and agricultural land. **Nepal** is estimated to lose 240 million m^3 of sediment annually through its river system. The Karnali, Sapta Gandaki and

Sapta Kosi rivers respectively carry an estimated 60, 73 and 142 million m^3 of suspended load annually. As the sediment load carried by the major rivers is high, any storage projects in these corridors have a high siltation rate.

The problem of flooding in the Terai is also high due to the high bed load carried by the rivers in addition to the suspended load. In the plains, almost all the rivers are widening and cutting their banks each year. River beds of some Terai rivers are rising at an annual rate of 15-30 cm, due to high sedimentation.

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 or productivity of agricultural lands.

The present status of land distribution of Sri Lanka based on the new definition in respect of decertification adopted in February 1990, is shown in Table 3

Table 3 Land Classification Based on Ratio of Rainfall and Potential Evapotranspiration in Srilanka.

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

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Although **Sri Lanka** has no desert areas, the decertification 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.

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 4

Table 4 : Land Use Types and Related Soil Erosion Rates in Srilanka

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

More recent studies of sediment transport estimates for major rivers in Srilanka are given in Table - 5

Table - 5 Sediment load in Srilanka

River Basin	Drainage area (in 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 50000 hectares of Bog and half bog soils and about 24000 hectares of alluvial soils that are water logged.

During the last two decades, the rate of soil erosion has increased in **Iran**. Decertification, deforestation, overgrazing, clear cutting, land use mislocation and irrigation land management are main causes of this problem, which ultimately deprives the country of its fertile soils. It is estimated that the annual loss of soil due to water erosion is 1500 tons per square kilometer, which also means that one mm of top soil is washed away each year. Out of 400 billion cubic meters of surface water, 25 percent is lost as run off. As a result of heavy siltation, it is estimated that 100 million cubic meters of major dams capacities are lost annually. Altogether, the annual rate of soil erosion in the country is estimated at 1.5 billion tons. Recent studies indicate that, as a consequence of heavy soil erosion in the country, annually 75 kg of nitrogen, 24 kg of phosphorous and 8 kg of potassium are lost from each hectare of arable land.

It is estimated that 175 mha of **India's** land is degraded. This includes 85 mha under agriculture and 35 mha of forest land. Among the various reasons for the land losing its productivity are the over-application of chemical fertilizers in agriculture, waterlogging as a result of over irrigation, canal seepage, poor drainage, overgrazing of common grazing lands and deforestation. The seriousness of deforestation has been dramatically brought out through the use of modern monitoring and mapping technologies.

Two of the main pressures on the vegetative cover in India are the need for fuelwood and fodder. In India almost 87 per cent of energy of cooking is obtained from firewood, agricultural wastes and cow-dung and only 13 per cent cooking energy is from commercial sources. Firewood alone provides 50 per cent of the cooking energy in cities and 70 per cent in villages. This dependence on firewood has put a great pressure on forests, and in fact on all vegetative matter. The demand, estimated at 157 million tones in 1986-87, is far in excess of the supply.

The other pressure is the need for fodder. With the world's largest cattle population of over 400 million animals, fodder availability in India is grossly inadequate. Pasture land only constitutes 3.9 per cent of the land and as a result is degraded. The pressure on forests is once again heavy. The cattle which are undernourished produce low quantities of milk. In degraded environments people find it easier to keep goats, and the increase in the goat population has been much more rapid than that of cattle, buffaloes and sheep. But goats in fragile ecosystems are as much a problem as a solution and, unless properly managed, can further degrade the environment.

By 1985 about half of India's land was estimated to be wasteland - land which had hardly any vegetation left on it.

Major land degradation issues and problems of **Pakistan** are - loss of soil fertility through soil erosion and leaching of nutrients in humid zones, loss of soil through salinity, Heavy sediments load in river waters, reducing the life span of Tarbela and Mongla dams choking water reservoirs and canal irrigation systems, shortage of irrigation water, Irrigation of saline ground water causing soil salinity, Flash floods, Movement of sand carried by air.

With the development of irrigation in **Pakistan**, the water table rose very rapidly to within three meters of the surface from an average depth of some 25 to 30 meters. Capillary action came into play. With evaporation at the soil surface, salt began to crystalize making the land sterile, some 1.3 million hectares of land have been severely affected by water logging and a further 4.7 million hectares moderately affected out of the gross command area of 16.3 million hectares. The area under slightly saline, moderately saline and highly saline soils have been reported to be 1.76, 0.96 and 1.31 respectively. According to another estimate, approximately 13 million hectares has fallen victim to water logging, salinization and alkalization forces.

CHAPTER 2

FORESTS AND WILDLIFE

Globally forests cover 4200 million hectares or 30 percent of the world's land area. But considering 57 percent of land area covered by forests in **Bhutan**, while combined together for **Bangladesh, Bhutan** and India, it is only 15.8 percent of the total land area (70.6 million hectares).

Deforestation is one of the most serious environmental debility which has taken hold of the SACEP region. Depletion of forest resources, soil erosion, increase of recurrence of floods and loss of wildlife and genetic resources rank as the most telling of the consequences of deforestation. Though the region was originally well endowed with a sizeable magnitude of various types of forests and scrub vegetation, the regions forest are now being depleted at the rate of between 0.6 and 2 percent per year.

In Maldives much of the natural woodland has been cleared and replaced by grassland and coconut. Fuelwood shortages are now apparent in many areas and construction timber for housing and boat building are largely imported due to depletion of the 15 species tranidionally used for dhoni construction. Casuarina planting is being encouraged by the Government to serve as wind breaks and also as sources of domestic fuelwood.

Based on published plant species lists and vegetation descriptions, 583 species of plants have been recorded in the Maldives. Of these, 323 or 55 percent are cultivated species. The numbers of species on individual islands vary according to land area and the basic formations follow a typical atoll conformation with salttolerant species forming a fringe, surrounding forest dominated natural vegetation in the centre. Localized stands of mangrove are present, usually on the lower dying marshy lagoon side, or inner areas of larger islands particularly in the south.

The archipelago supports a diverse and extensive marine fauna with over 1,000 species of finfish, 140 species of coral, 63 species of marine benthic algae and between 11 and 14 species of nesting seabirds. Unlike many atoll countries in the Pacific basin the reef resources are generally under-exploited since tuna form the staple diet and are preferred to reef fish. The major subsistence use of reef resources in the Maldives at the present time involves mining

living coral for construction and dredging coral sand for road surfacing and construction purposes. The impact of coral mining has been extensively reviewed and its impact on the sustainable use of reef systems is extreme.

Bangladesh has about 2.20 million hectares (15%) of forest area out of its total land area of 14.4. million hectares. But only 1.46 million hectares (6.6%) (Reserved forests 1.18 million hectares, protected forests 0.06 mln hectares etc.) has forest cover in the form of state owned reserved and protected forest area. 0.73 million hectares are categorised as unclassified state forest. The village homesteads cover an area of 0.27 million hectares. Besides, there are about 0.13 million hectares of land available for tree planting on sides of roads, railways, embankments, (together 0.08 million hectares) farmland ridges, tea estates (0.02 million hectares and khas land (0.03 million hectares) in the country.

The forests under the control of the Forest Department include Hill forest (1.65 million acres including about 2.963 million acres of plantations which have been established by replacing the existing natural forests), Sundarban Mangrove forests (1.45 million acres) and plainland forests.

The demand of timber and fuelwood at present level of per capita consumption is 0.38 cft and 2.3 cft respectively in the country as against supply in the year 1985-86 was 38 million cft of timber and 230 million cft of fuelwood. It is estimated that if the growth rate of population is assumed at an average rate of 1.75% and the per capity consumption rate for timber and fuelwood remain the same, the demand of timber and fuelwood by 2000 years would be around 49.88 million cft of timber and 301.92 million cft of fuelwood as against 40.5 million cft of timber and 245 million hectares in 1988.

Forests in **Bangladesh** are increasingly encountering tremanders pressures from various uses and signs of degradation are obvious. The extent of unequal distribution of forest resources among the districts is alarming. Over exploitation poses serious threat and recent increasing salinity due to reduction of freshwater discharge from the ganges has been considered to be a possible cause for widespread top dying of 'Sundre' trees in the sundarban mangrove forest. Encroachment of forest areas poses a serious problem and an estimated total of 76000 hectares have been lost to aquaculture, agriculture or homestead encroachment. About 54 percent of encroachment are in the reserved forest, 26 percent in the acquired forest, 13 and 7 percent in the vested and protected forest respectively. Only in a span of eight years the homestead forest land is reduced by 11 percent.

Other major reasons for forest depletion in the country include - population increase, transfer of forest land for development purposes, lease of forest land for development purposes, Theft by organized groups, Unauthorised feelling with the help of forest officials, Shifting cultivation, Over explosion as industrial raw materials, overgrazing of cattle, Shrimp cultivation in coastal areas, Natural calamities, Refugees and political upheavals.

Many species of mammals, amphibians, reptiles and birds are the magnificent heritage in the biological diversity of Bangladesh. A stable population of all the species form the ecosystem contributing to the health and sanitation of the environment they live in.

Due to poor management and careless exploitation in the past, the rich wildlife population of **Bangladesh** are dwindling day by day. The Royal Bengal Tiger was widely distributed in the past and now it is confined to Sunderban mangroves only, and occasional sighting is reported from Hill Tracts and Sylhet. It is on record that wild elephants existed even in the Bhawal-Modhupur Tract in the beginning of the twentieth century but now it is confined in the forests of Hill Tracts, Cox's Bazar and Sylhet each having common boundary with Burma and India. Spotted deer still abound in the Sundarbans and other deer like the barking deer are occasionally seen in other forest areas. White winged wood duck is now-a-days found in a small area of forests around Patukhali in Rangamati district.

The estuarine crocodiles are found in the waters of the Sundarbans only whereas the species was of common occurrence in the coastal waters in the past. The Gharial has a limited distribution in the Padma.

A summary of present status of wildlife is given in the Table - 6

Table 6 : Status of wildlife in Bangladesh

Class	Number			
	Order	Families	Genera	Species
Mammalia	9	31	74	119
Aves (Birds)	20	60	261	5782
Reptiles	2	19	66	124
Amphibia	1	4	9	19

Due to past misuse 18 species which has a wide distribution in the forests, fresh water and mangrove swamps have become extinct in the present century. The extinct species include Rhinoceros, wild buffalo, Indian bison (Gaur), Swamp deer, hog deer, wolf, blue bull, hispid hare, black duck, pink headed duck, peafowl and Bengal florican.

The International Union for Conservation of Nature and Natural Resources (IUCN) has enlisted 23 species of Bangladesh in its Ref data Book as endangered species of which the major ones are the Royal Bengal Tiger, Leopard, Clouted Leopard, Asian Wild Elephant, White Winged Wood Duck, Python, Estuarine Crocodile, and Gharial. This list, however, is not an exhaustive one and many other species will soon acquire eligibility to be placed in the Red Data Book. At present there are 27 threatened and 39 endangered species of wildlife in Bangladesh.

Other endangered wildlife include another cat, Panthera pardus, as well as primates, bears, civets, a mongoose, reptiles, snakes and elephants. Most terrestrial wildlife depends upon land of the Forest Department of habitat, but the Forest Department's institutional capacity to promote and administer integrate wildlife management has not yet been developed. Furthermore, land use restrictions placed on lease holders of public lands, as well as constraints on private forestry, severely limit private sector involvement in wildlife management. Lack of public interest in wildlife conservation has also led to neglect of the system of protected areas. The reserve system that has been adopted was not planned with clear priorities, nor have sufficient funds been allocated to the protection and management of parks and reserves.

Major forest types in Nepal are tropical, sub-tropical, warm temperate, cool temperate, sub-alpine and alpine. Of the total 6.8 million ha designated as forest area, 37 percent is natural forest, 5 percent shrubland and 4 percent tree-covered land adjacent to farms. Another 12 percent of the country's area is grassland. Of the remaining 5.5 million ha natural forest, 59 percent is of hardwood, 24 percent is mixed and 17 percent conifer species. Hardwoods are dominant in the Terai and lower Hills while conifers occur at higher elevations.

Another aspect of forest land is its cover type or crown density. Of the 5.5 million ha land with tree cover, 59 percent has medium crown cover, about 40 to 70 percent. Areas with high crown cover, exceeding 70 percent, constitute only 15 percent of the total forest land. The rest of the forest land is degraded, with crown cover ranging from 10 to 40 percent. High density forests are left only in protected forests in the Terai or in inaccessible areas in the Mountains.

More than half of the forests with poor crown cover (10-40%) is in the densely populated Hill region.

Over 75 percent of the people still depend on fuel wood to meet their energy requirements. Fuel wood is the only source of energy for cooking and heating in the rural areas. Its consumption in the Hills is slightly higher than in the Terai. The annual per capita fuel wood consumption in the Hills is about 708 kg whereas it is 689 kg in the Terai.

Out of the total household fuel consumption in the Eastern Development Region, about 30 percent is from dung cakes which could be used for manure if alternate energy sources were available. There is high pressure on forest resources due to lack of alternate energy sources.

The livestock sector in **Nepal** is heavily dependent on forests and grasslands. About 42 percent of the total TDN (Total Digestible Nutrients) requirement is estimated to be met from the forestry sector, In 1990-91, the total number of livestock in terms of livestock unit (LU) was estimated to be 9.8 million. The livestock in terms of LU will reach 11.6 million by the year 2000 AD. The fodder requirement or total digestible nutrients (TDN) is obtained from the accessible forests, shrublands and grasslands. At present, a total of 1.88 million tons of TDN is supplied from accessible forest areas. The Hill region alone supplies nearly 50 percent of the total TDN requirements. The TDN requirement was about 6.08 million tons in 1985 and has reached 6.39 million tons by 1990.

Annual per capita timber consumption was about 0.07 m3 in 1986 and it has been projected to increase to 0.11 m3 per capita per annum by the year 2000 AD. It may reach 0.12 m3 per capita per annum by the 2011. The timber consumption in 1991 was estimated at 0.04 m3 per capita for housing purposes.

Forest land in **Nepal** is not well distributed in relation to the population density. The per capita forest in the Hills and the Terai is only 0.26 and 0.11 ha respectively. However, other zones have over one hectare per capita. The western part of the country has more forest than the eastern and the per capita forest is more in the former areas. The national per capita of forest and shrubland, on an average, comes to about 0.37 ha.

If **Nepal's** forest were uniformly accessible, they could provide the basic needs for forestry products on a sustained yield basis. However, the distribution pattern of forest and population does not meet the growing demand for forest products. Accessible forest are already overcut

and destroyed. Because of the lack of a sustainable supply of forestry products, people have difficulty in collecting fuel wood and fodder to meet their requirements. It has been estimated that, in specific locations in the Hills, the demand-supply ratio of forest produce ranges from 2.3:1 to 4.1:1.

Annual tree planting in the country covered only 10,000 ha during 1979-86. The present plantation rate is less than the deforestation rate. At the same time the demand-supply situation of forestry products in the country is not favourable.

The immense bio-climatic diversity in **Nepal** supports more than 35 forest types. These forests comprise over 5400 species of vascular plants, including over 245 species of endemic plants and 700 species of medicinal plants. In addition, over 175 species of mammals, 850 species of birds 600 species of butterflies, 50 species of moths, 180 species of dragon flies, 170 species of fishes and other animals inhabit this small country. Presently, 26 species of mammals, 9 species of birds and 3 species of reptiles are declared endangered and are being protected by Nepalese law. These floral and faunal species are protected in eight national parks, four wildlife reserves and one hunting reserve that cover approximately 12,500 sq.km or 8.5 percent of the total land area. Two of these National parks, the Chitwan and the Mount Everest, are listed under the list of UNESCO's World Heritage sites. There are two protected or conservation areas as well. Considering all the national parks, wildlife reserves and conservation areas, about 12 percent of the Nepal's land mass receives attention for nature conservation.

The network of parks and protected areas represent almost all the ecological zones, and contains a large number of endemic plants and endangered animals. The national parks and wildlife reserves are serving as a "natural gene bank". The conservation areas in Nepal have been implemented with the aim of attaining balance between the needs of the local people, tourism development and nature conservation. Flora and fauna are under extreme pressure outside the national parks and protected areas primarily because of poaching and encroachment on forest land.

Limited attempts have been made to conserve bio-diversity outside parks, reserves and protected areas. It is assumed that about 20 bird species have probably become extinct in **Nepal**. Some other bird species are at risk and demand forest management. An estimate indicates that the destruction of vegetation and urbanization in the Kathmandu Valley has accelerated either the disappearance, migration or extinction of 33 species of birds between 1948-1977.

Forestry which covers only unprocessed wood, contributed 1.7% to the Gross Domestic Product (GDP), or 1.9 billion, in 1983 in **Srilanka**. 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 as 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 statistics on the forest cover of **Sri Lanka** shows that, the area of closed canopy natural forest, 1.33 million hectares, or 20.3% of the total area of the country and 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 encroachment), has been about 54,000 hectares. The total area of established forest plantation up to 1992, is 112,131 hectares and this figure is not significant compared to that of deforestation.

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

The major causes of forest degradation **Sri Lanka** are settled agriculture and shifting cultivation, introduction of cash crops and expansion of plantations; urbanisation and extensive agriculture; timber felling; gem mining; expansion of tourism; and encroachment.

The reduction of forest cover during the last 100 years is shown in Table 7 .

Table 7 - Reduction of Forest Cover (in hectares) in Srilanka

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

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.

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 it 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 8 shows the faunistic diversity, endemicity, and geographical distribution in **Sri Lanka.**

Table 8 Faunistic Diversity, Endemicity, and Distribution in Srilanka.

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

Sri Lanka currently has a fairly extensive system of protected areas, covering nearly 14% of its total land area. Sri Lanka is only on of five countries in the world, that has over 12% of the land area allocated exclusively for strict conservation.

This includes 12 National Parks - 466286 hectares, 3 Strict Nature Reserves - 31574 hectares, 3 Nature Reserves - 33372 hectares, 50 sanctuaries 249020 hectares, 42 MAB reserves 106810 hectares, 1 Sinharaja 11330 hectares, 1 Knuckles 16000 hectares and 13 Wet Zone Forest 24038 hectares.

In **Iran**, Forest and woodlands range to 18.04 million hectares, (3.8 million of its is forests). Rangelands 90 million hectares and National Park and protected areas - 8 million hectares. The per capital share of commercial forest is only 500 square meteres as compared to the world figure of 8000 square meters. Most of the commercial forests in the country are located in the north, along the southern shore of Caspian sea. The rate of annual deforestation during the past 30 years is staggering. The main causes of such disruption are overgrazing, clear cutting for urban and agriculture landuse and Fuelwood.

In **Bhutan** Forest cover about 57 percent of the land area.

Although the forest cover is largely intact in **Bhutan** and most forest maintains its original botanical composition, large parts of the forest are exploited by man, sometimes quite intensively. Subsistence farmers depend on relatively free access to the forest and its products. Since under the present system fertility of farmland can only be maintained through a constant input of biomass from the forest. Most of the country's need for fodder come from the forest. Leaves are collected from the forest and together with animal manure are later spread in the fields. Firewood is plentiful, and therefore, manure need not be burned, but the nutrients returned to the fields. Many non-wood products, such as bamboo, medicinal plants and edible plants are collected from the forests.

Wood is a traditional building material in the country and wood is used in the large Bhutanese houses. Fuel wood meets more than 95% of the country's energy demand, a consumption per capital which is amongst the highest in the world (1.8 cu.m/yr). In many parts of the country fuelwood is abundant utilising dead trees and branches, but fuelwood collection near towns, especially in Southern **Bhutan,** has damaged the forest.

Bhutan has lost approx. 35% of its natural forest cover, believed to be intact 10 years ago and 17% of its cover as compared to the preinvestment Survey of 1956-58.

Bhutan is situated in the border area of two major faunal and floral regions, the Palaearctic distributed in Asia, north of the Himalayas and further west, and the Indo-Malaysian found in India and South East Asia. The country contains a wide variety of largely unspoilt biotopes at different altitudes. The Himalayan climate becomes increasingly humid, and thereby biologically richer, towards the east where Bhutan is situated. The Buddhist respect for nature has resulted in very light hunting pressure. The combination of these factors gives Bhutan one of the greatest biological diversities in the world. There is not only a large number of species but also a large number of endemic species, animals and plants found nowhere else. For

example, there are seven species of rhododendron in West Nepal, 10 in Central Nepal, 29 in East **Nepal** but no less than 50 in **Bhutan.**

The importance of biological diversity is increasingly recognised not only for its own value but also, in many ways, as a valuable resource for mankind, although this value is very hard to quantify. For centuries local inhabitants have used the forest and grassland to collect a multitude of products for their daily life (food, herbs, medicine) and it is now realised that what was formerly termed Minor Forest Products are in many societies of major importance for survival. One example of this is the very claborate Tibetan medicine based on a multitude of herbs, whose properties are currently being explored by western pharmaceutical industries.

India has a very diverse forest vegetation ranging from the temperate vegetation in the Himalayas to the moist Evergreen forests in North East, the Western Coast and the Andaman & Nicobar Islands. The forest cover of the country, as per the latest assessment of the Forest Survey of **India** is 63.591 m.ha. comprising 19.44% of India's geographicalarea. However, the areas recorded as forests are higher and stand at 75.18 m.ha. The forest of India can be divided into 16 major groups comprising 221 types, tropical deciduous forests cover in India (37% of total forest cover) followed by tropical dry deciduous forest (28.6%). The unique tropical wet evergreen forests comprise only 8% of the total forest cover. Of the total areas of 63.91 million ha., dense forests (crown density above 40%) account for only 38.50 m. ha. There is no three cover over 11.27 m.ha. officially recorded as forest areas, while another 25.4 mha of forests are understocked. About 52.8% of forests do not have adequate regeneration. The per capita forest area has decreased from 0.20 ha. in 1951 to 0.11 ha. in 1981. India's forest wealth as with the case of other natural resources varies both in quantitative and qualitative forms.

Apart from natural forests, man-made forests are also expanding due to the afforestation programmes initiated by the Government. The land areas afforested increased from 0.52 lakh ha. in the First Five Year Plan to 177.77 lakh ha. in 1970-71. Despite this progress in afforestation, the target of attaining 33% land area under forest cover as laid down in the National Forest Policy 1988, appears to be a remote goal at the moment. The reasons are the tendency towards the deforestation and diversion of forest land for non-forestry purposes, the rising demands for fuelwood and fodder, the increasing incidence of illicit felling, and forest fires. According to an estimate, the total fuel wood removal from forest, both authorised, and unauthorised is more than 235 million cu.ms. as against the sustainable level of production of only 48 million cu.m., which is indentally placed as the annual fuelwood demand in India. Similarly, the incidence of grazing in forests for meeting the fodder needs of the large

livestock population in India is another crucial problem. According to the Forest Survey of India, forest area affected by fire range from 33% in West Bengal to 99% in Manipur. Only 14 States have been covered in these estimates.

With the passage of the Forest Conservation Act, 1980, the annual rate of diversion of forest land for non-forestry purposes has come down to 16000 ha . annually as compared to 0.15 m.ha. in the pre-1980 period. On the other hand the increase in tree cover through development of forest plantations and natural regeneration programmes under wasteland development schemes in the last decade, has increased the green cover roughly at about 1.8 million hectares per annum, a process which needs to be accelerated.

India is uniquely rich in all aspects of bio-diversity including ecosystem, species and genetic bio-diversity.

It is estimated that over 75,000 species of fauna and 45,000 of flora are found in **India.**

The trans-himalyan region with its sparse vegetation has the richest wild sheep and goat community n the world. The snow leopard (panthera uncia) is found here, as is the migratory Blacknecked Crane (Grus nigricollis). The Himalaya, the highest mountain range in the world, is located at the boundary of many biogeographical regions and is therefore one of the richest areas of India in terms of habitat and species diversity. In the north-west is the desert region with extensive grasslands. The Great Indian Bustard (Ardeotis nigriceps), a highly endangered bird, is found here.

North-east India is one of the richest regions of biodiversity in the country. It has several species of orchids, bamboos, ferns and other plants.

The Andaman and Nicobar Islands have some of the best-preserved evergreen forests of **India.** Several species of plants and animals are endemic to these islands. India has a very long coastline extending over 5,500 kms. Mangrove vegetation is characteristic of the estuarine tracts along the coast which sustain rich biological diversity. The total area of mangroves in India is approximately 6700 sq. kms. which comprises about 7% of the world's total mangrove are and harbours 59 species of 41 general belonging to different countries. India is also rich in coral reefs. Major reef formations in Indian seas occur at the Gulf of Mannar, Palk Bay, Gulf of Kutch, the Andaman and Nicobar islands and the Lakshadweep. With the exception of the Lakshadweep reefs which are atolls, other are of the fringing type. Submerged banks with coral growth are also known from the Arabian sea. The treat to

mangroves and coral reefs assume the form of biotic pressures such as fishing, landuse changes in surrounding areas and pollution of waters etc.

The Zoological Survey of **India**, the Botanical Survey of Indian and the Forest Survey of India study and document the plant and animal diversity of the country. Of the estimated 45,000 plant species, about 15,000 species of flowering plants have been described. Estimates of other plant taxa include 5,000 species of algae, 1,600 of lichens, 20,000 of fungi, 2,700 of bryophytes and 600 of pteridophytes. There are about 75,000 species of animals including 50,000 insects. 4,000 molluscs, 2,000 fishes, 140 amphibians, 420 reptiles, 1,200 birds and 340 mammals, and other invertebrates. A very large number of the species described are endemic to india. Among the larger animals 75 species of mammals 44 of birds, 15 of reptiles, and three of amphibians are threatened. Nearly 1,500 plant species are considered endangered.

Pakistan's forestry contribution toward GDP has been 0.3% in 1990 / 91. Only 1.8% 4.224 m ha of **Pakistan's** total area is under forest. Less than half of the total forest areas is capable of producing timber and fire wood. Over 40% of it is coniferous and scrub forest on the northern hills and mountains. The balance is made up of irrigated plantations and riverain forest along major rivers mangrove forest and trees planted on farm land. The timber and firewood extraction from government forests was 394 million cubic meters and 438 million cubic meters respectively during 1992 - 93.

Forest resource is faced with constant rapid decline. With only 0.03 ha of forest percapita at present and 3% annually growing population per capita forest is declining fast. This may also be due to lack of policy initiatives, insufficient inputs including reforestation programmes and wide spread unchecked illegal commercial logging. In addition deterioration in soil productivity inadequate irrigation poor quality planting stock, low survival rate of seedlings and saplings, poor regeneration and low stocking in coniferous forests, negligible regeneration rate in junipers, low intensity cultural operations, faulty logging practices, budget austerity are some of the debilitating factors in forest resource degradation.

More Than 50% domestic energy needs in Pakistan are met through fire wood.

CHAPTER 3

INLAND WATERS

Certain major impacts are brought to bear on the aquatic ecosystems by the process of development. Inland waters are used for irrigation, industry, urban and rural domestic, livestock etc. consumption. The percentage varies, as for example, in India 96 percent of water is used for agriculture, 3 percent municipal and water supply and 1 percent for industry. The increase in Population in the region has caused severe stress in the aquatic resources. Organic and biological pollution in the inland waters is mainly due to dumping of untreated or partially treated domestic wastes into the nearest water area. The industrial and physicalinfrastructure development bring about increasing changes in the natural environment and pollute the water. The use of pesticides and fertilizers is a significant cause of inland water pollution in the SACEP region.

Beneath many islands of the **Maldives** lies a freshwater aquifer which may change in volume with season and which rises and falls with the tide. Most groundwater assessments conducted to date have been only for Male, where the supply of aquifer water for human use is now increasingly being replaced by desalinated water. The volume of untapped groundwater resources on other islands is unknown. Increased extraction, exceeding natural recharge through rainfall has dramatically depleted lenses on some population islands. Poor sewage disposal has resulted in contamination of groundwater in the past, resulting in a high incidence of cholera and shigella, with major outbreaks in 1978 and 1982.

Calculations for Male suggest that at the current rate of overdraw the aquifer will be exhausted in the nest few years, and similar problems are likely to continue to arise in other heavily populated islands. The costs of replacing aquifer supplies through desalinators is high both in capital and recurrent terms.

A contrasting feature in the annual water cycle dominates life in **Bangladesh** : excessive water during the monsoon causing flood and insufficient water during the dry season creating drought - like situation. These two extremes influence the planning for water resources development in Bangladesh requiring effective measures in flood control, irrigation and drainage.

Bangladesh is endowed with a massive supply of readily accessed surface water and ground water. Water is also abundant for needs of industry and domestic use and provides ubiquitous means for the transport of goods and people . The river system that flows through Bangladesh comprises the third largest source of freshwater discharges to the world oceans. But the availability of water throughout the country is not fairly allocated / distributed. Flooding is an annual occurrence in Bangladesh and occurs mainly during monsoon months between July to September, when rainfall is in its maximum intensity & rivers are swollen with waters. During normal flooding about 26,000 sq.km. of land surface inundates, where 52,000 sq. km inundates during more severe flooding. Recent estimates show that 50% of total land of Bangladesh is vulnerable to flood. The flood depth to which land normally is being inundated varies from 30 cm to 2.5 m.

Droughts are also an increasing environmental hazard in Bangladesh, particularly in recent years. The north-west region particularly the Barind Tract are actually affected by lack of water during the months of March to May in Particular.

Water scarcity and increasing salinity which have been progressively getting worse in recent years and are like to become major problem if not tackled urgently. The problem of water scarcity in the surface water system stems from the increasing obstruction of water upstream both within **Bangladesh** but more particularly upstream of Bangladesh in Bihar and west Bengal province of India.

The drawing off water from the Ganges, particularly with the construction of the barrage of Farraka on the **India-Bangladesh** boarder has decreased dry season flows into **Bangladesh** considerably causing major problems with in the country. One of the major problems is the increasing sanitization in the coastal belt and encroaching in the agricultural production as well as domestic and industrial water use.

As **Bangladesh** faces extreme situation of water availability and the dilution factor in wet season is very high, dry period water quality informations are very important. It has been noticed that, most of the river quality in general are not that bad, excepting river like Buriganga, Karnaphuli or Sitalkhya, Balu which show significant amount of organic load and some other problems from time to time. Bhairab and 'Rupsa faces increased salinity and most of the rives high turbidity. A recent monitoring on Burriganga showed a near septic condition of the river which indicates its unsuitability for aquatic life.

Lakes in capital Dhaka and major port city Chittagong and also Kaptai Kaptai lake have been monitored. Except Kaptai lake, other lakes are in general moderately polluted, but sometimes may become severely polluted. Some of these receive even sewage from some sources and causes quality degradation significantly.

Ponds are widely abundant throughout the country and are extremely used for various purposes including washing of utensils, cloth, bating, fishing etc. Sometimes those are used for drinking too. As generally most of these ponds are mixed use type, those are polluted to various extent in general and not suited to drinking purpose.

Haors and beels which are other types of surface water bodies, are very important fishing rounds. It has been reported that due to increasing use of chemical pesticides and Fertilizers, these are having increased chemical pollution load, causing fish depletion.

Groundwater quality in **Bangladesh** is generally very good in term of overall mineralization, except in the south where rivers are tidal and tidal and the land almost at sea level, so that thee is little chance of the formation of appreciable fresh groundwater lenses in line with the Ghyben-Herzberg principle. However, general hydrodynamic considerations suggest that in at least some parts of the south, groundwater of low to moderate salinity might be found at depth.

Water pollution in **Bangladesh** overall may be classed into three groups :

* Faecal pollution is widespread and has a strong negative impact on human health. Pollution continued unabated caused a number of water borne diseases.

* Industrial pollution is localized but untreated. Industrial waste are dumped into rivers causing pollution of both the terrestrial and aquatic environments.

* Agrochemical pollution is feared as residues are expected to enter the food chain.

In the region south of the Himalayan ranges, the monsoon contributes to a rich water regime. As a result, several sources of water in the form of glaciers, snow pack, ground water and river networks exist in **Nepal**.

The country is drained by three major river basins, Sapta Kosi in the east, Karnali in the west and Sapta Gandaki which drains the region lying between these two basins, Nepalese rivers are classified into three classes based on their origin. Rivers in Class I originate in the High

Himalayas above the snow line and have a sustained dry season flow due to snow melt. The class it rivers originate below the snow line in the slopes of the Mahabharat Mountains which are perennial but have a low dry season flow. The Class III originate in the Siwalik ranges and southern slopes of the Mahabharat Mountains. These rivers are ephemeral and flashy with watersheds that are geologically fragile, erodible and are deteriorating fast due to population pressure.

The rivers drain a total of 191,000 sq. km. area, of which 74 percent lies within **Nepal**. The Class I rivers altogether occupy about 80 percent of the total drainage area of which 68 percent lies in **Nepal**. The total area under snow occupied by the major tributaries of the Class I rivers is 17,920 sq.k. representing about 8 percent of the country's area. There are about 6000 rivers and streams. Hundreds of these rivers are more than 160 km. long. The combined length of the rivers and streams exceeds 45,000 km.

The annual run-off from the total draingate area, including that in Tibet, is estimated to be 202 billion cu.m. The contribution from the Nepalese territory accounts to an annual run-off of 170 billion cu. m. The estimated annual mean run-off of all rivers is about 6396 cu.m/sec. About 72 percent of the total surface run-off occurs as instantaneous flow, while the rest is conserved as snow pack and ground water. About 4063 sq. km. area is estimated to be covered by surface water. This represents 97.3 percent under the larger rivers, followed by natural lakes (1.2%), ponds (1.2%), and reservoirs (0.3%), Only 9 percent of the total run-off occurs through Class II rivers while 3 percent flows out of Class III rivers.

Nepal's Terai Belt has rechargeable ground water potential which occurs in both artesian and non-artesian aquifers. Studies shown that ground water table occurs at a depth of 5 m. in the plains while artesian aquifers yield about 100 cu.m./hr. Ground water is used for irrigation, and for meeting drinking water needs through shallow tube wells at individual levels. Deep tube wells at several district centres meet drinking water requirements. Use of deep tube wells is yet to be carried out for irrigation. This aspect calls for further studies.

In the inner valleys and Hills, ground water occurrence is limited and wherever it occurs, the recharge characteristics are not understood but generally low. In kathmandu, the use of ground water at its current rate appears to be unsustainable as the recharge properties are unknown.

At present, irrigation is provided to about 0.943 million ha of cultivated land. Out of this 0.267, 0.186 and 0.490 million ha are under irrigation systems that are agency managed, agency-assisted farmer managed or exclusively farmer managed.

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 a 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 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.

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.

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 rives and reservoirs, for their domestic use.

The average annual run-off water volume was estimated 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 caused 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.

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.

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 a least 50-60% of the total waste load discharged into the canal network in Colombo.

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.

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).

The estimated ground water potential for the country is 780000 hectares metres per anum. In the regions devoid of large aquifers, ground water resources depend on local longterm recharge from rainfall infiltration and irrigation.

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 annual potential of the surface water resources of Iran is about $93x10^9$ cubic meter. In addition to surface water resources which originate from the precipitation within the country, a number of the trans boundary rivers flow along the borders of Iran or run into the country. In spite of different climatic characteristics of the country, groundwater resources are the main suppliers of the water needs in most of the catchment basins. The total amount of annual discharges from ground water resources is 45 billion cubic meter of which 64 percent is obtained from wells, 20 percent from quanats and 16 percent from springs. This immense volume of water is discharged by 20800 wells, 26000 quanats and 23000 springs. The water consumption of Iran is as follows - Drinking and sanitation 70000 MCM Industry 3500 MCM, Electricity - 1000 MCM.

With the high precipitation and an altitudinal variation of up to 7000m water resources are abundant in Bhutan. The high precipitation results in a rich vegetation, natural and cultivated, and the altitudinal difference give many possibilities for use of the water as a source of energy.

Bhutan's water resources are confined in four major river basins : Amo Chhu, Wangchhu, Sankosh and Manas. All four major rivers have their sources in glaciers which cover almost 10% of the country.

Water has traditionally been used for irrigation and the availability of water resources has determined the siting of settlements. Irrigation channels, often running over great distances, have been an integral part of agricultural practices and such channels are still built and maintained.

Water also provides a major potential sources of energy and income. A number of mimi and micro hydel plant have been built serving some thousand households.

Bhutan has a theoretiacal potential of providing 20,000 MW and a Power Master Plan is being formulated to identify a number of possible sites for hydro power plants. These are selected by using technical, economic and environmental criteria. The majority of the energy produced will be exported as local requirements are still quite modest and is expected to represent a considerable part of **Bhutan's** total export revenue.

The use of the water for large hydropower schemes is dependent on maintaining the existing flow pattern and the present silt load of the water. If afforestation or inappropriate agricultural

methods mean greater fluctuations and more silt, they an seriously upset plans for commercial exploitation of the hydroelectric power.

Bhutan's fresh water is not only an important source of energy for **Bhutan** and through export for India ad Bangladesh but an equally important source of clean and reasonably unpolluted water for the region. As fresh water of good quality will become a very precious commodity in the future, keeping Bhutan's water free of pollution is even more important for India and Bangladesh than for Bhutan itself.

India is rich in water resources, being endowed with a network of rivers and vast alluvial basins to hold groundwater. Conditions however vary widely from region to region.

The present and projected demand for water in India for various sectors has ben presented in the following Table - 9

Table - 9 Demand for water in India

Purpose	1990 (cukm)	2000 (cukm)	2025 (cukm)
Domestic	25	33	52
Irrigation	460	630	770
Energy	19	27	71
Industry	15	30	120
Others	33	30	37
Total	552	750	1050

In India, domestic wastes contribute about 90 percent of the total pollution, while 7 percent is contributed by large and medium scale industries and 3 percent by small scale industry. Of India's 3119 towns and cities, only eight have full sewage and treatment facilities ; 209 have

partial facilities. The Ganges along carries the untreated sewage of 114 cities, each with 50000 or more inhabitants. Among the rivers, the sabarmati near Ahmedabad and the ganga near varanasi and Kanpur are the most polluted stretches. The mahi, the Narmada, the Tapi, the Krishna, the Cauvery, the pennas, the Godavari and the Subarnarekha are also seriously polluted in stretches.

Inland water in Pakistan include rivers, streams (mainly those of Indus system), Lakes and other wet-lands as well as underground waters. The esturine water occupies lower delta of indus where it splits into number of distributries and is often in-undated by tidal floods.

More than 90% of inland water is being used for irrigation. Another 3 to 4 percent goes to Municipal supply for domestic consumption while about 1% is being utilized by industries. Since independence there has been a great increase in man made reservoirs for irrigation, generation of electricity, water supply and flood control. Some of these major reservoirs are Tarbela, Mangla, Warsak, Tanda, Baran, Khanpur and Rawal. Due to irrigation network in Pakistan several ecological changed have taken place, and some of these have posed problems. One of the major adverse impacts is water logging and salinity due to bad water management as well as due to saving of heavy expenditure on lining of canals. This has resulted in sub-optimum use of water from this badly managed irrigation system. Out of 123 billion m^3 water diversed annually only 67.65 billion m^3 are available at the heads of water courses in crop areas. Rest of the water is seeped into the surrounding soil causing rise in subsoil water table. This rise in water table is on the average 15 to 35 cm per year since modern irrigation system was built. In an area where sub-soil water has salinity 1000 ppm. which is acceptable to plants will rise @ of 1% in 20 years. It is evident that water logging, salivation, alkalization in addition to harming crops, favour human diseases like malaria, loss of forest cover, loss of genetic diversity.

The present contribution of rain to crops in irrigated areas is estimated at bout 7.40×10^3 m. The 'Barani' or rained tract is around five million hectares.

Besides surface water resources, ground water is also used for agriculture. Balochistan farmers tap subsurface water by an ancient method of underground channels known as 'Karez'.

The deep alluvial deposits of Indus plain form an extensive ground water aquifier. The total annual recharge of ground water from canal and reservoir seepage and rain is estimated at 46 million acre feet. In 1988 41 MAF were pumped out which is continuously increasing by sinking more tubewells @ of 10,000 tubewells per year.

CHAPTER - 4

COASTAL AND MARINE ENVIRONMENT

Bhutan, **Nepal** and Afganishtan are land locked countries in the SACEP region, otherwise, the rest of the countries do have coastal and marine environment of its own. Maldives is a Island country (consisting of a number of small Islands), Srilanka is an Island.

Although the land area of **Maldives** is only about 300 square kilometers, its maritime area of the exclusive economic zone is about 90000 square kilometers. It has 1190 islands, of which only 199 are currently inhabitance.

The Republic of **Maldives** consists of a chain of coral atolls, 80-120km wide, stretching 860 km. Geologically, the chain is stable with the atolls.

Geologically, the chain is stable with the atolls lying on top of two parallel submarine ridges, 300-450m deep, which rise from a flat submarine plateau. At the margins of the chain the ocean floor falls abruptly to a depth of between 2,600 and 3,00m to the west. The main channel separating the eastern and western chain of islands is generally between 250 and 300m deep. The atolls are separated by east-west channels more than 1000m deep, penetrating to the top of the submarine plateau which supports the ridges on which the islands stand.

The atolls vary in shape from circular, oval and elliptical to pear-shaped. Lagoon waters vary in depth from 40 to 60m and most open to the Indian Ocean although a few are almost closed, and channels through the atoll margin are in some instances as deep as the lagoon itself. Lagoons may contain microatolls, faros, patch reefs and knolls. Faros and microatolls are ring shaped coral structures, unique to the atolls of the Maldives.

Unlike many atolls in the Pacific those of the Maldives support coral structures and islands within the lagoon itself, although, as in the Pacific, most land is concentrated on the outer reef which surround the lagoons. The diversity of coralline structures within the lagoons. enhances overall atoll productivity, hence the maximum sustainable yield of a single atoll, reef fishery in the Maldives is likely to be higher than elsewhere Despite their high gross production

however, coral reef communities have high respiration rates resulting in low overall net productivity and hence, low sustainable yields of marine products. This problem is further compounded by the high species diversity of reef ecosystems and the low density of finfish and other species such as clams and sea cucumber, suitable for exploitation. Localised, heavy exploitation of single species to supply local and overseas markets, often results in over-exploitation and loss of species.

Atoll and reef arrangements and configurations cause considerable wave refraction and interference within the archipelago as a whole and in individual atoll lagoons. Deepwater swells are known to penetrate Male atoll causing problems to ships and barges. Manual wave calculations have suggested that swells with periods over 5 seconds and heights of 0.5m could occur inside the Male lagoon 5-6% of the time. Waves generated within the lagoon could be 1.4 m high with periods of 4.5 seconds for a wind speed of 20 msec.

Precise and long=term data on tidal range and patterns of tidal flow are scarce or absent. Tidal variation averages less than a metre in the southern Maldives and mean high water intervals are said to be ten hours and twenty minutes. Tidal range at Male is 1.1m.

The coast of **Bangladesh** comprising the complex delta of the Ganges - Brahmaputra - Meghna river system, has immense resources for development. The river system while flowing through Bangladesh on its way to the bay of Bengal carries an estimated annual sediment load of 2.4 billion tons. These sediments are subjected to coastal dynamic processes generated mainly by river flow and tidal and wind actions, leading to accretion and erosion in the coastal areas of Bangladesh.

The coastal morphology of Bangladesh is characterized by :

- A vast network of rivers ;
- An enormous discharge of river water heavily laden with sediments ;
- A large number of islands in between the channels ;
- The Swatch of No Ground running NE-SW partially across the continental shelf about 24 km south of the Bangladesh coast.

- A funnel shaped and shallow northern Bay of Bengal to the north of which the coastal area of Bangladesh is located ;

- Strong tidal and wind action ;

- Tropical cyclones and their associated storm surges ;

- Tectonically also active.

The coastal resource uses reflect primarily subsistence agriculture, some cash crops, coastal fisheries, aquaculture with an emphasis on shrimp production and some salt production. Major population pressure is exerted on the ecosystems and resources of the coastal zone, especially the near-shore zone, coastal islands and beaches. Land use conflicts and unsustainable uses are noticed in these areas.

Other conflicts arise from land leases by Land Ministry, indirectly permitting deforestation of ares reforested in the recent past, leaving coastal areas unprotected to storm and tidal surge resulting insignificant loss of life and property ; and degradation of environment.

Land uses in the coastal zone is adhoc and unmanaged, resulting in misuse of resources in some places and undue exposure of people to cyclone threats in others. There are many conflicts over land use between sectors e.g. aquaculture use versus forest use.

Other major land use conflicts involve aquaculture versus rice cultivation. Aquaculture for a longer period salinate these paddy fields and ultimately turn such fields unsuitable for rice cultivation. Another subject of confrontation is between, forestry, livestock, agriculture, and other interest over future uses of new charlands and barrier islands.

Cyclonic storm is an important feature of the Bangladesh coastal zones.

The impact of cyclones on the coastal belt are especially severe as it is aggravated by the conditions prevailing gin the area, such as extreme poverty, erosion, exposure and insecurity of tenure, which increase the vulnerability of the large affected population and reduce levels of preparedness. The absence of sufficient forest cover on the coastal belt compounds this situation. The triangular or funnel shape of the bay concentrates the force of the storm as it moves north and eastward from the Indian ocean.

Sri Lanka has a coastline of 1585 Kilometers in Length.

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 reached 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.

The long coastal zone of Sri Lanka is vital to the Nations 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.

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.

The coral reefs areshallow 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 stone 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.

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.

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.

Coastal and estuarine water resources in india depict the following quality characteristics : -

an exceptionally high concentration of lead and cadmium, 820 ug/1 and 336 ug/1 respectively, were observed in Thane creek of Bombay coast, while the mercury concentration is 0778 ug/1. The high levels of pollution particularly in Thane creek and Mahim creek are caused by the discharge of huge quantities domestic and industrial wastes. A major portion of the waste is released in Ulhas river and Bassein creek also . Sediment along the creeks and near-the-shore stations showed significant concentration of lead ; he Cochin region of the Kerala coast (South West Coastal Zones of India) is found to be most affected by petroleum hydrocarbons. During the pre-monsoon period, a concentration of 162 ug/1 was recorded in the estuarine area, while in the coastal area, the concentration recorded was 49 ug/1. This has been mainly due to the operation of oil tankers as well as the movement of mechanised fishing vessels. Further, it was also observed that the concentration of nutrients is high in the estuarine part and that in the coastal & offshore regions being in descending order except for a few observations and along the coasts of West Bengal & Orissa, the coastal water quality remains almost stable. However, the Dissolved Oxygen (DO) was found near critical level in some localised area. Lead, cadmium and mercury were found in very low concentrations in the ambient water. The sediment sample were rich in metals, particularly lead.

The coastal strip of **Pakistan** is arid with less than 20 cm precipitation a year. The dominant aquatic vegetation in the intertidal zone where fresh water outlets are present is the mangrove, while further out to sea algae and sea grass prevail.

Pakistan's territorial waters along the coast limit upto 12 N miles. The continental shelf is 200 m deep is near about 12 N.M. on the western end it extends around 70 NM on the eastern side. However buffer zone where commercial fishing is prohibited is margined at 35 NM along the coast. From the coast upto 200 Nm is exclusive economic zone in the Arabian sea.

Fisheries make 8% of gross domestic product (GDP). The sector employee 1% labour force. Fisheries provided over 5% of national export 80% of this earnings is shrimp fisheries. Pakistan's total fish and shrimp, loligos etc. catch estimated at landing sites in 1993-94 was 571,000 mt.

CHAPTER - 5

ATMOSPHERE AND CLIMATE

The **Maldives** experiences a tropical climate with a mean annual temperature of 28°C, daytime heights reach 32°C but nighttime lows rarely drop below 25.5°C. During the last 20 years the lowest recorded temperature was 22°C the highest 36°C. There is little seasonal variation in temperature. Monthly mean rainfall for Male is around 161 mm and some variation is evident north to south through the atoll chain, with the north being drier and the south wetter. On average, rainfall amounts to around 1.9 m per annum but there is considerable inter-annual variation from 1530 mm to 2700mm over the last 20 years. The wettest months are May, August- September and December, the driest January to April. Open water evaporation rate are in the range of 6mm per day and transpiration from plants is also high.

Air circulation is controlled by the north-south migration of the equatorial westerlies and the weather is dominated by two monsoon periods the SW monsoon from April to November and the NE monsoon from December to March when winds blow predominantly from either of these two directions. Strong winds and gales are relatively rare and cyclones are unknown, maximum wind velocities recorded at Male during June/July can reach 25-30m sec^{-1} (50-60 knots).

Bangladesh lies in tropical monsoon region to the south Eastern Himalayas. These mountains act as a barrier and modify the climate of the country to a large extent. Due to the Himalayas the country is saved from the rigors of the cola Siberian winds. The tropical monsoon climate is characterized by heavy rainfall during monsoon season and little or no rainfall during the dry winter months. The wind direction reverse from northeast in winter to southwest in summer.

Bangladesh has seasonal rainfall, divided into four period. During monsoon period (June - September) the rainfall varies between 1250 mm to 3700 or more. Pre and post monsoon rainfall varies between 200 mm to 900 mm and 100 mm to 300 mm respectively. During the winter months (December - February) rainfall occurs less than 90 mm.

Like rainfall, temperature also exhibit seasonal variation. Normal maximum temperature in the summer months vary between 30.50°C to 36,50°C with temperature occasionally

exceeding 37.70°C during April and May. Zones with five days or more extremely high temperature exceeding 40.0°C lie in the western part of the country. But rest of the country, such temperature are rarely experienced . At Dhaka, the average is 1 day in two years.

Bangladesh is mainly an alluvial deltaic plain with plain topography and lot of rainfall and sunshine. It is a developing country and still primarily an agricultural with limited industrial development. Number of automobiles compared to the number of people is still few. The neighbouring countries in the immediate neighbourhood are not that urbanised and industrialised and the apprehended quantity of transboundary pollution seems not that significant, though it is not quantified yet. Overall all there facts are mostly favourable for a good quality air environment in the country and the air quality in general is still very good with very little exception.

For **Bangladesh**, the environmental implications of a rise in global temperatures due to the emission of greenhouse gases (CO_2CH_4,N_2O, etc.) is likely to be significant. Bangladesh's own contribution to 'greenhouse' gas emission is relatively minor. Industrialisation is low and the majority of industries are small or cottage based. Regarding non industrial sources, the volume of methane emanating from irrigated paddy fields (23.5 million acres of total cultivable land) and from livestock slurry (21 million cattle heads) can be considered to be only marginal contributions.

A rise in global mean temperature is predicted to result in two principal environmental impacts both of which will have implications for Bangladesh.

* rising sea levels

* climate change

Given that one third of Bangladesh is at an elevation of less than 10m above sea level, the potential socio-economic impacts (effects on health, livelihood and food security) resulting from a small rise in sea level could be extensive. For example, it is estimated that a 1 meter rise in sea level in the Bay of Bengal would result in 12-18% of the total land area of Bangladesh being lost, including the majority of the Sundarbans. It is also suggested that the land area normally subject to seasonal flooding would increase by 17% as higher sea levels slow the drainage of flood water. Furthermore, the affected area are likely to suffer significant increase in salinity both of soils and groundwater.

Although it is difficult to predict the timing and magnitude of global environmental changes, it is anticipated that one of the most serious consequences for Bangladesh would be a potential reduction in the land/person ratio. This reduction would increase pressure on remaining land and natural resources and create a trend towards rural to urban migration. It is estimated that a 30% reduction in land availability due to sea level rise would displace 30-40% of the population.

Global warming is also predicted to result in modifications to atmospheric circulation patterns, bringing alterations in the frequency and seasonality of precipitation in Bangladesh Predictions for the year 2030 made by four General Circulation Models all suggest increased precipitation over. Bangladesh, with estimates ranging from 5 to 100%. Such changes in the water cycle will likely affect water availability, agricultural activity, flood protection practices, infrastructure planning and natural habitats.

It is quite possible that Bangladesh may also experience an increase in severe weather - related events such as droughts, floods and severe tropical cyclones. One global estimate is that an effective CO_2 doubling will increase the intensity of tropical cyclones by as much as 40%.

In **Nepal** the average precipitation is about 1600 mm but there is wide regional variation. In general the hills of eastern Nepal receive more rainfall than those in western Nepal. About 80 percent of the total precipitation occurs during the mansoon season (June - September).

Srilanka is a tropical island with a land area of 65610 sq. kms and a shoreline of 1585 kms. The topography comprises central hills with a maximum elevation of 2700m. surrounded by a broad lowland peneplain at an average elevation of 75m. Both the temperature distribution and the rainfall pattern are characteristic of the particular nature of topography.

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 part of the country. In the north-west and south-east regions, the day-time humidity drops to about 60%.

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 2000 m, 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.

Westerly winds prevail over the island from May to September. The winds at mean sea-level are from the south-west. During December to February, easterly winds blow across the island, with winds at mean se-level tending to be north-easterly. 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.

The annual rainfall in **Sri Lanka** varies between 900 mm and 6000 mm. The Wet Zone receives rainfall on an average exceeding 2500 mm, while the Dry Zone, receives rainfall below 2000 mm annually. The transition area receiving rainfall in the range of 2000-2500 mm is known as the Intermediate Zone.

A recent study funded by the Asian Development Bank (ADB), carried out in Sri Lanka, has shown that the most valnerable area due to climate change is the se-level rise and its consequences. 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.

The average annual precipitation in Iran is extremely variant. It differs from 25 mm in Lut Salt Desert to 2000 mm in the western coasts of the Caspian sea. The average annual precipitation in the whole country is 256 mm.

When the fever of the Oil War in the Persian Gulf subsided, another environmental crisis hit Iran. That is the sea level rises of the Caspian Sea (the largest lake on earth), which have caused considerable damages to coastal cities, villages, industries, agricultural lands, and tourist summer resorts. These areas have simply been inundated by sea water. Although some research is underway to determine the real causes of this rise, it is hypothesized the several factors are responsible :

- diversion of two rivers to the Caspian Sea.
- heavy deposition of rivers entering the sea.
- heavy precipitation in the coastal areas, as a result of climate change.

- obstruction of the mouth of Qaraboqas Bay in Turkmanistan.
- tectonic activities in the sea bed.

The Himalayan Range is the most recently formed in the world and is still rising. The country covers the southern slopes, from peaks of more than 7,500 metres down to an altitude of 200-300 metres on the southern boundary which is situated approximately where the Himalayan range rises suddenly from the North Indian plains.

A consequence of recent geological movements is heavy erosion Slopes are generally as steep as they can be and are mainly kept stable by vegetation. There is considerable natural erosion which is further exacerbated by human activities, especially when the soil becomes heavily water-logged during the monsoon.

The climate is characterized by a dry winter and a wet summer monsoon. The precipitation becomes heavier towards the south, with annual rainfalls of up to 5000 mm.

Rainfall in **India** is unequally distributed in space. The mean annual rainfall ranges formless than 100 mm in parts of the Rajashtan desert to more than 4000 mm in the Western Ghats portions of South West India and the North eastern parts of the country. The intra-annual distribution of precipitation is also uncertain and seasonally skewed. The bulk of rainfall is received during the South-west monsoon season (from June to September). However, even during this season there are periodic dry spells/droughts which are frequent in the arid and semi-arid zones of the country covering the States of Rajastan, Gujarat, portions of Madhya Pradesh and the States of Maharashtra, Karnataka and Andhra Pradesh located in the Deccan area. Consequently, the crop yields of the rained sorghum millet belt of arid and semi-arid India are subjected to periodic fluctuations.

Resource utilization nd processing have been increasing with the continuous economic growth of Pakistan. With the increase of human population agricultural and industrial development, chemical production, energy consumption and increased traffic have contributed to atmospheric pollution. Wind and thermal air currents sweep away pollutants, however in 'no wind' season. The pollution increases pollutants in atmosphere to toxic and hyper toxic levels, particularly in congested areas. The health and resource cost increases efficiency of manpower decreases which in turn affect national economic growth. Such adverse affects are difficult to quantify in economic terms. Polluted atmospheric human tolerance is very variable with variation in human age.

CHAPTER - 6

WASTES, TOXIC AND HAZARDOUS CHEMICALS

Generation of hazardous wastes and use of toxic chemicals are on the increase in SACEP region. More and more chemicals of varied and toxic nature are being used and produced alongwith toxic and hazardous wastes. These are being used in agricultural field, in industries and in limited cases and in a limited quantity in house holds.

Bangladesh is not an industrialised or highly urbanised country and mining activities are very limited too. Subsequently generation of toxic wastes and hazardous chemicals, though on the increase but still not of very significant amenity or threat except for a certain and localised cases. Even generally the wastes produced by industries in **Bangladesh** are of Primary types where the pollutants are mostly biodegradable, through in recent times, problems of hazardous toxic wastes from chemical industries electroplating, fertilizer, tanneries, textile processing, paper mill and Other chemical industries tend to gradually become matter of environmental concern. Information on types of chemicals used and hazardous wastes generated is still extremely limited while that on quantities generated is practically non-existent.

The inventories of toxic chemical users and hazardous wastes generators in **Bangladesh** are still preliminary.

According to preliminary estimates, there are about 480 (the actual number may be larger) organized large sector industries in **Bangladesh** using approximately 40 types of chemicals. They are mostly located in the large towns of Dhaka, Chittagong and Khulna. Large quantities of chemicals, such as chlorine, ammonia, inflammable petroleum products, technical grade highly poisonous pesticides and solvents are used, stored, handled and transported through populated areas without any safety codes.

Out of the 480 industries, 19 units (urea - 6, TSP - 1, chlor-alkali-1, pesticides - 10 refinery - 1), have inadequate or no safety or risk management plans and have potential for large - scale accidents. Ten units are very close to the populated area. Some of these installations are 15 to 20 years old with obsolete systems and are surrounded by slums with large populations at risk.

Highly toxic imported chemicals are transported through populated areas without safety codes or emergency preparedness in a manner which would never be allowed in the countries of their origin.

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).

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.

Most landfill sites in **Sri Lanka** are not adequately designed or controlled with due regard to environmental factors.

Pesticide wastes per annum in Srilanka, include empty steel drums -6000-7000, Liquid outdated pesticides 600-800 kg, solid outdated pesticides 1000 kg, packing material - 8000 kg.

The rate of per capita consumption of pesticides in Iran is about 3008 per annum on the basis of active ingredient content. Although biological and mechanical controls are also employed and integrated pest management is practiced, pest control is mainly dependent on chemical substances. As a result at many places agricultural soils of Iran are polluted and further soil pollution is caused by residue deposition of industrial wastes.

Industries in **Pakistan** in rare cases have pollution control arrangements and mostly those do discharge untreated effluent containing often hazardous chemicals.

The dumping of toxic industrial wastes in municipale disposal areas or on lands adjacent to industries with no record of location, quantity or toxic consumption is a matter of great concern.

Industrial wastes are normally discharged into a nearest water body or wide open depression. A survey of 150 industrial units revealed that all of these discharge their affluents into the sea, rivers, watercourses, drainage courses, or municipal drains.

Over 235 industries in Faisalabad discharge high levels of solids, heavy metals, aromatic dyes, inorganic salts and organic materials directly into municipal sewers without treatment, polluting nearby agricultural land.

Leather tanning factories near Peshawar drain their pollutants into Kabul river, threatening its use for domestic and irrigation as well as its fisheries.

Contamination of shallow ground water near industrial plants has created grave situation in and around towns where industries such as tanneries have been located. These Industries discharge toxic wastes into subsoil water through wells dug for this purpose or this water is speared over the ground which seeps down into subsoil water with Toxins. City of Kasur has more than 120 leather tanneries which discharge 136,000 cubic feet of effluents per day into surface water, open ground and unlined pits. The surface water and ground water have become heavily contaminated. In Kasur city and in localities around, various diseases have become common. These include intestinal, respiratory including lung cancer, opthlamic, dermis, nausia etc.

CHAPTER 7

NATURAL DISASTERS

The types of natural disasters in the SACEP include - floods, cyclones, earthquake, landslides etc. Vulnerability to these varies widely and also the magnitude and extent of those.

In April 1987, a storm centre in the southern Indian Ocean resulted in long-distance wave transmission which passed through much of the Maldivian archipelago. The waves caused enormous economic losses through damage to infrastructure, reclaimed land and vegetation. Male and the airport on the island of Hulule were the worst hit with extensive flooding and erosion. A new "island" approximately 250 metres long and 12 metres wide was formed on a submerged reef north of Male.

Other recent events of flooding such as those experienced at Thulhadhoo in 1988, were caused by high SW waves (2-2.5m high, duration 12-15 seconds) in association with a high spring tide and southwesterly wind. Damage caused was enhanced by the absence of natural beaches, reclamation of reef flat areas and the presence of low vertical sea walls which magnified overtopping and flooding.

In 1991, the country experienced unusually severe storms with high winds causing extensive damage to building and trees. An estimated 3,000 dwellings were damaged and more than 100,000 trees and agricultural bushes such as chillies uprooted or damaged, causing an overall loss of an estimated US$30 million.

Although a degree of coastal flooding has been experienced in the past, risks of flood damage resulting from long distance swell propagation in association with high tides, have increased in recent years by the improper management of the coastal zone. Construction of poorly designed seawalls and coastal structures and reclamation of land, reducing the extent of the protective reef flat have been contributing in varying degrees Information on local current patterns is still scanty and at best, qualitative Such information is vital in coastal construction work and in estimating the nature of sand transport within the reef system.

A recent review of historical records suggests that around eight major flooding events have occurred within the last 170 years and that one such event in 1819, resulted in 12 islands having to be abandoned.

Throughout the world, **Bangladesh** is known for its vulnerability to natural disasters.

The major natural disasters to which Bangladesh is subjected are cyclones, tornadoes, floods river bank erosion and droughts etc. In the past major earthquakes have occurred.

In **Bangladesh,** flooding is very much a part of the normal cycle of the seasons. A delta cannot develop physically without flooding and it is to floodwaters bearing plant nutrients in the form of dissolved and suspended solids that much of **Bangladesh's** fertility can be attributed. Each year, about 26,000 wq. km. i.e., 18% of the country is flooded. During severe floods, the affected area may exceed 52,000 sq. km. i.e., 18% of the country is flooded. During severe floods, the affected area may exceed 52,000 sq. km. i.e., 36% of the country and nearly 60% of the net cultivable area. In an average year, 775 billion cubic metre of water flows into the country from June to September through the three main rivers.

For two consecutive years, 1987 and 1988, **Bangladesh** has been deluged by exceptionally severe floods. Both these catastrophic floods attracted worldwide attention and concern. The 1988 flood was generated by intensive rainfall extending over north-east of the sub-continent. The flood peak of the Brahmaputra was the highest ever recorded. The flood peak of Ganges was also severe and most significantly, the two peaks usually coincided, with devastating effect on the country. The frequency of 1988 flood peak of Brahmaputra at Bahadurabad was in the order of 100 year event.

Devastating effects of 1988 flood were enormous. It inundated more than 90,000 sq. km of land area affecting nearly half of 110 million population, with 2300 deaths. Damage to the standing monsoon rice crop was about 1.6 million tons. Many schools, houses, livestock telecommunications, roads, railways and railways and bridges were damaged or destroyed. Production in much of the country came to a standstill. Lines of communication were disrupted for over a month. Capital stock losses were well over US$1 billion and GDP growth was setback severely.

Cyclones originating from the bay of Bengal are the most devastating disasters threatening the coastal districts of Bangladesh. In the last thirty five years, they have been responsible for the

largest number of disaster related deaths as well as considerable losses to agriculture and damage to infrastructure in the coastal areas.

Storm surge associated with tropical cyclones is one of the most serious problems in the coastal areas of **Bangladesh**. Records show that world's most pronounced storm surge disasters are observed in the Bay of Bengal. The impact of the cyclone of November 1970 was particularly severe. A wave of upto 9 m high was produced by this cyclone and is thought to have killed over 300,000 people.

The consequence of drought can be as far reaching and disastrous as the effect of major flood. In 1975, **Bangladesh** had a major drought when about 47% of the area and 53% of the population were affected. **Bangladesh** also experienced severe drought conditions in 1951, 1958, 1961, 1979, 1981, 1982 and in 1989.

River bank erosion along many rivers, both major and minor, carried away land and destroys houses and other structures. Close to a million people are displaced every year as a direct result of erosion.

A seismic Zone extends across the country and there is a risk of earthquake that could cause serious damage to infrastructure including embankments and other flood control structures.

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.

This 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 caused very severe destructions to life and property. Some villages were buried in a matter of minutes.

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.

The number of forest fires were 125 in 1991 (destroyed 298 hectors of forests) and 140 in 1990 (destroyed 375 hectares of forests).

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.

Severe drought occurred in Sri Lanka 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.

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 from 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 Bangla and the Arabian Sea.

Natural disasters in **Pakistan** are earth quakes, droughts, storms, floods, land slides, and more recently increasing affects of global warming. Most areas of **Pakistan** except southern Punjab and sindh are located within seismologically active zones and are susceptible to earthquakes. Major tremours hit Quetta in 1935,killing about 60,000 people. In 1975 more than 5,000 people were killed in Northern mountains and thousands of houses on mountain slopes were destroyed. Epicenter of most earthquakes experienced in NWFP and northern Punjab from time to time is in Hindu Kush. The February 1, 1991 tremour which rocked northern Pakistan was 6.8 on Richter scale. Some 500 people were killed and 2000 dwellings were demolished and also 100 cattle were killed. In early July 1994 earth - quake with its epicenter in Hindu Kush had intensity of 6.2 on Richter scale. There was some loss of life and property in Peshawar area.

Drought conditions are now repeatedly experienced in Pakistan. prolonged periods between rainfalls brings low riverine discharge.

Heavy floods have recurred periodically and some of these have been unprecedented, and played havocs all along river length upto delta. There had been numerous severe flooding of Indus plains since independence of varying magnitudes during the last 25 years in September 1992, 350 mm of rain was recorded in 24 hours in wet mountain areas of the country. There was wide spread sheet erosion associated with gullies and landslides in exposed locations. The flash flood washed huge number of logs which came floating edge to edge in 6 km long raft like formation striking and distroying bridges and buildings, cuting and washing away banks all along the Jhelum upto mangla reservoir. It brought unprecedented loss of life, property and infrastructure. In Punjab 1.94 million acres of crop area were damaged. Damage to cotton crop was 10.5% and to rice crop was 7.7%. Summary of the official figures of this flood damage in Punjab is tabulated below.

PART II
CAUSES AND CONSEQUENCES

CHAPTER - 8

POVERTY AND ENVIRONMENT

Introduction

The linkages between poverty and environmental stress have been highlighted for many years. At the 1972 Stockholm Conference on the Human Environment, Indira Gandhi, the then Prime Minister of India stressed that poverty was the world's greatest pollutant. This point was re-emphasised in the Brundtland Report a decade and a half later which described a "downward spiral of poverty and environmental degradation", whereby the poor are forced to draw unsustainally on available natural resources to satisfy immediate survival needs.

Process of Poverty and Environmental degradation linkages

The process which create and perpetuate poverty and environmental degradation are closely interlinked. There are some general poverty processes which are common to most developing countries including the SACEP countries. In this respect it is important to mention that some of the SACEP countries actually belong to the category of least developed countries (LDCS). These processes are mainly linked to historical patterns of land division and distribution, high population growth, policy biases against sustainable agriculture in the small holder sector, linkages between land, labour, capital and product markets which keep employment and wages down, interest values high, and returns to land below its potential, administrative and institutional controls which are biased against the poor, discrimination against poor rural woman, cultural and ethnic processes which go against certain groups, natural disasters like floods, cyclones, drought, pests, etc, which hit the poor most political and civil strifes - which affect the poor sections in the worst manner, and technological changes which the poor can not afford to adopt etc.

Some common poverty and environment linkages in SACEP countries

Poverty is the central issue and biggest challenge to environment in most of the SACEP countries. The difference, however, is one of degree and not of kind. Presently these countries manifest the following major factors related to poverty leading to environmental degradation:

- Low level of GDP.
- Low level of per capita income,
- A significant portion of people remaining below what is considered the poverty line.
- Low level of access to basic needs like food, health care, education, shelter and minimum calorie requirements etc.
- A highly discriminatory pattern of resource allocation where maximum national wealth is being concentrated in a few hands.

Table 1 : Gross National Product (1991)

Countries	GNP per capita($US)	Average Annual growth rate (percent) 1980-91
Afganistan	-	-
Bangladesh	205	4.3
Bhutan	174	7.6
India	330	5.4
Iran	2,274	2.2
Nepal	170	-
Pakistan	383	6.1
SriLanka	495	4.0
Maldives	-	-

* Source : World Resources Institute 1994-95.

Table 2 : Distribution of GDP among major sectors 1991 (percent)

Country	Agriculture	Industry	Services
Afganistan	-	-	-
Bangladesh	36.8	15.8	47.4
Bhutan	43	27	29
India	31.0	27.0	41.0
Iran	21.0	21.0	58.0
Nepal	59.0	14.0	27.0
Pakistan	26.0	26.0	49.0
Sri Lanka	27.0	25.0	48.0
Maldives	-	-	-

* Source : World Resources Institute. 1994-95.

In all the SAEP countries a major portion of population lie below the poverty line, about 80% people in Bangladesh, 40% in India, 49% in Nepal, 21.9% in Pakistan.

Table 3 : Per Capita Average Calories (as percentage of need), 1988-90

Afganistan	72
Bangladesh	88
Bhutan	128
India	101
Iran	125
Nepal	100
Pakistan	99
Srilanka	101
Maldives	-

* Source : World Resources Institute. 1994-95.

Table 4 : Percentage Share of Household Consumption Expenditure for food 1980/85

Afganistan	-
Bangladesh	59
Bhutan	-
India	52
Iran	37
Nepal	57
Pakistan	54
Sri Lanka	43
Maldives	-

* Sources : World Resources Institute. 1994-95.

Table 5 : Access to Safe Drinking Water Sanitation and health Services : 1990

	Drinking Water	Sanitation Services	Health Services
Countries	Urban/Rural	Urban/Rural	Total
Afganistan	40/19	13/-	29
Bangladesh	39/89	40/4	45
Bhutan	60/30	80/3	65
India	86/69	44/3	-
Iran	100/75	100/35	80
Nepal	66/34	34/3	-
Pakistan	82/42	53/12	99
Sri Lanka	80/55	68/45	-
Maldives	-	-	-

* Source : World Resources Institute. 1994-95.

Clearly, there is a relationship between poverty and environmental stress; poor people who can not meet their subsistence needs through purchase are forced to use common or private property resources such as forests for fuel and food, pastures for fodder, ponds, rivers and other water bodies for water and fish. Agricultural residues and farm dung are used as fuel. Shifting cultivation is largely practiced in many areas.These trends have led to large scale depletion of forests, land degradation, land erosion, contamination and siltation of water bodies and depletion of fish resources. The dire need to increase food production has resulted in unsustainable agricultural practices. The poor, being illiterate have little or no knowledge of sustainable agricultural practices and proper used of agro-chemicals on pesticides and very little access to improved techniques, quality seeds, better implements and irrigation facilities. This has resulted in degradation of land, severe reduction of natural nutrients and fall in land productivity. The poor are after must vulnerable and least able to cope with environmental changes and degradations and the impacts of natural disasters and hazard which are very common in the SACEP countries.

The poor are both agents and victims of environmental degradation. They suffer mostly, from the consequences of degradation whether caused by their own actions or by wasteful conmemption by higher income groups. Poverty also contributes to high population growth. With the poor, children are valuable; they gather fuel, collect drinking water, help in agricultural activities, and care for aging relatives. But as many children die, it is necessary to have many. The result is a vicious cycle: a large population leads to more poverty and more pressue on the environment.

Bangladesh is one of the poorest countries of the world. The per capita annual income is only $ 220, 60% of households are without sufficient land to produce enough food for their families. 20% of house holds do not even have enough land for a homestead. Some 60% of land is cultivated, food shortages affect more than half of the population.

85% of population still reside in villages, 25% of infants die before the age of 5, literacy rate is only 15-18% for females and 25-35% for males, less than 5% of population consume an adequate quantity and quality of food. Per Capita Calorie Consumption (1981-82) is 1943 compared to the minimum requirement of 2273 per day.

Poverty has alienated the majority poor not only from the mainstream economic development, but also from socio political process and development.

In **India** poverty still remains the major issue in environmental degradation. Inspite of the slowly rising per capita income, for a very large number of the poor, who depend on the resources of their immediate environment, poverty has been compounded by environmental degradation. There are 200 million people who live under poverty conditions in rural India. About 41.8 million people are under the poverty line in the urban areas (1987-88). The phenomenon of poverty is reflected in the quality of human population in India particularly in the mater of infant mortality and life expectancy. This is also reflected in inadequate supply of drinking water and sanitation facilities, growing incidence of water/vector borne diseases such as Malaria, Kala-azar, Encephalitis, Tuberculosis, Guinea Worm disease, Diarrhoea, and different respiratory diseases. House hold tap water is available to 35% of urban house holds and only 18% of rural house holds. Only 37% of urban house folds and 8% of rural house holds have access to sanitation services.

Table 6 : Mortality rate

Countries	Crude Death Rate(per 1000 population) (1990-95)	Infant Mortality Rate (per 1000 live births) (1990-95)	Under Five Mortality Rate (per 1,000 live births) (1991)
Afganistan	22	162	260
Bangladesh	14	108	140
Bhutan	17	129	210
India	10	88	131
Iran	7	40	67
Nepal	13	99	135
Pakistan	11	98	139
Sri Lanka	6	24	-
Maldives	-	-	-

* Source : World Resources Institute. 1994-95.

Table 7 : Life Expectancy (years) 1987

Countries	
Afganistan	42
Bangladesh	52
Bhutan	49
India	59
Iran	66
Pakistan	58
Sri Lanka	71
Maldives	-
Nepal	52

* Source : ESCAP (1990), State of the Environment in Asia and the Pacific

The Poverty situation in **Sri-Lanka** is showing gradual improvements. This is being reflected in crude death rate, infant mortality, which is lowest in the SACEP region. Access to safe drinking water and sanitation is maintaining some balanced improvement between urban and rural areas, percentage share of household consumption expenditure is also better than all SACEP countries except Iran. The daily supply of calories per person has also increased from 2200 units in 1981 to 2292 units in 1990. Per capita availability of cereals also increased from 127.43Kg in 1989 to 136.22Kg in 1991.

In **Nepal** agriculture is the major source of income and poor productivity is contributive to poverty. Around 50 percent of the farmers own land less than 0.5 ha. in size, and average land holding is 0.15 ha. Landless farmers have risen to 20 per cent by 1981/82 and 16 percent farmers own 63 per cent of the land under cultivation. Food productivity is falling by 0.5 per cent annually. Per capita production was 92 per cent of requirement (in 1976) and it came down to 80-85 per cent of requirement in 1988. 40-60 per cent population live at levels below minimum calorie intakes. Income of the bottom 40 per cent and top 10 per cent of the people are equal, having 23 per cent of the income in each case, and the middle 50 per cent have the remaining 54 per cent of the income.

Soil loss from terraces; decline in soil fertility, degradation of forest and over grazed pastures are the common features. Agricultural land is limited : 5 per cent or the hills is considered

good for agriculture, 38 per cent require terracing and the remaining is suitable merely for foresty. Further more, the agricultural holdings are small and fragmented; and out migration is in response to the inability of the hill farmer households to feed themselves.

In **Pakistan** poverty manifests itself largely among the unemployed, under employed, landless tenants, small farmers, nomads, pastoralists, scavengers, unskilled urban labour etc.
About 25% of the urban people and majority of rural people live in poor living conditions. The Federal Bureau of Statistics conducted a house hold income and expenditure survey in 1990-91 which worked out the poverty live at Rs. 280.00 per person per month. With this bench mark 21.9% of population of Pakistan is below poverty line.

According to an income distribution survey (1963-64) gini ratio works out 0.41%. Lowest house hold had 8% share in total income and highest 20% house hold share 45% of total income.

Rural population had lower standard of living compared to urban counterparts. Monthly income of rural house hold is Rs. 455 compared to Rs. 546 per capita for urban poor.

Among the SACEP countries **Iran** is rich in natural resources, including mineral resources, and bio diversity of plant and animal species. It shows a comparatively better picture in terms of GNP per capita, percentage share of house hold consumption expenditure for food, access to pure drinking water, sanitation services, health services, crude death rate, infant mortality etc, among the SACEP countries.

Bhutan is the poorest among the SACEP countries. This is evident in its poor per capita GNP, little contribution of industry sector in the GDP, poor access to common facilities like drinking water, sanitation, high crude death and infant mortality rate.

Poverty is putting serious pressure on environmental resources and shifting cultivation, deforestation and over grazing have already caused environmental degradation in the country.

Maldives, with a per capita GDP of US $ 703.5 in 1993 is recognised as one of the least developed countries (LDCs). It has a typical small island economy limited by natural and human resources, an acute shortage of raw materials; heavy imports of most requirements and an even increasing demand on government revenue to cater for the basic needs of an expanding population.

CHAPTER - 9

POPULATION AND LIFE STYLE

The population of SACEP countries in 1990 was 1174.8 million, ranging from 2.13 million in Maldives to 846.19 in India. The annual growth rate of population varies from 6.74 percent in Afganistan to 1.27 percent in SriLanka. Taking the global population to be 5295.30 millions in 1990, more than one fourth i,e 22.18 percent of the world's population live in the SACEP countries.

Table 1 : Size and growth of population

(million)

Countries	1990	1995	2025	Average Annual growth Rate(percent) 1990-95
Afganistan	16.56	-	45.83	6.74
Bangladesh	113.68	128.25	223.25	2.41
Bhutan	1.54	1.73	3.40	2.33
India	846.19	931.04	1,393.87	1.91
Iran	58.27	66.72	144.63	2.71
Nepal	19.57	22.12	40.06	2.45
Pakistan	118.12	134.97	259.56	2.67
Sri Lanka	17.22	18.35	24.74	1.27
Maldives	.21	.5	.6	3.43
Total	1191.36		2135.94	

* Source : World Resources Institute 1994-95.

By the year 2025 the population of the world is expected to be 8,472.45 millions when the SACEP countries would have a projected population of 2135.95 millions, which will be 25.21% of the global population.

The SACEP countries show the following important features in their linkages between population and life style.

- Agriculture is the main occupation in these countries with Nepal having the highest (59%) and Iran the lowest (21%) percentage of the total population engaged in this field.

- Contribution of the industry sector is improving in India, Pakistan, Bangladesh and Sri Lanka.

- Present size of population of most of these countries has become a problem for sustainable socio-economic development and at the existing rates of growth population of most of the SACEP countries will be more than double by the year 2025.

- Such increase in population is already creating serious problems of depletion of major resources and ecosystems.

- The large size of the youth population, high levels of unemployment, high rate of increase of labour force are creating serious negative impacts in the process of development.

- Women constitute 48-50% of the total population in most of the SACEP countries. However the rate of literacy among women is substantially lower than man. This is impeding over all socio-economic development including efforts in family, planning, health, sanitation etc.

- The share of women in the labour force is 8-33% in these countries which is one of the major factors affecting rapid socio-economic development.

- Except Sri Lanka all the SACEP countries have low rates of literacy in both male and female population. The worst situation is in Nepal where male literacy rate is 38% and female literacy rate is 13%. Illiteracy thus affects socio-economic development and also impacts on sustainable resource use.

Increase of population and the resultant pressure on agricultural land, reduction in the productivity of agriculture, depletion of wetlands, fragile ecosystems, deforestation, etc. are

driving the rural population to the cities. This is causing unhealthy growth of shanties and slures in most of the SACEP countries.

Low rates of economic growth is failing to absorlo the additional labour force; This is contributing to socio-economic and political instability, strife and rise of crimes and anti social activities.

The rural based joint-family system is gradually disintegrating leading to a break up of traditional value systems. Development is being interpreted and followed as blind imitation of western ways of wasteful and unsustainable life style. This is also leading to unhealthy competition in the society leading to corruption and other social evils.

With gradual improvement in economic conditions, upliftment of health care facilities, more and more access to basic human needs, the standard of living and life style of the people in these countries is also showing a gradual change. Reduction of existing high population growth rates has been identified as priority areas for development planning as the same impacts resource allocation, resource utilisation and the environment in multifarious manners and dimensions.

The present size, density, age structure, and quality of manpower in **Bangladesh** is an immediate threat to the environment and sustainable development. About 50% of the population is below 15 years of age. Another feature to look at is that currently the number of females in the very fertile age group of 15-45 is 47% of all females. Only 16% of the female population is literate compared to 31% of the males. About one third of the population is in the age group of 15-30, and about 120 million people are unemployed. Average annual growth rate of labour force is 3%. Agriculture is the main occupation, but it can no longer absorb the additional labour force.

Recently there has been a real decline in wages in the agriculture sector. Share cropping, tenancy, credit policies and aspects of the social structure have contributed to a significant transfer of land assets to a minority of larger land owners. Other sectors including industry are also not showing much prospects of creating sufficient number of job opportunities.

48.5 percent of the total population are female who suffer from basic gender disparities, as in health, nutrition, skills, training and employment opportunities for women.

food grains and provide for 225 million cubic metres of fuel. The per capita availability of land would be reduced from 0.89 ha. per head to 0.33 ha. per head. The pressure of population has resulted in very rapid degradation of the forests, natural ecosystems, wetlands, mangroves, national parks, sanctuaries, protected, areas, coral reefs. It has also resulted in overuse of agricultural and non-agricultural lands. The mountain regions are being exposed to increasing soil erosion, erosion of top soil and land slides. Another important impact is over exploitation of ground water resources,

Table 2 : Distribution of GDP Among Major Sectors 1991 (percent)

Countries	Agriculture	Industry	Services
Afganistan	-	-	-
Bangladesh	36.8	15.8	47.4
Bhutan	43	27	29.0
India	31	27	41
Iran	21	21	58
Nepal	59	14	27
Pakistan	26	26	49
Sri Lanka	27	25	48
Maldives	8.6	5.8	-

resulting ultimately in serious deterioration of water quality leading to an increasing incidence of water/vector borne diseases.

With its present population **Pakistan** is classed as the 10th most populous country in the world. At the same rate of growth it will be 8th in next 10 years and 6th in few decade. The impact of population is very evident on key natural resources including land and water. Economic pressures have led to deforestation, land degradation and irreparable loss of bio-diversity. Energy development has come at the cost of air pollution; industrial development has resulted in growing air and water pollution. Demographic pressure is causing serious overall degradation of all natural and fragile resource bases.

Pakistani society still holds a significant portion of the joint family system. The low literacy rate which sustain traditional values discourage parents, mainly in rural areas from sending

then children to schools, particularly the females. Urbanisation has resulted in the growth of unhealthy shanties, and increase in crime rates. Financial corruption and smuggling are on the rise. Use of CFCs and production of G.H.Gs are on the rise. Pollution of surface and subsoil is causing health hazards. The loss of bio diversity is alarming. Achievement of economic progress targets could not keep pace with external debt rise which has reached beyond $ 15.96 billion. Nation will face unpredictable difficulties before population growth is reduced and kept at par with the carrying capacity of the country's natural resources.

Population of **Sri Lanka** was 17.22 millions in 1990 and is estimated to reach 18.35 million in 1995 and 24.74 by the year 2025. The average annual growth rate of population is 1.27 which is the lowest among the SACEP countries. Sri Lanka also enjoys highest life expectancy among the SACEP countries. In case of both male and female literacy rate Sri-Lanka tops the list of SACEP countries.

In **Nepal** around 94 per cent of the hill districts are over-populated. In around three decade's duration the population is getting doubled. Four million girls approach reproductive age : and, this figure is 50 per cent higher than all women currently fertile; as such this generation, will have no impact on population control measures adopted. Typical household produces only two-third amount of food required and the hills are chronic food deficit areas; and in view of shortage of land and lack of employment opportunities out-migration is the only choice; north to south, and highland to lowland as well as to the urban areas. Population growth has become severe in building up negative effect on food balance: as projected, food deficit in 1995 is of a magnitude of 0.5 million M/T, affecting 2.6 million people - 12 per cent of the total population, and by 2010 it affects 6.2 million people - 20 per cent of total population. And this deficit is accentuated by the growing unemployment and under-employment.

The state of unemployment is notable : (I) 65 per cent of the household labour days are under utilised, and (II) off-farm work activity accounts to 15 per cent household working days. Due to lack of manufacturing industry for employment the hill population depends on infrastructure and reforestation activities. It has been estimated that during 1990-2000 labour force is to grow by 2.7 per cent par annum and by 2010 around 290,000 people will be entering labour market annually.

Table 3 : Adult Literacy Rate, 1990

Countries	Female/Male
Afganastin	-
Bangladesh	22/47
Bhutan	25/51
Iran	43/65
Nepal	13/38
Pakistan	21/47
Sri Lanka	84/93

Source : World Resources Institute 1994-95.

Table 4 : Position of Women in the Society

Countries	females as a percentage of males	Literacy (1990)	Labour Force (percentage)	couples using contraception	Average Age of Marriage	Year women received voting right
Bangladesh	99	47	8	40	17	1947
Bhutan	102	48	32	-	-	1953
India	100	55	25	43	19	1950
Iran	101	67	19	49	20	1963
Nepal	98	35	33	18	18	1951
Pakistan	100	45	13	20	20	1947
Sri lanka	106	89	27	24	24	1931
Maldives	-	-	-	-	-	-

Source : World Resources Institute 1994-95.

Maldives is the smallest partner among SACEP countries with a population of .21 million in 1990. The estimated population in 1995 is .25 million. The growth rate of population is

3.43% and the highest among SACEP countries. Fishing is the biggest contributor to the GDP, followed by agriculture. Tertiary sectors contribute 59.9%; the primary sectors 25.5% and secondary sectors 14.6% to the GDP in 1991. Services sector showed the highest potential in growth rate (25.3%) between 1981-91 while agricultural growth rate was the lowest (3%). Until the 1970 Maldives was rather isolated and its economy was based on fishing, shipping and cultivation of coconuts. The situation changed with the advent of tourism which initiated a period of accelerated economic growth. Tourism, and manufacturing sectors are experiencing, progressive growth. The country's export potential is also registering fast growth.

Bhutan's population in 1990 was 1.54 million and is estimated to reach 1.73 million in 1995. The present growth rate of population is 2.33 percent. Life expectancy is 49 years (1987) which is lowest in the SACEP region. Approximately 90% of the population is still engaged in agriculture, although only 16% of the land is permanently cultivable. This has led many farmers to practise the "slash and burn" method of shifting cultivation and the increase in the size of livestock herds has caused over grazing in many areas. Already the per capita rate of fuel wood consumption is one of the highest in the world.

Furthermore, a small population scattered over one of the world's most rugged terrains means that the per capita cost of essential infrastructure and delivery of social services is extremely high. All social services in Bhutan - education, medical and dental care - are free. The country has to pay for these services and its other development activities, being a least developed country with little to sell the outside world except timber, mineral ores and hydroelectric power, Bhutan could have resorted to a policy of unlimited and aggressive marketing of these natural resources. However, such a policy would quickly undermine the country's tradition of conservation and put Bhutan in the same predicament as countries that today face severe ecological and environmental problems : in a downward economic spiral in which the environment and the people who depend on it become increasingly impoverished.

Iran at present, with 57 million people, is the 20th most populated country of the world. If the trend of population growth (3.15%) continues over the next thirty years, Iran will become the 10th most populated country. Three million Afghani and Iraqi refuges in recent years have increased the real population to over 60 million. The reasons for such growth are multifaceted: The population under 15 years old comprises 45.5%of the total, while those over 65 years account for 3%. With such a young population, it is anticipated that the country's population will double in 30 years, further affecting natural resources use. Thus the consequence will be a more degraded environment, unless some vigorous measures are taken. As a result, family

planning is considered one of the main challenges of the country over the next decade, aimed at decreasing the rate of population growth from 3.2% to 2.3% by year 2010.

Iran has the highest GNP per capita among the SACEP countries. It's dependence on agriculture is the lowest among these countries. The percentage share of house hold consumption expenditure for food is also the lowest in the SACEP region. Access to drinking water and sanitation in the urban areas is 100% which is unique in the SACEP region. In adult literacy rate Iran ranks second after Sri Lanka both in the case of male and females.

CHAPTER - 10

URBANISATION

The SACEP countries are characterised by a comparatively low level of urbanisation with the exception of Iran where the current rate of urban population is about 60%. Bhutan has an urban population of about 6% being the lowest in the region. The rate of growth of urban population is high in Nepal (6.86%), Bangladesh (5.44%), Bhutan (5.86%), Pakistan (4.87%), and Iran (4.57%). The rate of urbanisation in Iran is 3.94%, 3.55% in Maldives and 1.57% in Sri Lanka.

Table 1 : Urbanisation in SACEP countries

Countries	Total Population 1990 (million)	1990 million of total	Percentage 1985-90	1985	Growth Rate	Largest city population as percentage of urban population (1990)	
Afganistan	16.56	3.60	-	21.73	-	5.84	5654
Bangladesh	115.59	15.76	6.2	13.63	19.5	5.44	402
Bhutan	1.52	0.08	2.8	5.30	6.4	5.43	-
India	853.37	238.95	18.8	28.00	26.8	3.94	4.95
Iran	56.59	31.07	38	54.90	60.4	4.57	295
Maldives	0.22	0.04	-	20.60	-	3.55	-
Nepal	19.14	1.84	3.5	9.59	13.7	6.86	1964
Pakistan	122.67	39.23	23.5	31.98	34.7	4.87	1954
SriLanka	17.21	3.68	19.9	21.37	22.4	1.57	1676

Source : World Resources Institute 1994-95.

Between 1965-94 urban population of some SACEP countries like Bangladesh, Bhutan, and Nepal have increased three times. In case of Nepal the increase is about four times. In India and Pakistan the increase is more than one and a half times. The lowest growth rate has been recorded in Srilanka.

The process of urban growth in the SACEP region is laking place mainly due to rural to urban migration, territorial expansion of existing urban centres or creation of new urban centres and also due to natural growth of population in urban areas.

Both rural push factors and urban pull factors play important rote in the rural to urban migration process.Among the rural push factors are high rural population growth rate, increase in rural poverty, landlessness, inability of the agricultural and other rural sectors to absorve the increasing labour force, unemployment, frequency and intensity of natural hazards and different socio-political problems and strifes. On the other hand, the expansion of either real or perceived job opportunities and possibilities of socio-economic improvement in the cities have been the major urban pull factors. In most of the SACEP countries, industrial, commercial and other economic activities are centred in a few cities. This is leading to concentration of urban population in a few urban centres.

In Bangladesh 40.62% of urban population is living in a few large city centres, like Dhaka, Chittagong, Khulna and Rajshahi. In India significant urban population is centred in cities like Bombay, Calcutta, Delhi and Madras. In Iran 29.65% of urban population live in large cities. Such concentration is 19.64% in Nepal, 19.54% in Pakistan and 16.76% in SriLanka.

Urban life in the SACEP region is characterised mainly by a large proportion of people living in slums; significant portion of urban population living below poverty live; a large portion of urban population are deprived of access to safe water and water borne sanitation. Most of the urban centres do not have adequate arrangements of sewage,removal of wastes and garbage. Air pollution and noise pollution are also becoming serious problems in major urban centres.

The rate of urbanisation in **Bangladesh** is expected to decline gradually from the current rate of 5.4%. However even at a gradually declining rate the percentage of urban population is estimated to be 26.4% by the year 2000 and 36.8% by 2015 AD.

Poverty is a major feature of urbanisation in Bangladesh. About 56% of the urban population live below poverty line income; 60% of urban people do not have access to drinking water.

In Dhaka 15% of the people have sewage and 35% have septic tank connections. Sewage system in other cities is practically absent. In Chittagong 31% of the people have septic tank arrangements. In the district towns and sub-districts this arrangement is only 21%. In many large cities about one third to one half of the population live in slums. The living density is up to 2000 persons or more per acre in some slum areas. The per capita living space is even

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down to 10 square feet in some settlements. 4.2% of all urban children suffer from chronic maluntrition and about 6.9% suffer from acute maluntrition.

With about 217 million urban population (1991) **India** has one of the largest urban population in the world. It is estimated that by 2000 AD, the urban population will increase to 300 million. Urbanisation has mainly occurred due to the structural transformation of Indian economy from an agricultural one to an industrial/service based one. Migration from rural areas is considered a major contributor to urban population growth. Urban India consists of close to 3500 towns with populations varying from 5000 to 10 million. Nearly two thirds of the urban population is concentrated in 317 towns or cities with a population over 100,000, 23 metropolitan areas have population exceeding 1 million. The four largest cities, Bombay, Calcutta, Delhi and Madras account for one sixth of the urban population.

About 20-30% people live in slums; 27% of the urban people live below the poverty line; 27% does not have access to safe drinking water; over 75% do not have access to water borne sanitation.

Sri Lanka currently has a comparatively low rate of urban growth (1.5%). But this is projected to increase gradually i,e, at the rate of 1.9% between 1996-2001; 2.4% between 2001-2006; and 2.9% between 2006-2011. By the year 2016-2021 this rate is estimated to reach 3% when the urban population world about 40%. Sri Lanka is planning to have a decentralised urbanisation with only two or three major cities i,e, Colombo, Trincomatlee and Galle. The urbanisation will mainly take place in small and medium sized towns, due to the decentralised development policies and programmers as well as due to the demographic situation in the rural sector.

In Colombo which is the largest city, only .37 million people have sewage connections, 47% of the housing units had pit toilets, bucket toilets or none. About 52% of the housing units had piped water. Inadequate disposal of urban refuge and sewage poses the biggest health hazard to urban people.

In **Nepal** urban centre was defined in 1961; the number rose from 10(in 1952/54) to 23 in 1981 and to 33 in number in 1987. The distribution of these settlements is 8 in hills, 3 in Kathmandu, 4 in inner terai and 18 in the terai.

Kathmandu, Birgunj and Biratnagar formed a location triangle encompassing major industrial enterprise, and in 1981 out of 64 medium and large scale industries 52 were concentrated within the triangle zone. Average urban growth rate during 1981-91 was 5 percent annually; there was decline in growth rate in some of the terai and inner terai urban centres while comparing between the two decades 1971-81 and 1981-91; whereas Pokhara, Bharatpur and Kathmandu have been singled out as the three fastest growing towns of Nepal.

Data of the past three decades (1961-1991) shows that the proportion of population living in urban areas increase with the size of the urban centre. Secondary gateway towns along the foothill as well show growth rates in excess of 4 per cent in the eighties. Emerging trends indicate that Kathmandu valley, Terai and Inner Terai region and Pokhara (among the hill town) will experience urban development in the near future. Urban population of Nepal has been projected to 3.2 million in 2002.

In 1994 **Pakistan**'s urban population is 33%. There are 415 urban localities out of which only 14 have population about .2 million. Karachi is the only metropolitan city having over 5 million people. There are 2443 slums in the urban areas, where people badly suffer from health hazards like maluntrition epidemics, parasitic diseases and water borne diseases, and also natural hazards like high rain or medium to high floods.

At the present growth rate Pakistan's population is likely to exceed 200 million during the second decade of 21st century. The consequential increase in the size of the urban population is likely to create serious housing, health, garbage disposal, water supply and sanitation problems in the urban centres.

Iran has the highest rate of urban population (54%) in the SACEP region. By 1995 the rate of urban population will be about 60%. In the process of urbanisation housing industry has flourished. The person per room index has come down from 2 to 1.7 and the percentage of houses with 1 to 2 rooms during the last decade showed a decrease from 43.8% to 32%. The proportion of mud-brick houses also decreased from 54.8% to 28.8% over the same period. By the year 2000, the percentage of urban population will exceed 60%. This will need further and planned efforts to improve the quality of housing and other facilities.

With a population of .22 million, **Maldives** has only one major urban centre in the capital city of Male. Some of the other islands are rapidly approaching an urbanised state. Problems of land shortage, over crowding, declining fresh water quality and quantity are major problems. Male's major source of drinking water is rain water. Around 83% of the atoll population have

no form of water treatment. Of the 5613 house holds on Male, 91% are connected to sewage compared to only around 5% in the atolls where 13% of the house holds have septic tanks and 80% use the traditional beach system.

Bhutan has a high rate of urbanisation, (5.43%). Yet only about 6% of the people live in the few urban centres including the capital city. The quality and coverage of urban facilities is moderate. However the government has under taken a number of schemes to improve water supply, sanitation, primary health care and educational facilities in the country specially in the urban areas on a priority basis.

CHAPTER - 11

AGRICULTURE AND FISHERIES

Basically all the SACEP countries have agriculture based economies and majority of the people live in the rural areas. As environment and development issues are very closely inter linked the state of agriculture and fisheries which are related, sectors greatly affect the trend of sustainable development. The dependence on agriculture ranges from 48% in Bhutan, to 8.6% in Maldives. Other countries like Bangladesh (43%), India (31%), Pakistan (26%), Sri Lanka (27%) and Iran (21%) are also significantly dependent on agriculture, pasture and related activities. Agriculture also provides employment and raw material for many agro-based industries.

The net cultivated area of **Bangladesh** covers 60% of the total land area, the highest percentage in Asia. However per capita arable land per person is less than 0.1 ha. The country would need to increase its food cereal by 2 million tons, to achieve self sufficiency in food. The trend towards greater food grain production, through intensive cultivation, introduction of high yielding varies of crops, application of chemical fertilities, pesticides and irrigation facilities have created a mummer of environmental problems. The major problems are :-

- Loss of bio-diversity through conversion of land to agriculture.
- Loss of genetic resource, due to introduction of HYVs.
- Depletion of soil nutrients and organic matter.
- Conversion of wet lands into crop fields.
- Encroachment of agriculture on forest land.
- Loss of forest cover due to shifting cultivation in the hill area.
- Desertification in the northern districts due to loss of tree cover.
- Inappropriate use of chemical fertiliser and pesticides which has polluted the surface and ground waters.
- Shortage of pulses, oil seeds, other cash crops, vegetables and fodder due to over emphasis on production of food cereal.
- Increased prevalence of surface water for irrigation has resulted in an increase in waterborne diseases and of water associated pests such as mosquitos.
- Reduction in water flows due to surface water abstraction which adversely affects fisheries, downstream water use, navigation and ecology.

The fishery sector contributes 3.5% to GDP in Bangladesh and provides full time employment to about 2.0 million people. In addition 73% of rural population engage in part time fishing for family consumption and to supplement income. Important environmental impacts in fishery sector are displacement of inland capture fisheries, contamination of acquatic ecosystems, depletion of wetlands, increased soil salinity and damage to agricultural land and mangroves due to unregulated shrimp culture, over fishing and harvesting of small fish fries leading to depletion of fish resources.

In **India** 140.90 mha of land out of a total landmass of 329 ha. was under cultivation in 1984-85. Irrigation potential went up from 22.6 mha in the 50s to 74.3 hma by 1989-90. Better seeds, inputs and irrigation helped the country to produce 170.2 million tonnes per annum in 1950-51, i,e, an increase of 235 per cent.

In india environmental problems of commercial agriculture and irrigation are numerous. Chemical contamination of drinking water on account of excess floride, brackishness, iron, arsenic, nitrates, animal wastes and pesticides/fertiliser residues is a reflection of the growing trend of both point (industrial pollution) and non-point source (fertiliser/pesticide application in commercial agriculture) on surface and ground water resources, which also are used for drinking purposes by human beings and livestock.

India is no longer dependent on import of food grains. How ever the people still spend 85% of their income on food. The poorest 20% of the population are still unable to consume more than 1,500 calories a day.

The effort to attain self sufficiency in food has however led to the inevitable erosion of the biological and environmental base of the country. Intensive agriculture led to problems like land deterioration, water depletion, pest infestations and loss of genetic diversity of crops. Excessive use of chemical fertilises and pesticides and poor drainage have led to pollution in many rural areas. Land, water and biological resources which support agriculture and animal husbandry and provide the essential requirements of food, drinking water and fuel are all under severe pressure.

With the world's largest cattle population of over 400 million animals, fodder availability in India is grossly inadequate. Pasture land only constitutes 3.9% of the total land area which thus faces serious degradation. India is rich both in marine and fresh water fish. It is estimated that the continental shelf alone has an area of 0.44 m.sq.kms. with an estimated production

potential of 4.5 m. tonnes of marine produce per year. The present harvest of marine resources is around 1.75 m. tonnes.

In **Pakistan** agriculture contributes 26% to the GDP; accounts for half of total labour force; is the largest source of foreign exchange earning and serves as the base sector for major industries like sugar, textiles and edible oil.

In Pakistan contribution of livestock sector to the GDP is 7.95%. During 1993-94, 18 million tonnes of milk, 887,000 tonnes of beaf, 187000 tonnes of mutton, 52,000 tonnes of wool, 268,000 tonnes of poultry meat and 5.5 billion eggs were produced.

Per capita consumption of fish in Pakistan is 2Kg/year. During 1993-94 fish production in Pakistan was 571,000 tonnes and Rs. 3586 million were earned in fish and fish product export.

Development of agriculture has not however been a mixed blessing; pests and diseases of crops reduced crop yield over the years. Use of pesticides increased.Integrated pest management and disease control were not practiced. Pesticide mismanagement has resulted in contamination of water ecosystem and degradation of soil. This has also resulted in diminishing of fish and bird population.

Improvement of livestock sector has resulted in degradation of range lands. It has also increased GHGs. Unregulated shrimp culture has resulted in increased salinity and depletion of agricultural land.

In **Nepal** basic data on production and yields for the duration 1972-86 shows decline in the yields of all crops: the reasons advanced being (i) marginal land brought into cultivation, (ii) decline in quality of compost, (iii) loss of soil fertility through erosion, and (iv) paucity of irrigation.

Farmers have been categorised in three groups as per size of the land holdings. Farmers having land below 0.5 ha. are subsistence oriented and so forced to take off-farm work, seasonal migration and resort to intensive cropping. The farmers holding land in the range of 0.51-1.0 ha. are likely to be cereal deficit households and are vulnerable to the vagaries of the weather, and off-farm income is needed to supplement their food supply. Farms 1.01 ha. or larger are self-sufficient towards producing enough cereals for their needs. But it has been observed that compost application on larger farms are very low. The areas under some form

of irrigation facilities were estimated; and out of the total facilities 72 per cent is contributed by the farmers.

Fish production activities are taking place in 60 districts out of the 75; and integrated fishery development programme are operatng in 21 districts. Aqua-culture development shows potentiality for expansion. Production trends for warm water fisheries indicate the attainment of sustainable development.

In **Sri Lanka** agriculture contributes 27% to the GDP. Agriculture livestock and fisheries development has been largely influenced by the free economic policies since 1977. This has helped introduction of better equipment, know-how, technology and capital. Paddy production has recorded a steady increase through the last three decades. In 1992 production stood at 2.38 million mt. Livestock production was 1.6 million in 1992. Fish production increased to 159,151 mt. from 144,266 mt. in 1986.

As usual there have been serious environmental impacts of such developments in agriculture and fisheries. Large extents of forest have been cleared for agriculture. Land degradation and soil erosion from shifting cultivation is a major concern. Large scale use of agro-chemicals and agro-pesticides have polluted lands, reduced natural land nutrients, polluted water bodies, reduced fish wealth. Flora and fauna has been adversely affected by land clearing for agriculture.

The agriculture sectors in **Iran** plays an important role in economic development, though the country is not self-sufficient in food and has to import 5.5 million tonnes of food annually. Cereal production occupies 64% of the croplands of which 66% are dry farming. Dry farming, however is a threat to natural areas, and a cause of soil erosion, since some rainfed farming areas are on slopes above 20%. Altogether, due to rapid population growth; rural emigration; and scarcity of water, fertilizers, and spare parts for machinery, the business of agriculture sector in the country is not promising. Iran is rich is fisheries with an annual production of 256.000 tonnes.

The contribution of agriculture to the GDP of **Bhutan** is the second highest in the SACEP region with a percentage of 48% Bhutan has traditionally been a country of subsistence farmers. Area of croplands is 18.5 million ha. Production and consumption of rice has become increasingly popular even outside the traditionally rice growing areas.Agricultural products such as apples, cardamom, oranges and other fruit products equivalent to US $ 6.5 million were exported in 1989.

Unlike other SACEP countries agriculture in **Maldives** contributes only 8.6% to GDP (1991). Total cultivable land is cited as 46,766 acres of which most is used for subsistence production. Crops include coconut, fruits, vegetables, tubers and coarse cereals. Citrus and coconut production have been adversely affected by pests and diseases and coconut production declined significantly in the early seventies and remained stagnant till the 80's. Productivity is generally low as a consequence of poor genetic stock, close planting and lack of use of fertilises or manners Fisheries sector is extremely important in Maldives contributing about 15% to GDP in 1990-91, and about 80% of the export income during the same years. Fishing has always been a central activity in Maldives and this is being gradually expanded through mechanisation of traditional fishing fleet, fuel distribution systems and fish collection facilities. The total catch doubled between 1981 and 1985 to around 60,000 tonnes, reaching 82,000 tonnes in 1992.

CHAPTER - 12

INDUSTRY

In terms of its contribution to the GDP, industrial sector in the SACEP countries comes after agriculture and service sectors. In some countries the contribution of agriculture sector is the highest while in some other countries the service sector contribution is most prominent. But in all the SACEP countries industry sector has the third position in case of its contribution to GDP. This however does not give an appropriate picture of this sector's impact on the environment and sustainable development. As far as industrial pollution and degradation of the environment and natural resources are concerned industry is the single biggest sector responsible for the damages to the environment, ecology and the resource base. The quantum and nature and extent of pollution differs from country to country depending on the stage, growth rate of industries, the technologies adopted, adoption of anti-pollution measures, creation of industrial zones with adequate measures to ensure safety of the environment and the people and a number of related factors. But certain major trends are common among all the countries, which are :-

- At the initial stages of industrialisation little caution was taken to ensure safety of the environment.
- Very few industries have inbuilt arrangements for antipollution measures.
- Technologies introduced in the industries are old, out dated and there is no significant initiative to change the old technology for new and environment friendly technologies.
- The process of industrialisation in most of the SACEP countries started in the Govt. sector. Even to-day some of the major industrial units in the SACEP countries are owned by government sector. Though it is the primary responsibility of the govt. to take anti-pollution measures, this is not being done to the extent desirable and necessary.
- In the private sector introduction of environment friendly technologies are not either known or considered costly and therefore not adopted as a rule or unless specifically compelled by law.
- Most of the SACEP countries either lack rigorous legislation to stop industrial pollution, of even if there are such laws, the same are not known to the industrialists or not followed properly by them.

- All types of industries, whether they are, heavy, medium sized or small lack adequate anti pollution measures.
- The nature and quantity of industrial pollution is large scale and hazardous in India, causing serious threats to water, air and soil and the ecosystems. However in other countries like Bangladesh, Pakistan, SriLanka and Iran also, industrial pollution is rapidly becoming a threat to the environment; human beings, flora and fanna. Unplanned industrialisation and failure to take anti-pollution measures is also creating increasing concern in countries like Nepal, Bhutan and Maldives, where the threat to water quality and fragile ecosystems due to industrial pollution is increasing rapidly.

The establishment of a diversified industrial structure, based on a unique combination of heavy and small scale industries and large number of specific industrial locations in **India** is causing serious pressure on air, water and land resource, and fragile ecosystems. Major polluting industries in India are cement(65), thermal power plants (68), fertiliser (108), oil refinery (12), distillery (178), sugar (363), pulp and paler (330), chlor-Alkali (27), synthetics and semi synthetics (34), pesticides, iron and steel, tanneries, petrochemicals, etc.

The air and water quality secenario due to industrial pollution is very serious in some parts of India. Pollution load in respect of air is of a relatively high order in the metropolitan cities of Delhi, Bombay, Calcutta and Madras. Relatively high frequency of suspended matter SO_2, NO_2 and heavy metals are present in the air, in Delhi. Air quality in some other major cities like Agra, Baroda, Cochin, Howrah, Jharia and Dhanbad, Simla, Surat and Faridabad is also being threatened with high concentrations of SO_2, NO_2 and S.P.M. Moreover 22 non-metropolitan areas in Madhya Pradesh, Orissa, Andrapradesh, Tamil Naru, Kerala, Mahrastra, Delhi, Bihar and West Bengal are most prone to industrial pollution. Pollution problem in small towns basically relate to water. 90% of water supplied to 241 class II towns in 17 states in India is polluted. It has been found that 6 major rivers in India namely the Ganges, Indus, Krishna, Godawari, Subarnarekha, and Sabarmati are grossly polluted, both from industrial and municipal sources. It is estimated that 3/4th of the waste water is generated from Municipal sources; 88% of the municipal sewage being from class I cities. Air and water pollution problems are critical in respect of fertilisers, paper and pulp, sugar and thermal plants. The rapid growth of chemical, petro-chemicals, fertiliser and engineering industries has increased the incidence of toxic, flammable and explosive chemicals in India.

Various forms and sources of air and water pollution and solid waste generation in India indicate the somewhat precarious environmental health of the country not conforming with

ambient air/noise and water quality standards. There are also serious effects on human health, fish resources, land and soil, and ground water resources.

Industrial sector in **Bangladesh** is small, but has the potential of growth. From 1985 to 1990 the average growth of industry sector has been 4.02%. Number of industries, big, medium and small, total to about 30,000. The major industries in Bangladesh are jute, textile, sugar cane, tannery, steel, machine tools, electrical machines, diesel plants, refineries, pharmaceutical, and chemicals.

Generally, the wastes produced by industries in Bangladesh are of primary types (agro-based industries, textiles, jute mills and tanneries etc) where the pollutants are generally bio-degradable. In recent times problems of hazardous/toxic wastes from chemical industries, electroplating, fertiliser, paper mills and other chemical industries are becoming matter of concern. Major environmental problems created by industry in Bangladesh are the following:-

- Decreased water quality in all major rivers and other water bodies.
- Increased morbidity and mortality in the health sector.
- Decreased production and quality of production in the fisheries sector.
- Decreased quality of community life in human settlements sector.

In Bangladesh large industrial establishments discharge their wastes in rivers. Factories of various sizes are located in residential areas. In most of the industries safety measures are absent. Most of the large industries are owned by the public sector which hardly have any anti-pollution arrangements. These industries are most negligent in following anti-pollution laws. Most of the old industries have inefficient and highly polluting technologies. The country lacks any legal basis to impose EIA or any other strict measure to ensure safety of the environment. Private sector industries consider adoption of environmental measures as expensive. Information gap regarding environment friendly technology is also a major factor.

Industrial sector in **Pakistan** has the potential to become the major sector in the economy by 2000. The large scale manufacturing sector grew by 4.49% during 1993-94. During the same period the labour intensive small scale industrial growth was 8.4%, The major industries in Pakistan are textile, polyester fiver and yarn, jute goods, fertilisers, cement, sugar, paper and pulp, soda ash, petro-chemicals, iron and steel. The country has 61 industrial estates.

The haphazard development of industries in urban areas have caused congestion, created slums, caused pollution to land, air, water, with serious consequences to human health and resource base.

In **Nepal** the average growth rate of the industrial units from 1967/77 to 1986/87 was 15 per cent and the employment also rose in the same magnitude. The number of establishment in 1986/87 was recorded as 9359 out of which manufacturing units figure out to be 3633 employing over 137,000 people. Industries with foreign collaboration figure out to be 117 units with capital investment amounting to Rs. 5,418.6 million in 1991. Establishments located in urban areas are 3110; and 78 per cent of these are manufacturing units. Analysis of 1589 manufacturing industries located in 11 municipal areas indicate : (I) 48 per cent are located in Kathmandu valley, (II) 6 per cent in the hilly region, and (III) 46 per cent in the terai and inner tarai; furthermore 68 per cent of those are located in the triangular zone within Kathmandu, Birgunj and Biratnagar.

More than 80 per cent of the industrial activity is understood to be concentrated in four major zones : (I) Kathmandu valley, (II) Biratnagar-Itahari, (III) Brigunj Hetauda, and (IV) Butwal-Siddhartha Nagar. Industrial growth and expansion have followed merely infrastructure facilities without any consideration of land use. It is growing haphazardly along the major north-south roads leading to East-West highways. The IUCN (1990) survey records that 84 percent of the industries are having problems of air pollution, and 50 per cent of these units have not adopted pollution control measures. Survey of point source pollution indicates that 64 per cent of urban based manufacturing establishments are pollution prone. Another (1991) survey confirms that industrial effluents contain various types of heavy metals (including toxic elements) and non fecal and fecal coliform bacteria.

The manufacturing Industry in **Sri Lanka** comprises of a few large scale industries including petroleum, cement and paper which are established outside the main cities and small and medium scale industries which are established in or near cities. There are several industrial estates, mostly focused on export oriented products. Sri Lanka follows a highly liberalised industrial policy intended to achieve newly industrialised country status by the year 2000, and, in this context, there is likely to be a proliferation of industries in the next few years.

In sri Lanka water pollution is one of the chronic problems caused mainly by, sewage, fertilises, pesticides and industrial effluent. Large scale mining of coral reefs for manufacture of lime which also occurs inland is causing serious environmental impacts. Mining reduces

the coral reef barriers against wave erosion, destroys the habitat of large number of marine fauna and flora, including fish.

In Sri Lanka, most of the solid wastes generated by industry ends at on site or site disposal. Most of the dumps are open. Common toxic and hazardous wastes are claners and thinners, alkaline digressers, alkaline phenolic digressere and acid surface treatment chemicals. Hazardous wastes are also generated by some textile industries, especially those that operate bleaching, dying and printing processes.

In **Iran** the rise of industrialisation during the past two decades has been very prominent. In some areas the number of industrial complexes has almost doubled. There are five old industrial estates in the country which contain over 600 industrial units. Recently 32 new industrial estates have began operation and another 36 estates are scheduled to be built by the year 2003.

Such industrial growth in are having adverse impact on the environment. In some cases industrial liquid waters are being discharged to seas, lakes, ponds, streams, or just outside the factory, creating environmental pollution and degradation. However in the new industrial estates treatment plants are being built to face the challenge of environmental pollution.

Bhutan is at the primary stage of industrialisation and all types of industries contribute 12.4% to the GDP. Important industrial units are hydro electric plants, food processing units and different types of small and cottage industries. Bhutan also has a few number of urban centres. As such the only major type of pollution is of rivers and water bodies through discharge of industrial effluents. In some limited locations dumping of solid wastes in open dumps is also creating health hazards.

In **Maldives** manufacturing sector contributes 5.8% to the GDP, sand mining sector contributes 1.8%. Industry is in its infancy and includes garment production and fish canning for export. Small scale industry has recently centred mainly on Male and some islands of Male atoll and includes soft drink manufacture, manufacture of PVC pipe, fibre glass boats, cement blocks, toilet soap and a number of food products.

So far the industrial sector has not posed any major threat to the environment. However solid waste disposal in the open dumps and sea shores and sewage disposal in the sea would ultimately create environmental problems if not taken care of at this very early stage.

CHAPTER - 13

ENERGY

Development of any nation depends on production and consumption of energy. The nature and extent of energy use is also an indictor of the stage of development in any country. The rational use of energy has an important role to play in supporting sustainable development. Energy is not only essential for meeting household needs but is also a critical factor in industrial and agricultural production as well as for transport. Energy consumption in developing countries fall into two distinct categories i,e, commercial and traditional. Countries with access to modern commercial fuels - coal, petroleum products, natural gas and electricity are mare urbanised and industrialised with better utility grids and fuel distribution systems. The less developed among the developing countries depend heavily on traditional biomassfuels - wood, crop residues, and animal dung etc. The SACEP countries combine use of both commercial and traditional sources of energy. The dependence on traditional sources is more in case of less industrialised and urbanised countries like Maldives, Bhutan (98%), Nepal (97%), Bangladesh and less in cases of India (31%), Iran (2%), Pakistan and Sri Lanka (61%).

Table 1 : Energy consumption : 1991

Countries	Commercial Energy use. Percentage (Petajoules)	Traditional Energy Per capita	Consumption of total
Bangladesh	262	2	64.77%
Bhutan	3	2	98
India	8,011	9	31
Iran	2,906	48	2
Nepal	15	1	97
Pakistan	1,032	8	-
Sri Lanka	67	4	61
Maldives	-	-	-

(NB : World average per capita is 60 petajoinles)

* Source : World Resources Institute 1994-95.

The SACEP countries suffer from some basic defficiencies common to developing countries. Developing countries account for 75% of world population but consume only about 30% of the global energy. They consume only 26% of the commercial energy and 85% of the traditional energy. Per capita consumption of energy in the developing world is less than one sixth of that in the developed countries and less than one tenth than in the United States. In all SACEP countries like other developing countries the demand for industrial and residential energy outstrip the growth in power generating capacity and in production and use of coal and oil, leading to electricity and primary fuel shortages. Commercial energy shortage, aside from then inconvenience, after miserably decrease natural productivity. Factories suffer regular from black-outs and loadshedings, industrial boils lack fuel, backup diesel generations need to be procured - these are common pitfalls of shortages. In India for example, the economic losses associated with such power shortages are estimated at 1 to 2% of national income. In the non-commercial sector the expanding population has created chronic shortages of traditional fuel resulting in environmental degradation and degrading soil fertility. Fuel wood is disappearing and more and more agricultural residues and animal manure are being used as fuel. Another important issue in the SACEP countries is inefficiency; energy is lost at every stage of production, distribution and use. Lack of proper maintenance and poor quality fuel further erode the capacity and reliability of power plants. Distribution net works compound energy waste. Because of outdated, inefficient, ill maintained equipment, low-voltage lines serving widely dispersed rural customers, and pilferage, losses between power station and customer average about 17% in the developing countries. This rate is higher in most of the SACEP countries. In the home, people often burn raw coal, wood and other bio fuels in open fire places and low efficiency stoves and heaters, wasting energy and releasing dangerous pollutants. The traditional "three stone stove" has only 10% efficiency while the introduction of improved types of 'ovens' or chullas can easily improve efficiency between 30-40%.

The cost of energy in most of the SACEP countries is highly subsidised leading to wastages. For example, in India, where farmer pay low electricity prices, the proliferation and over use of inefficient electric irrigation pumps have driven up agricultural demand for electricity by 15% annually and contributed to system over loads.

In **India** commercial energy accounts for about 50% of the total energy consumed; the rest comes from a variety of non commercial sources such as fire wood, cow-dung, agricultural wastes etc. The use of commercial energy in India has goue up from 1400 MW, in 1947 to 64000 M.W.in 1990, about 60% of the commercial energy is produced from coal and lignit however, increasing reliance on this source of energy leads to many environmental problems, like degradation of land, deforestation, soil erosion, land slips and disruption of squifers.

Displacement of people their rehabilitation, and health of the workers are also important problems. Use of coal in thermal power stations also creates environmental problems as Indias coal is very high in ash content about 30% of electric power in India is produced by hydroelectric projects. Natural gas accounts for 2% and nuclear energy for about 2.5% of the total energy production. for domestic energy, liquified petroleum gas (LPG) is fast becoming the most popular cooking fuel especially in urban areas, being cleaner and more efficient then traditional cooking fuels. The production of LPG shot up from 6,71,000 tonnes in 1985 to 27,64,000 tonnes in 1990. Bio gas is a low-cost appropriate energy technology with major potential in rural areas. At present 1.4 million family size bio-gas plants generat energy for cooking in villages across the country. Wind energy offers bright prospect in India. It is estimated that the potential for this energy is around 20000 M.W. making it an important source for the future. The potential of energy from biomass, wind direct solar radiation utilization and small hydro electric bower generation is immense. Technologies have been developed to a level where, with all-out efforts and proper policy support, these sources can provide almost all our energy needs in the long run.

Bangladesh is at a very early stage of development and the per-capita energy consumption is very low. Energy crisis exists both in the commercial and traditional sectors. The short fall is about 10% of the total consumption which is made up by petroleum imports. At present about 73.1% of the total energy use is met from biomass fuel domestic sector uses about 64.77% of the total energy and 81% of the total biomass fuel. Even the industrial sector gets 69.6% of its energy from biomass fuel. Natural gas consumption is dominated power industry to the extent of 36%-67% of total energy consumption in the rural areas is done for subsistence purposes. 16.4% energy is used for agricultural and 16.59% is used for industry 82.7% energy in the villages are obtained from local surceases. Agricultural residues and cattle dung provide 63.5% of biomass fuel.

Major environmental concerns in the energy sector are as follows

- Deforestation to satisfy rural energy requirements has caused problems of flooding soil erosion and situation in many areas.
- Loss of forest cover greatly reduces bio-diversity as many species loss their habitat and food supplies.
- Deforestation and local climate changes can lead to more substantial environmental problems such as decertification.
- The use of livestock manure for fuel in rural areas deprives the soil of natural fertilizer and leads to nutrient depletion and loss of soil organic matter.

- Energy conservation awareness is generally low throughout the country.
- Flat commercial rates for natural gas encourages wastage of the resource.
- Propable environmental impacts of coal, peat etc. mining projects in the near-future.
- Air and thermal pollution of water bolies arises from power station. This affects human health and leads to lon of aquatic diversity and fish productivity.

In **Pakistan** demand of energy is growing at 12% per annum while supply has grown by 7% annum. The supply mix constituted mainly of oil 40.1% gas 37.7% electricity 15.3% coal and others 6.9%. During 1992-93 maximum power demand was 8611 MW with annual growth of 8.1%.

The total demand for commercial energy is met from oil, gas and coal. During 1992-93 the demand of oil was 32,200,000 tonnes; demand of gas was 1598 MMCFD; demand for coal was 6,456,000 tonnes. and biomass some of energy demand was 66214000 tonnes. During 1992-93 residential sector consumed 16.52% of gas; 33.88% of electricity 4.37% of oil. The remaing was consumed by industry, agriculture, commerce and transport.

In Pakistan 90% of rural household and 60% urban house holds use fuel wood to meet their fuel requirements. Farm dung, sand dust, and cotton striks are also used. The non-commercial fuel resources account for 54% such consumption. It is estimated that over 30 million cubic meters per year fire wood is needed for this type of energy consumption.

Energy sector is a big source of environmental degradation with the present sources of energy. Pakistan is trying to improve the energy situation through better management, improvement of manpower, introduction of better technology and installation of hydel power sources. Pakistan has not paid serious attention to harness solar energy, wind and sea tide energy in which it has great potential.

Sri Lanka's indegenous sources of primary energy are hydro-electricity, and bio-mass, including fuel wood. 80% of the total energy is used for cooking, lighting and transport. With hydro-electric sources of power generation approaching the limits for economic development, the future expansion of electricity generation will have to depend on diesel of coal powered thermal power. During 1990-92, on an average hydro-electricity has contributed 11% petroleum 30% and biomass 59% to the primary energy supply. In 1992 thermal power contributed about 20% of the total electricity generated. Such plants operation heavy diesel or residual oil, having a high sulphur content. The transport sector consumes more than 50%

of the imported petroleum. Biomass including fuel wood, bagasse and charcoal constitute around 60% of the total energy supply, over 80% of the biomass is used in households for cooking purpose, and the balance in industry, particularly in rural industry.

The wastage of energy in the domestic sector is colossal. The 3 stone open fireplaces or built in mud stoves operate at average 10% fuel efficiency. Improved stoves can improve the efficiency by about 30%. Use of electricity can also be made by reducing enefficiency in management, reduction of system loss and introduction of compact fluorescent lamps.

Sri Lanka's per capita energy consumption being very low by world standards, damage to the environment is not yet a serious problem. However increase in production of energy through thermal power stations and increase in the use of biomass would increase the emission of polluting gases in future. This would need taking preventive measures to protect the quality of the environment.

In **Nepal** due to paucity in exploitation of its potential hydropower there is as yet major reliance on traditional fuelwood and the use of commercial energy (petrol, coal, electricity) remains to be known as the urban fuel. Forest being the major energy source plantation programme is on active list and barren is being identified for reafforestation scheme. Agricultural waste and animal dung are additionally important biogenetic sources for energy.

Installed hydropower capacity by (1990) was merely 238 MW and by 2000 it is expected to rise to 654 MW, 1.6 per cent of the economically feasible potential. Consumption of generated electrical in various sector (including 44 per cent in domestic sector) in 1985 is notable. There has been considerable increase (153 percent in the consumption of fossil fuel i the period between 1960 and 1985; and increase in demand of kerosene between 1982 and 1983/84 has risen by 81 per cent.

The possibility of raising solar energy and evidence of abundant wind energy are the potential avenues requiring both judicious investment and effortful exercises. In other words realistic development of alternative energy could meet enormous needs of energy in totality at large.

Iran has the highest per capita consumption of energy in the SACEP region and the lowest per capita use of energy for traditional purposes. Iran is rich in oil and other mineral resources. The main resource for production of energy is oil and oil products. Major portion of the energy is used in industry, transportion, and electrification for industrial, commercial and domestic use. Motor vehicles account for a large proportion of carbon-monoxide,

nitrogen-dioxide, hydrocarbons, lead and particulates pollution. Gasoline consumption in Tehran has also increased considerably in recent years. Motor vehicles in Tehran consume 40% of the total gasoline used in Iran.

Residential areas also burn gas oil or heavy fuel which cause air pollution. Public boths, bakeries, house and apartment buildings etc. fall within this category. The expansion of natural gas distribution which is expanding at a fast rate is likely to reduce this pollution burden significantly.

In **Bhutan** fuel wood needs 95% of country's energy demand, a consumption per capita which is amongst the highest in the world (1.8 CUM/YR). This has however resulted in large scale depletion of forests with concurrent environmental damages including loss of bio diversity, soil erosion, land slide, sedimentation of rivers and water bodies etc. The generation of electricity is mainly based on thermal power plants and the gradual need for industrialisation and urbanisation would also lead to an increase in energy needs, Bhutan has great potential for development of hydro-electricity which would used financial and technological assistance from external sources. Traditionally Bhutan is relenctant to step into the 'foreign aid' trap. However initiatives are already on the way to increase the country's energy supply gradually through utilisation of domestic resources.

In **Maldives** all energy sources for transport and electricity generation are imported. Firewood is extensively need for cooking purposes. Fuel consumption for electricity generation has increased from around 0.4 million gallons in 1981 to 1.9 million gallons in 1992. Petroleum products account for 12% of total imports by value. About 80% of the electricity generated in the country is consumed in Male. In Male 50% of the electricity is used for residential purpose, 28% for manufacturing and commercial purposes and 22% for government buildings and public places. 20% of house holds in Male and 93% in the atolls use fire wood for cooking. Kerosine oil is also a major item being used for cooking in Male.

CHAPTER 14

TRANSPORT

Transport as a whole is not a serious environmental problem in the SACEP countries, though increasing vehicular pollution in the growing and major urban centres is becoming an issue of growing concern. The imperatives of fast economic development and required growth in the modern sectors to reduce poverty and improve the standard of living calls for faster growth in industrialisation and urbanisation process with concomitant and rapid expansion of the transport sector.

The SACEP countries show an unique combination of fastest and slowest moving models of transport i.e. from air transport with jet planes, railways, waterways, roads, engine driven steamers, launches, motor boats, slow moving country boats, cars, trucks, three wheelers, cycles, and animal driven carts.

Transport systems consume scarce resources of land and energy and have a variety of adverse impacts on the environment including pollution of air, water bodies, damage to human health etc. A lot depends on what type of fuel is used by the vehicles. The number of vehicular traffic on roads like cars, trucks, three wheelers is increasing at a very fast rate in all the SACEP countries.This is happening in big cities like Bombay, Calcutta, Delhi, Madras, Dhaka, Chittagong, Tehran, Colombo, Kathmandu, and also in other medium sized urban centres which are expanding at a very rapid pace. Motorised vehicles cause air and noise pollution mostly due to lack of proper and timely maintenance and use of low grade fuels, which contain higher percentage of sulphur and lead. The over all trend of transport sector in the SACEP countries include the following:

- Motorised vessel pollution including vehicular pollution will be on the increase.
- Noise pollution will cross acceptable limit in more and more urban centres.
- Number of motorised vehicles will increase at a very accelerated pace.
- Over loading in vehicles will aggravate.
- Maintenance of road, railway and waterways network will be more and difficult and costly.
- Number of reconditioned vehicles imported from developed countries will be introduced in more and more numbers.

- The quality of maintenance will further deteriorate due to serious negligence in following relevant rules and standards.
- Water transports will decline due to siltation of waterways which will increase pressure on road and rail transport.
- Private sector transportation will develop more rapidly than public sector.
- Number of accidents leading to loss of human life and resources will increase further.
- Adverse impact on human health will aggravate.

In **Bangladesh** 86% of different vehicles on roads are found to emit black smoke alone at an unacceptable level. There is also wide spread unchecked pollution arising from inland and costal shipping seriously affecting water quality, fish wealth, and coastal and marine ecosystems.

Important issues related to transport sector include:

- Inadequate urban transport planning and management.
- Import and introduction of reconditioned vehicles in large quantities.
- Lack of proper maintenance of old vehicles and use of low quality fuels.
- Permanent loss of land to more and more road construction.
- Siltation of inland and waterways and their closure due to unplanned flood control, drainage and irrigation projects.
- Inadequate attention to natural drainage and loss of top soil while constructing roads and railway tracks.
- Navigation being hampered due to siltation of waterways and erosion of river banks.
- Lack of proper transport safety measures leading to heavy loss of life and property.

In **India** transport sector is creating air pollution in most of the major cities and noise pollution is on the increase. The transport system is heavily dependent on petroleum, consuming nearly a third of the countries oil and substantial portion of diesel supplies. The use of private cars and lorries is fast increasing. Use of railway is gradually declining. Public transport systems are showing a low rate of increase. Efficient use of fuel and proper maintenance of vehicles are issues of top most concern. In case of railways steam locomotives need to be phased out as soon as possible. Swift electrification of high-density trunk routes connecting major cities like Bombay, Calcutta, Delhi and Madras should be a priority. Electric trolley buses also need to be introduced in big cities. Emission control measures need to be updated and meticulously implemented. Questions of road safety and human health also need to be given priority.

Public transport caters to more than 80% of total passenger traffic in **Sri Lanka**. Private motor cars are used by few and average rate of private car using is five thousand people per car. Yet number of private motor car has doubled between 1975 - 1992, at an annual growth rate of 6%. The number of motor cycles has increased at the rate of about 27%. The private truck or lorry population has increased at the rate of 33% since 1975. The percentage of imported reconditioned vehicles is about 70-80% in Sri Lanka.

The major transport related problems are consumption of scarce land for construction and expansion of roads and highways. Socio-economic problems of payment of compensation, displacement of people are also important concerns. Energy sector is totally dependent on imported petroleum and related produces with serious environmental and financial problems. Problems of air pollution, noise pollution and adverse impact on human health are also on the increase. Energy saving, improvement of operational efficiencies, strict control of emissions are probable means of controlling adverse impacts on the environment and human population.

In **Nepal**, physiographically the distribution of road in the terai is high, in the hill it is significant and in the mountain it remains negligible. Following 1989-90 road mileage the distribution under the categories of Highway, District road and interconnecting roads are almost equally balanced and the figure of urban road is significant.

In view of regional development the north-south and east-west oriented road linkages, district/village level transport, development project related roads and essential provision of maintenance as well as stabilisation are quite important and this pattern of programme formulation has been followed in the Eighth Plan. Progress of programme implementation related to ropeway, railways, trolley bus and internal water route may need to be effortfully reviewed and revised in the course of implementation utilizing maximum hydropower which may be possibly availed in a given time and location.

Major modes of transport in **Pakistan** are highways and roads, railways, and air transport. Marine transport is used mainly for cargo, though some passengers are carried during the Haj season. The highway and railway systems are extensively used, both for cargo and passengers. Pakistan has opened its internal air traffic to private sector.

Transport sector in Pakistan employ about 1.82 million people which is a sufficient relief to unemployment problem. The employment potential of the sector is increasing with the pace of development.

Transport sector is a major consumer of non-renewable energy resources. It is a great source of air and noise pollution. Maintenance of roads and railway tracks is also costly.

Modern systems of public transportation, such as tramways and subways, have not yet been constructed in **Iran**; however during the past few years, attempts have been made in this regard.

At present, there are neither sufficient public transportation vehicles, nor efficient mass transit networks. As a result, a large portion of city residents use private cars leading to great problems of air pollution:

- The highest percentage of motor vehicles includes private gasoline engine vehicles, and lowest proportion belongs to gas oil run public vehicles.

- Traffic congestion due to the rapid increase in the number of vehicles and very slow improvement in the road system, are among the biggest problems in Tehran, which lead to many other difficulties as well.

- For example, running in traffic jams, and, as a result, motor vehicles account for a large proportion of carbonmonoxide, nitrogendioxide, hydrocarbons, lead, and particulates pollution.

- Gasoline consumption in Tehran has also increased considerably in recent years. Motor vehicles in Tehran consumes 40% of the total gasoline used in Iran.

A concerted effort is underway to deal with the above problems effectively. For example, projects are underway to construct metro and expand the mass transit network in Tehran in the near future. Furthermore, the Environmental High Council has promulgated strict standards for imported cars, as well as those manufactured locally. All imported cars must use unleaded gasoline, and a project is underway to change taxis and city buses to LPG or CNG dual-fuel.

Transport sector contributes 6.3% to the GDP in **Maldives**. Male is the major transport centre and the sole point of contract for external trade. Traditionally the sole mode of inter-atoll transportation was by sailing dhonis (boats) which have largely been replaced by mechanised crafts of various types. Hulule is the only international airport and there are four more internal airports. Between 1982-1992 number of registered vehicles rose from 18,103 to 45,236 including hand carts. The number of carts, lorries/trucks, and pick-ups have risen from 326

to 725; 156 to 455; and 46 to 267 respectively between 1982-1992. A significant portion of these vehicles are based in Male contributing to significant compaction of the road surface and consequent reduction in natural aquifer recharge.

Bhutan is the land locked country. Roads provide the only means of internal transport. Buses, trucks/lorries, three wheeled motor rickshaws, animal carts, and horses are used as means of transport. The capital city of Thimpu has the only airport. As the pace of development is increasing the number of motor vehicles is also increasing. So far transport sector is not creating any major concern for the environment.

CHAPTER-15

TOURISM

Tourism is a fast growing industry in most of the SACEP countries, contributing significantly to foreign exchange earning, employment and the GDP as a whole. Most of these countries have great tourist potential, due to their rich cultural heritage, archaeological remains, historical monuments, mangrove forests, sandy beaches, snowy mountains with world's tallest peaks, unique ecological and biological diversity of flora and fauna.

In countries like Maldives it is a major contributing factor to the national economy. In other countries like Nepal, Bhutan and Sri Lanka it is one of the fast growing industries. India has the largest number of tourists visiting in the SACEP region while tourism is slowly developing in Bangladesh.

India has one of the most institutionalised development sectors in tourism. It is a vast land of physical, ecological, cultural and linguistic diversity. Bounded by the Himalayan mountain ranges, in the north and the Indian Ocean in the south it has a wide variety of natural, ecological and geographical areas and consequeuntly of habitats and wildlife. All these alongwith its historical monuments, archaeological findings, tiger reserves, deep forests, attract millions of foreign tourists every year. India has also improved its tourist facilities and areas which are attracting an ever increasing number of tourists to have a look at the beauty, variety and mystery which it offers. The Tajmahal and other important monuments at Agra, Delhi, the religious shrines in southern and northern cities like Goya, Kashi and Brindhaban, the lure of the Himalayas and many more resorts, parks, game reserves, sanctuaries make India one of the most attractive tourist attractions in the world.

The government of India is cautious about the negative impact of tourism on the environment, ecology and cultural heritages. Elaborate tourist guide lines exist to protect the tourist attractions from decay and damage. The expenditure to develop and protect the tourist spots is also significant. Elaborate arrangements and net work of facilities have been developed to sustain the tourist industry.

Tourism is not very much developed in **Bangladesh** and the country has no significant tourist industry. Although Bangladesh has the largest sand beach at Cox's Bazar and the world's single biggest mangrove forest which is the habitat of the Royal Bengal tiger and the spotted

deer, few tourists stop in Bangladesh. The hill districts of Chittagong, the archaeological findings in Mahasthangarh (Bogra) and Mainamati (Comilla), the terracotta Kantajeer mondir (Dinajpur) and many other historical monuments offer unique tourist attractions.

Tourism in Bangladesh has not been properly developed. Modern tourist facilities and network or comfortable communication facilities do not exist to facilitate tourist attractions. Therefore tourism has remained mostly a domestic and seasonal activity. People visit Cox's Bazar, the Sunderbans, the hilly area of Sylhet in winter. The national parks, exist by name only and they are used as picnic spots at best.

Overall tourism activity has not as yet contributed to significant pollution or environmental degradation. However, there have been pollution in the beaches of Cox's Bazar, over extraction of corals in the St.Martin's Island. Uncontrolled exploitation of turtles shell and other wildlife is also becoming a problem in the sea beaches. Moreover, lack of proper care is also causing damage to historical and cultural monuments. Inadequate sewage treatment by tourist hotels, floating debris in coastal water, higher turbidity along the beach shore are negative factors in the sustainable development of the tourist sector in Bangladesh.

Pakistan is remarkable for its cultural heritage consisting of archaeological sites, monuments, settlements, individual buildings, work of art, varity of its flora and fauna, richness in species, from beaches and deserts in Sindh to coniferous forests and snows of Himalayas and unique assemblage of some of world's tallest peaks. There is great tourism potential. Tourism is an industry and resource which has valuable role to play not only in relation to balance of payments but also in terms of local employment and source of supplementary income. Tourism is one of the major financial resources and foreign exchange earnings. According to official figures 0.391 million tourists arrived in Pakistan in 1992. Similarly foreign earning for the same period from tourism sector was US$ 163 Million. The tourist influx provided 5,44,000 persons employment and generated local revenue of RS. 1.740 Billion. The tourist related activities contributed RS. 14.504 Billion to Pakistan's. economy.

Tourism is a fragile resource. It should be developed and managed with care otherwise it can be a major instrument of environment degradation of the resource base on which it depends.

Tourist lodge in natural areas can also have negative impact. The natural area does not remain natural with the development of roads and other infrastructures. Hill stations like Murree and Gilghit area are overcrowded with local tourists and these areas are littered, noisy and no more pleasant as these were some 20 years ago.

Saifal Maluk Lake gives shock to those who had seen it as a clean and most natural area some two decades back. This is a littered area with dirty hut-restaurants cleaning fresh slaughtered chicken in the clean water of lake. Also jeep drivers wash their jeeps at the edge of the lake giving very ugly appearance of otherwise a place of very high beauty.

For successful tourism negative impacts and associated services are identified in advance and are directed into positive channel. The tourism industry in Pakistan must not be explored on short sighted unsustainable basis otherwise its potential will be lost before it achieves slight level of development.

In **Maldives** tourism is the second largest contributor to the economy. In contributes 17%, to the GDP and provides over 25% of government revenue. The number of annual tourist arrivals (241,852 in 1993) now exceeds the total population of the country. At present there are 69 tourist resorts on small islands and in the capital. Resorts are established on uninhabited islands leased to resort developers for a five year period. About three thousand local people are employed in tourist industry. Over 61% of tourists came from Europe, mainly Germany and Italy in 1992.

The tourism industry is dependent upon the maintenance of environmental quality. Most of the present visits relate to marine based activities such as scuba driving in the coral reef environments and visitors expect a high level of water quality and pristine reef environments. The Ministry of Tourism has therefore established regulations controlling aspects of environment quality on resort islands including inter alia the numbers of buildings which may be constructed and the disposal of solid waste.

Although **Bhutan** has a great tourist potential, the Royal Government has deliberately limited the number of tourists entering the Kingdom each year. In fragile mountain areas throughout the world, the trekking and tourism industry has destroyed forests, created "garbage trails" of non-biodegradable waste, and often seriously distorted the social life and farming patterns of the local people. By limiting the number of tourists, the government hopes to minimize the negative environment and cultural affects of the tourism industry.

In 1993, an eco-tourism seminar was organized by the Royal Society for the Protection of Nature and Tourism Authority of Bhutan. About 150 participants,mostly tour and trek operators and government officials discussed sanitation, garbage management, and other pollution problems in tourism and drafted recommendations to preserve Bhutan's natural and cultural heritage in the context of tourism.

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 sectors, from the inception of organised tourism trade in 1967, upto 1982. Tourist arrivals increased at an average annual rate of over 20%. The ethnic violence in 1983, severely affected the tourism trade in Sri Lanka. A major recovery of tourist arrivals were observed in 1990 and 1991, with an increase to 297,888 and 317,703 respectively. 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 four fold, from 1982 to 1991.

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 the foreign exchange earnings from tourism in 1991,was 6434 million Rupees (US$155.5 Million) 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 tourists are becoming in increasingly more concious of the environment, and the environmental aspects in selecting tourist destinations. Sri Lanka's national attractions are valuable resources for tourism, and include -

* beaches and coastal features;
* wildlife in national park, reserves, and other areas;
* forests, including the Sri lanka Rain forests;
* tanks, lakes, lagoons, and river;
* marine features, including coral reefs and pearls;
* tea plantation, and other agricultural activities
* gem stones.

Poorly managed and unplanned tourist development results in damage to the national environment on which the tourism industry depends for its survival. Some tourist hotel developments have not given sufficient regard to architectural, aesthetical environmental and operating aspects. The consequences have been adverse, resulting in a number of problems. The worst examples are Unawatuna and Hikkaduma 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 channel;
* over-extraction of water from tube wells resulting in salination of the coastal water table ;
* Solid waste accumulation;
* non-bio-degradable plastic;
* Illegal constriction 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 visual obstruction, 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 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.

Nepal is one of the most attractive tourist attractions not only in the SACEP region, but it occupies a very prominent place in the world tourist map also.

Touristic statistics(1987) records 6.7 per cent annual growth rate during the past decade and foreign exchange earning of RS 1.088 billion,26 per cent of all earnings. The figure of tourist inflow has risen from 163 to 248 thousand during the decade 1980/90. Mid-altitude trekking and wildlife tourism visiting natural resource related areas are notable in terms of number of tourists. The religious tourists visit traditional sites. Economic contribution of natural resource

tourism(1987) is around US $ 4.8 million out of which 11 per cent is the revenue earning to the government. The National Parks were visited by over 37,000 people in 1987 specially the Chitwan National Park; and the revenue earned comes up to US $ 3.96 million. The impacts on the resource base are :(i) Increased fuelwood demand affecting watershed and vulnerable areas, (ii) ecological consequences of consistent overuse on aquatic life, flora and fauna, and (iii) environment pollution. Management philosophy practiced by the Annapurna Conservation Area Project is yet to be extensively exercised.Specific points required to be considered are : (1)Introduce fuel sufficiency rule for all the protected areas; (2)work out managemental plans for natural areas which generate economic incentives to local people ;(3) create incentives for investment; (4)levy a new environmental tax for park management; and (5)reorganisation of management and monitoring under one organisation.

Iran, the legendary Persia is rich in tourist attractions which include historic monuments, archaeological sites, a large number of natural parks, wildlife sanctuaries, protected areas. The tourist industry faced a setback after the Islamic Revolution when different types of restrictions were imposed on the entry of foreigners. However, very recently Iran is again opening its doors to the tourists and a number of liberal steps have been taken to help tourist industry.With further liberalisation and improvement of tourist facilities and transport and communication networks the tourist potential of Iran is likely to improve gradually.

CHAPTER-16

HUMAN HEALTH AND THE ENVIRONMENT

Man is a part of the environment where he lives and as such the living conditions provided by the environment are very closely linked to the people and their health. Good health is largely dependent on basic environmental amenities: healthy living conditions, clean water, sanitation, improved nutrition and basic health care. Although, health care is often equated with medicine, living conditions i.e. the overall impact of the environment on the living conditions of man play the dominant role.

Countries in the **SACEP** region fall in the category of developing and least developed countries. Most of the people in these countries have little access to adequate food, minimum calorie needs, pure drinking water, proper sanitation facilities, primary health care etc. High mortality rate specially among the children, low life expectancy at birth, prevalence of different infections and parasitic diseases, air-borne diseases etc. prevail in most of the **SACEP** countries. The basic problems are a very high population with rapid growth rates which are beyond the sustaining capability of these countries and endemic poverty which create a vicious cycle of poverty, population growth and degradation of health conditions. Illiteracy plays a very dominant role in this whole process of environmental degradation and poor health conditions.

Some improvements in the **SACEP** region have been achieved in several important areas of health, including infant care, immunization, eradication of small pox, malaria, cholera and epidemic control. However, in recent years malaria and diarrhoea have staged a come back in many **SACEP** countries specially in India and Bangladesh. The recent outbreak of plague in India is an serious indication of serious environmental conditions.

Exceptionally high infant (under one year old) and child (under five years old) mortality rates prevail in a number of **SACEP** countries. Infant mortality rate (per thousand) was 129 for Bhutan, 129 for Nepal, 120 for Bangladesh, 110 for Pakistan, 100 for India, 65 for Iran, and 34 for Sri Lanka in 1987. On the other hand, child mortality rate for the same countries during the same period was 200, 200, 191, 169, 152, 94,45 respectively. The life expectancy at birth for these countries for the same period was 49, 52, 58, 59, 66 and 71 respectively. Population with access to health services were 19% for Bhutan, 45% for Bangladesh, 55% for Pakistan, 78% for Iran and 93% for Sri Lanka.

The **SACEP** countries seriously suffer from different water borne diseases which are directly related to degrading environmental condition. Diarrhoeal diseases kill over 1.5 million children every year or 3 children every minute in seven out of nine **SACEP** countries expect Iran and Afganistan. A study of young children in Bangladeshi villages revealed that each child suffered on average 6-8 episodes of diarrhoea per year lasting a total of 55 days or 15% of the year. Often the hazards of diarrhoea are compounded by infestations with parasites such as hookworm.

Malaria continues to be one of the main public health problems in several countries of the region. The number of malaria cases in 1989 in Bangladesh were 51, 19 in Bhutan, 1850 in India, 21 in Nepal, 229 in Srilanka.Over the years the number of cases of malaria are increasing in Bangladesh, Bhutan, India. The situation shows a slight downward trend in Nepal and a considerable reduction in Sri Lanka. In Maldives no indigenous case has been detected for several years.

A high incidence of viral hepatitis caused by faecal contamination of water and food has also been reported by many countries in the region. It is an increasingly serious health concern in Pakistan, Bangladesh, India, Nepal and Sri Lanka.

There is a general lack of information about the incidence and prevalence of parasitic infections such as amoebiases, ascariasis, helminthiasis and hook worm. However, a study in rural areas of Nepal indicated occurrences of soil transmitted helminthiasis in more than 54 percent of faecal samples. Another group of major diseases prevalent in the **SACEP** region is air-borne. These include pneumonia, bronchitis and other respiratory diseases which are aggravated by air pollution. In India , the available figures indicate that acute respiratory infection (ARI) accounts for 10-25 percent of infant mortality. In Sri Lanka, **ARI** is again a leading cause of morbidity and mortality. There were 1837 cases of **ARI** per 100,000 population in Sri Lanka in 1982. **ARI** is also prevalent is rural Pakistan, Nepal and Bhutan, especially in the hill areas where indoor pollution is high during winter months. This is caused by household heating through the combustion of biofuels which expose women to high concentrations of suspended particulates and benzopyrene. Surveys conducted in India show that rural women are exposed to almost 5,000 ppm of suspended particles, whereas the allowed maximum limit for the occupational environment is 290 ppm. Contaminated food is also responsible for a high proportion of diarrhoeal and other infectious diseases particularly in the developing countries of the region. A continuing increase in the population and the slowing down of expansion in croplands since the mid-1970s has resulted in agricultural production effort being intensified. An incidental result has been a new threat to human

health, namely, agrochemical pollution. Gains in agricultural productivity resulted largely from the use of high yielding crop varieties requiring the intensive use of inputs such as irrigation water, chemical fertilizers and pesticides. Improved wheat strains accounted for much of the wheat planted in Bangladesh, India, Nepal and Pakistan. Problems consequent upon this are the environmental and economic risks arising from widespread monocroping. Planting only one crop variety, season after season, gradually drains soil nutrients and then requires increased application of costly chemical fertilizers. Outbreaks of disease and pests, especially those resistant to commonly used pesticides, are more severe, resulting in greater economic and ecological damages.

The farmers in most of the **SACEP** countries specially those engaged in subsistence agriculture are mostly illiterate and have no proper knowledge regarding the chemical fertilizers and pesticides. Though this has increased production of agricultural crops, nonetheless created environmental hazards for all animals, men and other non target organisms. Unintentional acute poisoning may occur through occupational exposure, accidents, misuse on food contamination. Agricultural Workers using pesticides are therefore at high risk. Mass poisoning through contaminated foods, accidental ingestion, spillage during manufacture, transport or storage take place in most of these countries. However, governments in these countries have limited resources to monitor health effects and the symptoms of pesticide poisoning can be similar to those of other diseases. India accounts for one third of estimated annual pesticide poisoning cases in developing countries. Farm labourers employed in spraying operations are worst affected. Cases of deformity or stunted growth of offspring, blindness, cancer, diseases of the liver and nervous system have been identified as caused by direct poisoning in some cotton growing areas of India. According to a recent **WHO** study five out of every one thousand Sri Lankan agricultural workers are hospitalized annually due to pesticide poisoning.

In **India** due to rapid industrialization and urbanization pollution of air and water is taking serious turns. Use of toxic, flammable and explosive chemicals are increasing in chemical, petro-chemical, fertilizer and engineering industry. In the petro-chemicals Ethylene Oxide, Phenol, Acetone, Benzene and Toluene are listed as hazardous chemicals. There is also bound to be a spurt in the use of Hydrogen Cyanide,Carbon disulphide, Thionyl chloride, Phosgene, Ammonia, Chlorine, Oleum and Hydrogen Fluoride. Flyash, Phospho-gypsum and iron and steel slags are the principal forms of solid wastes generated in India to the extent of millions of tons. The abundance of these various forms and sources of air and water pollution and solid waste generation all indicate, inter alia, a precarious environmental health of the country.

In **Bangladesh** no formal studies have been carried out on the adverse impact of environmental degradation including pollution of water, air, pesticides, agro-chemicals etc on human health. However, there is large scale pollution of water in most of the major industrial locations. Pollution of river Buriganga from tannery wastes of Hazaribagh, pollution of Karnaphuli river from effluent of Karnaphuli Paper Mill and other rivers in Khulna, Ashuganj have far exceeded acceptable limits of water quality. No major industry has proper arrangement for the safety of workers. Added to these are low access to pure drinking water, sanitation facilities and low calorie intakes which combinedly cause a number of diseases including dysentery, typhoid, cholera, tuberculoses, worms, malaria etc.

Health status in **Pakistan** due to environmental causes is characterised by prevalence of high infant mortality rate, and diseases like diarrhoea, pneumonia cardiovascular diseases, cancer, malaria, T.B, different communicable diseases and different parasite diseases. Problems of malnutrition, drinking water contamination are becoming serious concerns. Major health problems are found in communities living in slums and congested environment. Serious health hazards are being created by unhygienic conditions, congestion in traffic and air pollution. Another major health problem in Pakistan is drug addiction. The numbers of drug addicts presently is more than 1.7 million.

In **Sri Lanka** severe environmental pollution resulting in ill-health are caused by unhygienic slums, inadequate water and sanitary facilities, alcohol and drug abuse etc. Water pollution causes typhoid, dysentery, cholera, and worm infestation. Inadequate sanitation causes gastro-intestinal disorders and parasitic infestation. In Sri Lanka roundworm, hookworm, and whipworm infestations are common. Organic wastes support rodents and insect vectors. Rats are responsible for the spread of leptospirosis which is a fatal disease. Due to non-availability of treatment facilities in most industries, domestic garbage, animal and human wastes, most of the urban lagoons, lakes and rivers are polluted. As a result diarrhoea, hepatitis A and B, cholera, polio myelitis and amoebiosis are common diseases in the major industrial areas.

In **Nepal** cereal balance by household (1977/78) indicates that all farmers are deficient in relation to expressed requirements. The most disadvantaged groups are small farmers and only or mainly subsistence farmers. They produce 25 to 38 per cent of their requirements and this severity is accentuated by growing unemployment and under-employment. Protein deficiency is a general problem and chronic malnutrition affects 80 per cent of the children.

Standard of health indicators have improved due to immunisation campaign, malaria eradication, family planning and health facilities provided in urban areas. Maternity death rate

is high in rural areas and around 77,000 people (2.1 per cent of economically active population) are estimated to be disabled.

There is express relationship between chronic bronchitis and habit of smoking as found in Kathmandu and Jumla. Water borne disease affect 80 per cent of the population at any given time; and there is high mortality rate due to gastro-enteritis, diarrhoea and other communicable disease. Incidence of iodine deficiency is high; 70 per cent of the villages in some areas are affected by goitre.

Sedimentation and flood hazards, industrial pollution and dumping of solid wastes have affected quality of air and drinking water. Most industries located close to water bodies discharge toxic effluent without treatment. Quality of drinking water in major urban centres has been found poor; water samples of Kathmandu, Pokhara and Biratnagar contain contamination of fecal and fecal coliform bacteria; and even the ground water of Kathmandu has been found contaminated. Ill-ventilated housing system without chimney is often the cause of chronic bronchitis. The trend of air pollution is on increase in Kathmandu urban area and there is high level of lead content and other, particulates.

Maldives is at the primary stage of industrialisation and urbanisation. As such the threat of air, water and other pollutions is not serious. Moreover, health care and immunisation measures have been stepped up since the early 70s. As a result infant mortality has declined from 95 per thousand in 1980 to less than 31 per thousand in 1992. Maternal mortality has been greatly reduced to less than 3 per thousand and life expectancy has risen to 67 years. There is now almost universal immunization of children against five infectious diseases and clean water supply is available to around 60% of population outside Male. Outbreak of major water borne diseases such as cholera and typhoid have been greatly reduced.

Iran is facing serious air and water pollution from industrial sources; pollution from domestic and urban wastes; and pesticides and soil pollution from diverse sources. Air pollution is mainly from motor vehicles, industries and domestic and small size workshops. Gasoline consumption by vehicles produce a large quantity of carbonmonoxide, nitrogendioxide, hydrocarbons, lead and particulate pollution. The cement factories, petrochemical complexes, copper smelters,aluminum smelters, steel mills, pulp and paper plants and a large chemical industries also create considerable air pollution. Moreover, there are power plants, brick burning furnaces, oil refineries and thousands of various metal foundaries which also add to air pollution: A large number of houses burn gas oil or heavy fuel which also cause air pollution. Industries have also polluted seas, lakes, ponds, and streams. The Persian Gulf has

also been seriously polluted by industrial and domestic wastes from shore line, oil seepage from rigs and ships and marine emergencies and oil spill following the conflicts in the Persian Gulf. The Gulf War has created serious environmental problem for an area of over 500,000 sq.km. of Iran. Acid rain and smog covered the southern and western parts of the country. According to recent studies by **WHO** on soil and water samples in Iran, the rate of lead has increased 600% and the rate of carcinogenous particles of carbon showed an increase of 200%. The pollution caused by oil wells has been and still is a serious health hazard for a population of 12,500,000. Iran uses pesticides at the rate of 300gr per capita and as a result agricultural soils are polluted. Residue deposition of domestic and industrial waste also add to the problem. All these combined pollutions are having and likely to have more serious implications for human health in Iran.

In 1990 life expectancy in **Bhutan** was 49 years. Infant mortality is estimated at 142 per 1000 (1989) but is considerably higher in some areas. Maternal mortality is 7.7 per thousand (1984). Respiratory tract infections and acute diarrhoea and dysentery are the main causes for morbidity and mortality in the 0-5 years age group. Poor hygienic conditions and high prevalence of parasitic infections and contagious diseases also contribute to morbidity and mortality.

Significant health improvements have recently been made in Bhutan with special efforts to reach the entire population through the free health service. Health related programs such as immunization, malaria eradication,and mother and child health services have received high priority and have resulted in improved health conditions for a significant number of people. Leprosy and tuberculosis have been significantly reduced.

Bhutan's immunization coverage is presently the highest in South Asia and universal child immunization was reached in 1991. A salt iodisation programme has removed the grave consequences of iodine deficiency.

Water supply schemes are being established in all major towns and in 962 villages. These water schemes will reduce the incidence of water borne diseases and will provide clean drinking water.

Traditional stoves fill the house with smoke causing serious eye damage and respiratory problems. An effort is being made to install smokeless Stoves in rural house-holds.

PART III
RESPONSE

CHAPTER-17

ENVIRONMENTAL TECHNOLOGY

Environmental technology is a very broad concept, the essence of which is to ensure that the process of development does not destroy the environment, ecology and resource base. The word technology in this context, should mean and include the patterns and techniques both traditional and modern which would ensure a process of sustainable development. The SACEP countries like other developing countries have adopted development strategies which in many cases have caused irrepairable damage to their environment and resource bases. In many cases the technologies adopted were simple imitations of the developed countries without any serious consideration for the traditional and sustainable patterns of resource use which sustained these countries, their population and quality of life for centuries. One of the main reasons for introduction of unsustainable technologies was the dire urgency to increase the production of food and other goods and services to meet the need of a rapidly growing population. The rush to meet and feed the rapidly growing need for luxurious and wasteful patterns of consumption also led to introduction of environmentally damaging technologies in the SACEP countries. In some cases the imperatives for rapid industrialisation contributed to this process, specially in those areas where industrialisation did not follow the sustainable strategy.

The major impacts of large scale adoption of technologies which are not environment friendly in the SACEP countries have been the following:

--- Depletion of the environment,ecology and resource base,

--- Rapid and continuous process of air,water and soil pollution;

--- Irrepairable damage to the environment and resource base;

--- Production of commodities which are not related to meeting the basic survival needs of the majority people;

--- Diversion of scarce resources to production of commodities which feed luxurious and wasteful consumption patterns of a few;

--- Institutionalisation of an unsustainable process of development which has made these countries highly dependent on foreign aid and technology;

--- Destruction of traditional technologies and consumption patterns which were sustainable.

Introduction of environmental technology is an essential condition for sustainable development. As the SACEP countries face serious scarcity of development resources and cannot afford any wastage, they need environmental technologies more than the developed countries. Some of these countries are at the very primary stage of development and therefore need to introduce environmental technology in no time to avoid further environmental degradation and enjoy the benefits of development without trading off the resource bases and welfare of the majority of the people.

Introduction of environmental technology involves a few important tasks. Some of these are:

--- Evaluation of existing technologies and determining their adverse impact on the environment ;

--- Making an inventory of traditional and less costly technologies which can be improved and expanded for sustainable development ;

--- Formulating an appropriate development strategy which would benefit the majority of the people and meet their basic and survival needs ;

--- Drawing an action plan to phase out unsustainable and pollutant technologies;

--- Ensuring introduction of environmental technologies in new industries ;

--- Supporting the process of introduction of environmental technology and phasing out of old and pollutant technologies through legal measures, fiscal incentives, financial and technological help.

--- Educating the people, and the development agents regarding the benefits of environmental technology, their availability, and the means to introduce them.

The above process will need proper identification of sectors which deserve priority in the field of environmental technology, keeping in view the stage of development of the country, its overall development priority, the nature and extent of its resource potentials, etc.

The sectors which would deserve priority would be mainly the following :-

--- Whose development causes lesser environmental degradation essential for development.

--- Whose development is beneficial for welfare of the masses.

--- Without the development of which human welfare is not possible or it is negligible.

--- For the development of which resources are available.

--- For the development of which resources may be wasted.

--- For the development of which resources will be economically utilized.

--- For the development of which selfreliance is possible.

--- For the development of which foreign dependence is required.

--- For the development of which technology can be acquired even in exchange with the available resource needed by the other party.

--- For the development of which technology cannot be acquired or purchased at least in the near future.

--- For which development is of utmost necessity, and technology transfer is impossible at any cost.

--- For the development of which technology is easily offered.

--- For the development of which technology with other party can be shared on incentive.

--- For the development of which joint efforts with others can be applied.

India has the largest industrial base among the SACEP countries. The technologies in

existence combine traditional ones in rural areas and modern technologies for medium and heavy industries. But the speed and process of industrialisation has not been able to give due importance to the introduction of environmental technology in industry and other fields of development. As a result India is now the worst effected country due to unsustainable development technologies, suffering from large scale depletion of resources,pollution of environment, degradation of ecology and causing serious threats to human health.

In order to help the access to environmental technology India is considering the following steps on a priority basis :-

--- Organisation strengthening for research and technology development under the National Materials Initiatives under industrial development programme for raw material upgradation, performance improvement in conventional materials, energy substitution and conservation and environmental sustainability under the Science & Technology Programme under the Industrial Sector ;

--- Launching of a Technology Mission on Cleaner Production; coordinate activities for promoting cleaner technologies in India through government policies, strengthening of R&D institutions, industry associations, financial institutions and regulatory agencies.

--- Formulation of industry specific task forces for selection of demonstration and development projects;

--- Identification of cleaner technologies developed in research laboratories/industrial units in India and abroad and facilitating transfer and adaptation of such technologies in India:

--- Establishing centres for cleaner technologies in various parts of the country for developing a centralised data base and providing information to industries ;

--- Capacity building for environmental audit for pollution prevention.

--- Capacity building for developing indigenous design engineering capability for absorption, adaptation and improvement of imported technology ;

--- Formulation of standards in terms of waste discharge per unit quantity of raw material ;

--- Formulation of legal and economic measures to ensure absorption of clean technologies ; and

--- Capacity building for assessment of environment impact of clean technologies.

The pattern of development in **Sri Lanka** has been changing from an agricultural to an industrial based economy over the last few decades. 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 effect of rapid industrialisation with little or no environmental planning, require immediate remedial action. These 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.

The Government of Sri Lanka (GOSL) 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 back drop, the GOSL has developed an Industrial Pollution Management Strategy aimed at reversing the current trend of environmental degradation due to industrialisation. The basic featers of this strategy are :-

* 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 exiting

industries;

* Mechanisms to promote pollution control as a pioneering industries;
* 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 mere fact that the success of the Industrial Pollution Strategy developed by the GOSL is dependent upon close cooperation with industry, calls for pro-activity in environmental related issues rather than the reactive nature usually adopted by industry. To this end,the GOSL 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. In order to encourage such interaction the GOSL 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, and professional associations, educational institutions and non-governmental organisations.

The procedures that need to be adopted by industries include the following :

* Development of environmental awareness
* Development of cost-benefit awareness
* Management commitment
* Reorganization of management structure
* Undertaking of environmental audits
* Constant evaluation of pollution prevention measures
* Implementation of such measures
* Training at staff levels
* Constant monitoring of results
* Periodic review audits.

In addition to providing technical assistance in the area of waste minimisation the GOSL industrial pollution management programme reaches out to assist industries in an area perceived as the greatest constraint in compliance with environmental regulations,finances for implementation.

The GOSL is actively encouraging private sector participation in infrastructure development. The private sector of Sri Lanka has also expressed a great deal of interest in participating in environmental goods and services. 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.Other areas of private sector interest in the provision of environmental services is in centralized industrial waste water treatment.The environmental engineering consulting services available in the country is yet immature. A phased-in accreditation programme has been developed for the laboratories where initial compliance with an interim accreditation programme is envisioned.

Tibetan civilisation in the Himalayan plateau,traditional tribal culture in the rugged precipitous mountain and Hindu civilisation in the low land, developed the pattern of resource management in **Nepal** in the ages past. The clustered settlement as the core with provisions of upland field,grassland and natural field, grassland and natural forest evolving agro-pastoralism cum forest preservation are the basis of traditional resource management.

Beautiful terraces carved out in the hilly terrain are the testimony of the environmental technology developed through the ages. The coincidence between the available amount of warmth and a profitable kind of crop rotation in each altitude indicates that maximum amount of harvest was always aimed at. Crop rotation is the system to respond to the carrying capacity of the land in reference; and crop rotationa came up as the pattern of resource management for facilitating sustainable growth and maximum use of the nourishing meadows. Enrichening the land with dung and urine of depastured animals after the harvest, and raising butter and cheese at the same time are the technique of maximising productivity. A study conducted in 1984 in the Nepalese midland, alowed that population pressure leads to weakening of community solidarity, decrease in income and deterioration of quality of life resulting in inferiority complex and outflow of talent. Watershed management programmes have been undertaken in all the eco-belts in the midland hills. Agro-forestry has gained popularity in meeting human needs in economic terms. Watershed programmes at the district levels are supportive to the protected areas by resorting to rehabilitation of degraded terrain. Extension programme is promoting conservation with expressive objective of upgrading quality of life and enlarging management capabilities. The concept of users' group has grown popular and is progressively getting established in making profitable use of and management of resources.

The concept of environmental technology in **Bangladesh** environment management context is a relatively new one.Existing technologies in the industrial and other fields are not

environment friendly and as such are contributing to environmental pollution and degradation in many ways. Some of the important aspects of this scenario are as follows:

* Most of the industrial development in Bangladesh took place in the fifties and sixties when the question of environment friendly technology was not such a burning issue.
* Major industries are owned by the govt. sector. Govt. owned industries are mostly running at losses and moreover in developing countries like Bangladesh govt. sector industrial units usually suffer from the wrong idea that they need not give importance to pollution related issues and introduction of environmental technologies.
* Introduction of environmental technologies are considered costly.
* There is serious lack of information,knowledge and data regarding environmental technology and their availability.
* Existing institutions and laws related to the management of environment have not attained any considerable success in pursuing the industrial units both in the govt. and private sector in introducing environment friendly technology.

Responses to Introduce Environmental Technology

Certain efforts have been made recently in developing and adopting environmental technology which can reduce or obstruct the rate of environmental degradation or pollution.

Some of those include:

* Development and use of fuel efficient stoves,particularly for rural areas and their wide scale use is presently in the process;
* Introduction of, natural dyes (turmeric) in the textile dyeing industries in lieu of chemical;
* Development and wide use of low cost two pit system and three pitcher system sanitary latrines for rural Bangladesh in particular;
* Use of shallow pump engines in country boats which were used for irrigation and other purposes only;
* Introduction of special Tara pump which may be used to extract water particularly for safe drinking purposes, where ground water label is at a level non reachable to most of the regular hand pumps;
* Handloom is widely used and encouraged which does not consume other

energy any but human energy and is highly efficient;

* Introduction of environment friendly integrated pest management;
* Introduction of motor propelled rickshaws which can reduce the labour of the rickshaw puller and provide better efficiency.
* Local environmental firms have been working towards installing cost effective and locally suitable effluent treatment plants in many areas. Moreover use of local indigenous methods of agriculture, aquaculture, silviculture, are widely encouraged and new environment friendly technological innovations are very much appreciated and widely introduced. The country is very responsive to foster development of environment friendly technology.

Like other developing countries in the SACEP region **Pakistan** also finds it essential to gradually change over to environmental technology. In this respect Pakistan attaches great importance to improvement and invention of indigenous technology for sustainable development.

In this respect special emphasis is being given in the following fields:-

-- Development of indigenous filters for cement factory exhausts, study, and disseminate economics of recovery of wastes.
-- Development of plants for small scale units covering availability of local resource to replace less economical plants requiring huge quantities of raw material which is in short supply.
-- Development of Energy from municipal waste plants for every city. Hydel power electricity plants to be developed to replace village hydel power flour mills, very abundant in Northern mountain areas.

Iran is rich in oil and other mineral resources. It is also rich in diversity of flora and fauna. Currently it is undergoing a rapid pace of industrial development, harnessing of natural resources and urban development. The existing state of technology for development has proved to be highly unsustainable leading to large scale destruction of resources, ecology and environment. The need to introduce environmental technology is therefore felt in all major areas of development including industry, transport mining, agriculture and also human resources development.

As the present high population growth rate of 3.2% is a serious threat to sustainable development, modern family planning techniques and methods are being increasingly adopted to reduce population growth rate to 2.3% by the year 2010. Iran is also putting a lot of

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emphasis on expansion of literacy and technical education to utilize its resource potential in a more sustainable manner. Efforts are being taken to improve the traditional and wasteful irrigation system, and improve the condition of water supply and sewerage system in all the major cities over the next 20 years. Iran is trying to improve the pollution in the transport secter by constructing public transport networks to reduce the number of individual motor cars. Strict environmental standards have been imposed for both imported and locally manufactured cars. All imported cars must use lead free gasoline. A project is underway to change taxis and city buses to LPG or pollution free fuel. Iran is introducing anti-pollution equipments in all major industries including oil, refinery, cement factory etc. Steps are being taken to convert brick furnaces to use natural gas. Newly established founderies are being equipped with emission control devices. Natural gas connections are being expanded to domestic areas. The standards of water and air quality are being reviewed and implemented carefully.

Maldives is at a very primary stage of economic development where primary sectors contribute 35.5%, secondary sectors 14.6%, and tertiary sector 59.9% to the GDP. The industry, transport and energy sector are not creating any major environmental problems. Environmental aspects are traditionally respected by the people and the government is also taking strict measures in tourism industry, transport and other sectors to reduce environmental pollution and ensure sustainable development. Selection of environmental technology is an important issue as most of the development activities are being planned, initiated and supervised by the government.

Though a poor country **Bhutan** has great traditional respect to protect its culture, heritage, resource base, diversity of flora and fauna. The government and people are fully aware of the great biological wealth containing in the rich eco-systems. As a result Bhutan has integrated environmental concerns into the development strategy, plans and programs. Bhutan attaches great importance on sustainable traditional technology. It has shown great restraint in importing foreign technology which in many cases hamper its conservation priorities. In May 1990 a group of people consisting of representatives from all sections of the people including the environmentalists met at Paro, Bhutan to discuss the problems of technology and development. Part of the Paro Resolution which is quoted below, correctly represents the strategy of Bhutan towards environmental technology, --- "we recognize the potential of new technology and industries, but ... no amount of technology or monetary assets can make up for a razed forest, depleted soils, polluted waters or ravaged climate".

CHAPTER - 18

ENVIRONMENTAL MANAGEMENT: POLICIES, INSTITUTIONS AND MONITORING MECHANISMS

In developing countries like those in the SACEP region, proper institutional approach to environmental management with well formulated policies, established institutions and responsible monitoring mechanisms are of recent origin. As a matter of fact most of these countries started this process after the Stockholm U.N. Conference on Human Environment in 1972. Since then specific institutions like Ministries/Departments/Agencies started being established, antipollution laws began to be formulated, environmental quality standards came into operation; the people started getting concerned about the environment; environmental lobbies started emerging, the NGOs started a concerted effort to create public opinion to protect the environment and in some countries even the National Constitutions came up with guarantees to protect and promote the environment.

Since 1972, the SACEP Countries have advanced a long way towards environmental management, though the nature and level of the institutional approach to environmental management vary to a great extent. Most of these countries by now have developed policies, institutions and mechanisms for management and protection of the environment.

India has a very strong organisational framework for environmental management. Article 48-A of the Directive Principles of State Policy of the Indian Constitution, states: "The State shall endeavor to protect and improve the environment and to safe guard the forests and wild life of the country." Article 51-A(g) mentions that it shall be the duty of every citizen of India " to protect and improve the natural environment, including forests, lakes, rivers and wild life and have compassion for living creatures." In keeping with the spirit and provisions of these statutes, the National Council of Environmental Planning and Coordination (NCEPC) was set up in 1972 to propose solutions to environmental problems. The Tiwari Committee was setup in 1980 to recommend legislative and administrative and measures to protect the environment.

The Department of Environment was setup in 1980 which became a part of the Ministry of Environment and Forest in 1985 and works as the focal agency in the administrative structure

of the Central Government for planning, promotion and coordination of environmental programs. The activities of the ministry include conservation, survey and planning for the preservation of the flora and fauna, prevention and control of pollution, regeneration of degraded areas, impact assessment, conservation, research, education and information.

India has enacted a number of specific laws for environmental protection such as Environment (Protection) Act, 1986; Water (Prevention and Control of Pollution) Act,1974; Air (Prevention and Control of Pollution) Act, 1981 to regulate various environmental problems. There are also specific laws on forest, wildlife, biosphere resources, hazardous wastes, hazardous chemicals etc. which provide a strong regulatory basis for environmental protection.

A fairly detailed promotional policy frame work is also in place. The policy frame work comprises the National Forest Policy, 1988, the National Conservation Strategy and Policy Statement on Environment and Development, 1992 and the Policy Statement for Abatement of Pollution, 1992. These policy statements complement the National Water Policy, the Factory Act, 1948 and other related legislation having a bearing on natural resources and economic activities.

Most of the states have also set up their own Departments of Environment, Pollution Control Boards and other associated bodies. Various other Ministries and Departments, including those of Urban Development, Oceanography, Non-Conventional Energy Sources etc., at the state and central levels, are also concerned with different aspects of the environment. Greater coordination among these various agencies - government and non-government - would strengthen environmental efforts. State Governments are in the process of involving themselves seriously in environmental planning.

The Non-Government Organizations (NGOs) in India are also playing a vital role in environmental management and protection. The government is increasingly utilizing the potential to form a very strong and powerful lobby in favour of environmental protection in India. A few thousands of NGOs are now working in all parts of India for conservation of forests, eco-systems, wild-life, waste lands, rehabilitations of tribals and creation of public awareness on all environmental problems. They also actively participate in specific development activities for protection and promotion of environment.

The local government institutions like Metropolitan City Corporations in big cities, Municipal Organizations in other cities and also different tiers of local government organizations in India play very effective roles in the management of environment within their respective areas.

They work to improve urban facilities provide basic amenities and also work to improve the state of health and education.

The private sector in India is also becoming concerned regarding environmental issues. The industrialists and other organizations related to activities which affect the environment, are becoming increasingly responsive to existing laws, regulations, standards and norms of environment.

Environmental management in **Bangladesh** started in the mid 70s,in a very rudimentary manner. However, over the last few decades the concern for environmental protection has undergone substantial change. By now, the Constitution, Principle on State Policy and the policy of the new democratic government reflect appropriate concern for protection of the environment. At the top of administrative arrangement there is the Ministry of Environment and Forest which was created in 1989 to look after the overall problems of environment and ecology and related problems in all. Concurrently the capability of the Department of Environment has also been expanded so that it can effectively address relevant problems at the field levels. The Department of Forest looks after the protection, conservation and development of forests, national parks, wildlife and wetlands. The Planning Commission plays a vital role in integrating environmental issues in the development of all the sectors. Other important Ministries/ Division/ Agencies related to major environmental issues are Ministry of Agriculture, Water Resources, Land, Fisheries and Livestocks, Industries, Health, Labour and Manpower, Energy and Mineral Resources etc.

In Bangladesh environmental laws are related basically to three important aspects i.e. conservation of natural resources, protection of environmental health, control of environmental pollution and promotion of the environment. Some important laws are:

* The Environment Pollution Control Ordinance, 1977.
* Pesticide Ordinance of 1971 and 1983 and Pesticide Rules, 1985.
* Factories Act, 1965 and Factory Rules, 1979.
* Motor vehicles Ordinance, 1939 (modified upto 1983)
* Forest Act, 1927 (amended in 1989)
* Pourashava Ordinance, 1977.
* Wildlife (Preservation) Order, 1973
* Bangladesh Pure Food Ordinance, 1953.

In addition to the above the government has adopted the Environmental Policy in 1991 with

the objective of protecting the environment, ecology and resource base, ensuring environmentally sustainable development and involving the people in all environmental activities. The government has also formulated a draft National Environmental Management Action Plan (NEMAP) which identifies the environmental problems and formulates specific action plan to address them. The government has also formulated National Conservation Strategy (NCS) to ensure sustainable management and utilization of all natural resources and protection of fragile eco-systems. A new umbrella legislation namely Environment Protect Act 1994 is expected to be adopted soon. This law will provide the legal framework for implementation of Environmental Impact Assessments (EIAs) and Environmental Quality Standards (EQS). The government has formulated Forestry Master Plan, banned logging in high forests, prohibited use of fuel wood for brick burning, stopped export of all types of wild life including frogs. A ban has also been imposed on killing of all types of wildlife. The government is successfully implementing a massive afforestation program which has already turned into a social movement.

The NGOs in Bangladesh are also playing an important role in different poverty alleviation and environmental activities. NGOs are implementing development schemes in agriculture, forestry, agro-forestry, fisheries, population control, rural works programme, health and nutrition, water and sanitation, non-agricultural income and employment generation activities and rural credit for poverty alleviation with commendable success. The NGOs with their extensive grass-roots experience, proven efficiency and administrative and financial flexibility are achieving success in organizing the rural poor and improving the quality of life thorough multi-sectoral development activities. the NGOs by now have extended their activities to about 335 thanas out of 460 thanas and have covered about 15.2% of the total target group households of which most are rural based.

Sri Lanka has by now a well developed mechanism for environmental management. The Central Environmental Authority (CEA) was established in 1981, under the National Environmental Act of 1980. The CEA is a policy making, coordinating body to formulate correct perspectives on environmental issues. Recently the CEA has been empowered with stringent legal provisions, to control environmental pollution, and mitigate the adverse impacts of development activities by introducing a legally binding Environmental Impact Assessment (EIA) procedure. Under the provision in the National Environment Act, the National Environment Council was established, as an advising body to the CEA.

The National Environmental Act has provided for the establishment of District Environment Agencies (DEAs), in each Administrative District. A National Environment Steering

Committee (NESC) was also established at the National level. The linkages between environment and development are being coordinated, mainly through NESC, by conflict resolution.

Sri Lanka has also a number of laws, acts, regulations, and bye- laws, forming together, an Occupational Safety and Health Risk Legislation. These include -

* Colombo Municipal Council Water Works Ordination No.18 of 1907
* Controls of Pesticides Act No. 33 of 1980
* Malathion Control Act No. 22 of 1985
* Poisons, Opium and Dangerous Drugs Ordinance No. 17 of 1929
* Irrigation Ordinance No. 32 of 1946
* Water Resources Board Act No. 29 of 1964
* Agrarian Services Act No. 58 of 1979
* Fisheries Ordinance No. 24 of 1940
* Coast Conservation Act No. 57 of 1981
* Mines and Minerals Law No. 4 of 1973
* Electricity Act No. 19 of 1950.

Sri Lank also prepared a National Environmental Action plan (1992-96) to update and integrate environmental considerations in different sectors such as land, water, forest, bio-diversity, urbanisation, industry, energy, minerals, policy, institutions, education and culture. In 1993 Sri Lanka also formulated detailed guide lines for EIA. Sri Lanka has also conducted a programme on environmental audit for Consultants and Industry, in 1993 aimed to develop expertise and efficiency in sustainable and cost effective environmental management. In 1994 Environment Protection Licensing Scheme was introduced to charge the polluters according to the pollution load and discharge. The government has initiated a scheme to provide 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 industries.

In Sri Lanka the NGOs play a vital role, not only in mobilizing people to participate in 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 Singhana

Forests, 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 plat 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 the environment 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 NGOs have now actively involved in the implementation of environment projects, in close cooperation with the CEA, and with financial assistance from donor agencies.

In **Pakistan**, government and people's attention was concentrated to greater extent on environmental issues after the Stockholm U.N. conference on Human Environment in 1972. During the 12 years period between 1972 and 1984 there was marked change in environmental awareness. A new Environment and Urban Affairs Division was created in 1975 in the Government.

As the environmental problems aggravated and become visible to every one the expression of concern for these started mounting at every level of Pakistani people. In 1983 Environmental protection Ordinance was enacted. Under the same ordinance a high powered Environmental Protection Agency (EPA) was created. Major task before this agency was preparation of National Environmental Policy and framing of National Environmental Quality Standards. The Agency was also given the task of administration of Environmental Protection Ordinance of Pakistan and coordination of environmental policies and programmes nationally and internationally.

Environmental aspects are now incorporated in economic planning. During the second half of 7th plan government and environmental international and local NGOs expressed their commitments to have a National Conservation Strategy. This was formulated in March 1992. A Cabinet committee was set up for implementation of environmental action programmes. As a consequence, control standards for municipal and industrial emission effluent and for vehicles exhaust/noise were approved.

The NCS unit of the Urban Affairs Division, and Environment Section of Planning and Development Division, for the sustainable development of the country, are responsible for expeditious projects formulation as per NCS approved Action Plan. The capacity of Apex Implementation Unit in Ministry of Environment, as well as of Planning and Development units in the Federal Ministries that bear directly on the environment need to be enhanced. EPAs capabilities which are concerned with environmentally fragile regions need to be developed. Activities of NGOs, trade and industry organisations and rural communities regarding environment should be strengthened through implementation of projects and schemes on environmental conservation for which funds have been provided for the approved projects.

Nepal's development planning began in 1956. Environmental elements were sectorally pursued in the course of seeking economic return during the First Four Plans; watershed development emerged as the major developmental theme in the Fifth Plan and the concept of ecological balance was advanced in the Sixth Plan. During the Seventh Plan environment was underlined as the concern for National Development; and major formulations such as National Conservation Strategy for Nepal, Master Plan for the Forestry Sector and EIA Guidelines for major sectors were the notable exercises.

In the Eighth Plan (1992-97) enunciation and formulation of environmental elements are internalised as essential constituent in relevant sectors and environment has been identified as a major separate sector. Nepal Environmental Policy and Action Plan has worked out policy areas and relevant programme with reference to the implementing institutions towards developing correlative exercises between policy, programme and implementational practices.

The Environment Protection Council created in 1992 under the Prime Minister, and its secretariat developing focal points with relevant ministries await endorsement by the Parliament for the authoritative power it requires to exercise. The importance of monitoring and evaluation has been often talked about; there is the provision of Central Monitoring and Evaluation Division; as such mechanisms in practice are to be followed to achieve the objectives it seeks for.

A large number of other organizations including the Parliamentary Committee on Natural Resources and Environment, designated focal points in ten different ministries, a large number of private organization and NGOs also contribute significantly to the management of the environment in the Nepal.

Iran's concern for the environment dates back to 1956 when a legislation was enacted to protect bio-diversity of plans and animals. In 1963, the Organization for Control of Hunting and Fishing was established. After the 1972 Stockholm Conference, the Organization was restructured and became the Department of Environment of Iran. After the Islamic Revolution in 1979, the Department was empowered through Article 50 of the Constitution to make environmental conservation a public duty. Thus, all activities which cause pollution or damages to the environment are forbidden.

In 1986 the Department was reshaped and expanded to conduct research on all environmental matters, formulate laws, regulations and standards in environmental matters, promote environmental education, ensure enforcement of all environmental rules and regulations.

There is an Environmental High Council and three coordinating councils to formulate environmental policies and strategies and ensure coordination in their implementation.

The important environmental laws in Iran are:

* The Environmental Protection and Enhancement Act of 1974 and regulation for EPEA 1975.
* The Clean Air Act, 1975
* The Clean Water Act, 1984.

Besides, there are guidelines for urban sanitation and control of air pollution and noise pollution. The First Development Plan (1983-1993) included several action plans for environmental conservation. In addition to the Department of Environment, which is the focal authority for environmental management, some other ministries and organization have specific plans and programmes for environmental improvement. Among these, Forest and Range Organization, Ministry of Housing and Urban Planning, Meteorological Organization, Ministry of Agriculture, Ministry of Industries, Ministry of Petroleum, Municipalities and the Ministry of Energy perform vital functions.

The central goal of development and modernisation in **Bhutan** is guided by "gross national happiness" rather than by the "gross national product". It has therefore, refused to mortgage its natural resources base in an unsustainable manner to accept foreign aid in large quantities and to pay off outstanding loans. Resource conservation has always been a top priority in Bhutan. The institutional frame work for the management of the environment includes the National Environment Commission, the Forestry Service Division, the Royal Society for the Protection of Nature, the Bhutan Trust Fund for Environmental Conservation. The National

Environmental Commission headed by a Deputy Minister for Environment is responsible for formulating the national environmental strategy and institutionalizing Environmental Impact Assessment (EIA) for development activities. The Forestry Service Division has a Nature Conservation Section, responsible for protection of wildlife and protected areas and reserves. The Royal Society for the Protection of Nature is an NGO which plays an important role in creating public awareness on environmental issues. The Bhutan Trust Fund for Environmental Conservation provides funds for Bhutans's conservation efforts.

Important laws and plans in the environment sector are:

* The Bhutan Forest Act, 1969
* The National Forest Policy, 1985
* The Forest and Nature Conservation Act, 1993
* The Master Plan for Forestry Development, 1991
* Revised Protected Area System, 1993

The Royal Government of Bhutan is making all out efforts to ensure proper protection and management of its environment by involving the people directly in all relevant activities.

In **Maldives** environmental management in managed by the Environment Division in the Ministry of Planning, Human Resources and Environment. It has drawn a National Environment Action Plan to ensure sustainable development and implement appropriate policies for the protection and management of the environment as a matter of priority. Maldives has also drawn sectoral policies for fresh water resources and waste management. EIA is needed for all development projects. The government is controlling coral mining to reduce the damaging environmental impact. This has been completely banned in all areas where alternative supply of prefabricated building blocks are available. No coral is allowed to be used in construction of any government building. The government has also formulated policies, rules and regulations for management of fisheries and tourism.

The Environmental Protection and Preservation Act was passed in 1993 with wide powers of environmental regulations and enforcement. The Act covers transboundary movement of hazardous waste and the disposal of waste within the country. It empowers the Ministry to draft guidelines for the protection of the environment and makes it responsible for the identification and designation of protected areas and natural reserves. In addition, the Ministry is designated as the responsible body for formulating policies, rules and regulations regarding the environment. Recently the government has also established an Environmental Research Unit within Environment Division.

CHAPTER-19

COMMUNICATION FOR THE ENVIRONMENT: EDUCATION AND AWARENESS

Introduction

In the overall policy and strategy for environmental management creating awareness, improving and expanding the level of environmental education is one of the key issues. Problems of environmental protection, resource conservation and sustainable development can be well addressed only through active participation of all citizens. Only a conscious and educated population can effectively contribute in this process. Environmental awareness and education among the people is a pre- requisite for their meaningful involvement in the process of sustainable development and environmental protection. 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.

> 'There is still considerable lack of awareness of the interrelated nature of all human activities, and the environment, due to inaccurate or insufficient information. 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.'

Regarding re-orienting education towards sustainable development, 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 sustainablity 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 generation. Today's young people, as the leaders of tomorrow, bear special obligations to their natural heritage.'

Definition and implications of environmental education

Environmental education is regarded as a permanent process in which individual and the community gain awareness of their environment and acquire the knowledge, values, skills, experiences, and also the determination which will enable them to act individually and collectively to solve present and future environmental problems. Environmental education should consider the environment in its totality, it should be a continuous life long process, be interdisciplinary, should examine relevant issues from local, national, regional and global perspectives, consider present as well as potential situations, and should aim at real problem solving.

Environmental education can be broadly classified as formal means and methods of education and informal methods and media for education and motivation. Formal education in environment is imparted through inclusion of relevant issues in the curricula at different levels of education and training. Informal education is disseminated through different media including newspapers and periodicals, radio, TV, videos, films dramas, pictorial calendars, posters, seminars and workshops, public speeches etc. Action oriented programmes on environmental issues can also play a vital role in actually teaching the people regarding environmental protection, improvement and resource conservation. Environmental education should be very specific to different target groups like farmers, industrial workers, children, students, teachers, women, social and religious groups, policy planners and implementors, political organisations, entrepreneurs, industrialists and businessmen, owners of motor vehicle, and NGOs etc.

Environmental Awareness : Its implications

Environmental awareness basically means and includes the following:

* understanding what the environment is and the dire need to preserve and protect it;
* caring for all those materials and concepts which constitute the environment;
* abstaining from activities which adversely affect the environment;
* taking positive steps to protect, preserve and nurse the environment.

Environmental awareness is essential for the following basic objectives:

* to protect nature and natural resource bases;
* to ensure a process of sustainable development;

* to initiate action to control environmental pollution and resource depletion.
* to improve the quality of life in a harmonious manner with nature;

Environmental awareness must begin with a knowledge and concern for the environmental issues. Environmental issues may appear in different shapes and magnitude in different geographical boundaries and socio-economic conditions. However, there are issues which are universal in nature, while some problems are specific to different countries and locations. Environmental awareness relates to all such local, national, regional and global problems.

Environmental Issues as the subject of Education and Awareness

In the context of SACEP countries, the major environmental issues can be identified as follows:

a) Socio-economic problems: These include:

* poverty
* population
* illiteracy
* health
* sanitation
* housing
* water supply
* problems arising out of development activities in the field of agriculture (such as unplanned use of agro-chemicals, burning of agricultural wastes).
* Industry (pollution by different industries),
* urbanization (growth of slums, solid wastes),
* deforestation
* soil erosion
* soil nutrient depletion
* indiscriminate use of agro-chemicals;

b) Natural calamities and problems like:

* floods
* tidal surges
* cyclones

* drought
* salinity
* deseritification etc;

c) Regional and international issues like

* depletion of wetlands
* destruction of watersheds,
* pollution of common rivers and shared waters;
* pollution in the bay of Bengal and the coastal areas;
* climate changes
* greenhouse affect
* depletion of ozone layer
* sea level rise etc.

Role of Awareness in Environmental Management.

Environment concerns all and must be taken care of by all concerned. Protection of the environment, conservation of resources and initiatives for sustainable development demand serious and committed concern, knowledge and skills on the part of people as a whole and those engaged in the management of resources and implementation of development plans and programmes. Sustainable development requires a change in values and attitudes towards environment and development. This makes it essential to have a new assessment of existing needs and proper appreciation of future problems and potentials.

Adequate awareness makes a person acquainted with the surrounding environment, makes him sensible, reasonable, conscious and judicious. It improves his capability in dealing with problems and bringing out new, dynamic and workable solutions. Improved health, lower birth' rate and better nutrition can be achieved through the attainment of greater literacy rates, improvement of social and civic responsibility. A well informed, educated and motivated person is better equipped to improve his/her socio-economic condition and environment. Such a person can also be a source of inspiration and action oriented attitude towards improving the surrounding environment. Presently, most people base their understanding of environment and development issues on traditional knowledge or information provided by a conventional education system or static social process. Many, thus, remain ignorant about ways in which they could improve traditional behavior, practices and contribute towards improving the environment and better use of resources.

Environmental awareness is not something confined within class rooms, laboratories, libraries or seminar rooms. Nor it is the concern of only any particular type or class of people including the students, scholars or professionals. It involves everything and everybody and all human knowledge and activities necessary to maintain a happy, prosperous and harmonised life in this planet. The fundamental goal of environmental education is to equip people to think in terms of a future which is totally commensurate with the idea of an environmentally safe and sustainable process of development.

Environmental awareness, if properly understood, constitutes a comprehensive lifelong understanding, and responses to changes in a dynamic world. It prepares the individual for life through an appreciation of the major problems of the contemporary world, and the provision of skills and attributes needed to play a productive role towards improving life and protecting environment with due regard given to social and ethical values. By adopting a holistic approach, the rooted in a broad interdisciplinary base, it recreates an overall perspective which acknowledges the fact that natural environment and man-made environment are profoundly interdependent.

Creating awareness regarding the environment transforming present attitudes which suffer from ignorance and inertia and introducing practices for sustainable development would need primarily the following:

a) Education and Motivation
b) Action Programs

Objectives of Education and Motivation Program

Education and Motivation programs should have the following objectives:

a) to create mass awareness about the need for the protection of the environment, conservation of resources bases, and sustainable use of resources;
b) motivate the people to refrain from activities which destroy or deplete nature and natural resources;
c) to encourage people to help the protection and nourishment of nature, its potentials, flora and fauna;
d) to ensure environmentally sound and sustainable development in all fields including agriculture, industry, water resources etc.;
e) to ensure better utilization and development of human resource;

f) to increase and conserve scarce natural resources by activities such as, tree plantation, fish farming, livestock rearing, poultry farming, agro-forestry activities;

g) to educate and develop the poorer section of the people;

h) to make the womenfolk, specially poorer among them; environment conscious;

i) to integrate environment in all development issues;

Methods

A programme to create mass awareness, transform existing attitudes and initiate practices for sustainable development may be persuaded through the use of both:

a) formal means and methods of education and media

b) informal methods of education and motivation.

Formal Education

Formal education includes- i) environmental education to those undergoing formal education (today's students, tomorrow's planners, designers and policy makers). This is the most effective long-term action. It is necessary to work out details and prepare materials (both references and text) for different levels (primary,secondary and tertiary) and different disciplines (engineering,medicine,commerce,physical sciences,social sciences, etc.) and pursue their adoption. (ii) The increased awareness of the importance of environmental education has created a need for effective new training programmes for teachers at both the pre-service and in service levels. Moreover when teaching integrated environmental education programmes,it is often necessary to make them familiar with the new perspective and adjust them with activity based programmes which call for more initiative.

Non-formal Education

In many countries of Asia,campaigns for the promotion of pure literacy have given way to functional literacy programmes based on real life situation. In the process,environmental education has become an essential component in nonformal literacy programmes. Actually the main objectives of nonformal education are to impart knowledge about the human environment, to present a background environment for monitoring useful materials concerning natural resource and environmental management.

The environmental nonformal education may be imparted through two broad ways -(a) Institution or organization based activities, and (b) Centrally organized mass propaganda method.

In the SACEP countries where the literacy rate is very low and the resources are limited, centrally organized mass media appears to be a really effective and fruitful method for creating environmental awareness and improving the quality of related education.

Use of Communication Media

The following communication media can be extensively used to create mass awareness among the people in the SACEP region:

Various **radio** programmes on different environmental themes can be produced and broadcasted. These may include motivational radio spots,radio talks,radio talks,radio question and answer sessions and dramas.

Television programs like **TV** spots, Quiz programmes,Magazine programmes and Teledramas can be produced and telecasted.

Motivational video **films** can be produced for distribution and exhibition at different places and in cinema halls in each country of the region.

Pictorial calendars containing massages on environmental problems,resource conservation and sustainable resource use can be printed and distributed.

Posters on different themes can also be printed and distributed. Moreover,various slogans on environment can be developed and printed on vehicles,rickshaws,umbrellas, match boxes,tax and bill books,etc.

Newspapers and periodicals play a vital role in channelizing various messages to the people. At present there are a large number of dailies, weeklies and other periodicals being published in each the country of the region. As such environmental messages published in the form of advertisements could reach a large number of people. Besides,the services of eminent environmental journalists could be utilized for writing features on environmental issues to be published regularly in newspapers.

Seminars and workshops can be arranged to motivate and involve people in environmental protection and sustainable resource use activities.The opinion of the people and their experience can thus be shared for initiating sustainable activities at grassroots level.

Observance of National Campaigns and Organising Village Level Competitions

Awareness raising and motivation is also possible through observance of national campaigns and organising village level competitions. Preservation of the environmental resource bases and their sustainable use must be turned into a People's movement through nation-wide campaigns like Family Planning,Tree Plantation etc.All conventional and nonconventional means and media need to be organized and utilised to achieve the goals of environmental protection,conservation and sustainable development.

The political leaders,the intellectuals,the local elite, religious leaders, the teachers, local government organaisation leaders can contribute significantly in motivating the people and ensuring inclusion of conservation and sustainable development strategies into local level planning schemes.

Once the concept of conservation and sustainable management of resources is explained to the people and understood by the them through national campaigns,village level competition can be arranged to encourage wide spread implementation of these ideas. Awards at national and all other levels including the villages can be given for commendable contributions in the areas of sustainable management of resources and environmental improvement.

Action Oriented Programmes

People are likely to forget what they hear and learn unless these are put to sustainable practices and action programmes.Any initiative to create mass awareness, change exiting negative attitudes and encourage sustainable development must therefore also include components of action oriented programmes.In the context SACEP countries the following major areas of activities can be identified;

a) Afforestation/Social forestry
b) Seedlings/sapling farms
c) Sanitary latrine : installation and distribution
d) Tubewells: installation and distribution
e) Display/distribution of improved stoves

f) Digging of ponds and water areas

g) Promoting Agro-based and environment friendly industries

h) Promoting income generation activities in the non- agricultural sector

i) Bio-gas plants

Target Group wise Action

In creating public awareness,changing current attitudes and encouraging sustainable development,certain target groups must be identified for specific orientation and motivation. In the SACEP region the following target groups can easily be identified:

a) **Farmers**

A large portion of the people in SACEP region live in the villages and depend on agriculture or related activities for their livelihood. The major portion of the environmental resources in this region are also located in rural areas.Thus the rural people and the farmers must be made specific targets in imparting environmental education and creation awareness related to important environmental issues in the field of agriculture and other rural resources.

b) **Children,Students and Teachers**

The teachers and students are organized groups and it is easier to motivate them.The children of today are the future citizens.Once they are educated regarding environmental problems and are conscious about the steps to be taken for environmental protection and management,this is going to have a sustained impact on the process of overall environmental management and improvement.

c) **Women**

In all SACEP countries women constitute about half of the total population.Improvement of the level of understanding, education and consciousness among women will bring a long term,desired and revolutionary change in the field of environmental improvement.

d) **Social and Religious Groups**

Different social and religious groups can play a vital role in creating public awareness regarding environmental issues. The Imams of mosques and the priests of churches and temples are respected people and can substantially contribute towards popularization of the concepts of environmental improvement. To make such efforts successful it will be necessary to train them in a proper and adequate manner.

Implementation of Programmes

The process of creating public awareness on environmental matters is a broad based and long term task.As such all available agencies and initiatives must be enlisted to make it a success. Implementation of such a gigantic task should be taken up by all-

a) Government organizations
b) Private Organizations
c) NGOs

All Ministries/Departments/Agencies of the governments can take up specific programmes to draw the attention of the people regarding important areas of environmental concern within their respective jurisdiction. The Ministries of Education, Information, Agriculture, Industry, Youth, Social Welfare, Womens Affair,Law etc. have very important roles to play in this respect. The Ministries of Environment and Forest/Divisions in charge of environment can play a vital role in initiating a major and nationwide action programme in this respect.It can also coordinate and monitor such programmes undertaken by other government agencies.

The private organizations like educational institutions,clubs,etc can also play a very useful role in educating the people in related matters.

The NGOs are fast emerging as a very effective agency for development along with government in many SACEP countries. By this time some of the NGOs have created a very laudable record of development activities in many environment related field such as forestry,fishery,education,mass communication,organizing the poor and vulnerable groups for income generating activities, poverty alleviation programmes, family planning, health and programmes etc. Since the NGOs have the required freedom in selecting their own areas of activity and target groups and can ensure target-group participation at all levels the programmes show better results,specially in environmental activities.

Education Attainments of the Population of the Region

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 9% in Pakistan, to 70% in Bangladesh. 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 counties 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

No Schooling:	Completed 1st:	Entered 2nd:	Post 2nd:	Adult Lit:	Mean Yrs
Countries %	Level %	Level %	%	25+% 1990	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.ofKorea 15	28	45	12	96	8.8

Source:Col. 1-4 UNESCO Year Book 1991; Col. 5&6 UNDP, Human Dev.Indication 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 counties 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 counties. 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.

Table 2: Media Access Index in Relation to Developed Countries (North = 100) 1988/89

Countries	Radios	Daily Newspaper Circulation	Telephone
Afghanistan	10	-	-
Bangladesh	4	3	-
Bhutan	1	-	-
India	8	8	1
Maldives	11	2	3
Nepal	3	-	-
Pakistan	9	19	2
Sri Lanks	19	10	2
For comparison			
Rep. of Korea	100	-	64

Source: UNDP, Human Development Indicat, 1991

Status of Environmental Education and Awareness in the SACEP Region

A regional review of environmental education and awareness reveals that programs have been more or less designed to suit the specific needs of different countries more or less at various levels. At the primary school level, environmental education involves the understanding of the natural environment.

The introduction of Environmental Education in the primary school curriculum of Bangladesh late in the 70's and early 80's was a healthy development. Similarly, at the lower secondary and secondary levels also issues relating to the environment were given a prominent place in the course of General Science (for grades 8) and Biological Science (for grades 10). Teacher's Guides have been prepared and published for these subjects for primary, lower secondary and secondary stages by the National Curriculum and Textbook Board. Also, for the primary stage the elements of Environmental studies have been incorporated in the curriculum of the Primary Training Institutes in the country which organize both preservice and in service courses for the primary school teachers. However, the use of proper aids in schools is lacking and in view of the poor physical condition of most of the primary schools in the country, the general quality of teaching is less than satisfactory.

At the secondary school level, most countries have introduced a variety of environmental themes. Bangladesh has introduced population education which covers the interrelationship between population, the natural environment, pollution and society.

At the secondary stage, the curriculum of General Science emphasizes activity- based method of teaching with practical experiments and demonstrations to be done by both the pupils and the teachers.

The curriculum of General Science of the secondary stage which was prepared in the late 1970's has already become rather out dated. The environmental concerns have become more pronounced in the meantime. Such issues as the environmental pollution, global warning, Ozone layer depletion and the danger of extinction of certain plant and animal species have come to the forefront in recent years. The curriculum now needs to be revised and the teacher training programmes both preservice and inservice modified accordingly.

At the higher levels of education, the programmes of teaching environmental issues in the various universities is rather isolated and disjointed. The programmes of research in this area are also severely underfunded. There is a need to strengthen the programme of studies in the environmental sciences in all the universities of the country, and especially the research activities, to generate knowledge about environmental conditions and ways to solve the problems that are arising in this sphere. The research activities of the academic level should be directed to identify the scope of the subject matters, on the one hand and to identify the most effective method of teaching environmental subjects, on the other. Often an inter disciplinary approach would be most effective in these research efforts. Bangladesh also introduced a pilot project entitled "Muktangan Siksha" or open air education in 1976, mainly to foster an understanding of nature.

India initiated formal environmental education in 1979, but before that, many schools had incorporated environmental concepts such as the relationships between humans, animals and nature into their curricula. In some of the programmes, health, sanitation and nutrition were also covered.

The National Policy on Education (1986) stresses the paramount need to create consciousness about the environment. This must permeate all ages and sections of the society, beginning with the child. The Policy gives unqualified priority to universalization of elementary education and substantial improvement in the quality of education. Detailed school mapping exercises have been planned under a master plan for universal provision of facilities for environmental education. The National Council of Education Research and Training (NCERT) has been assigned the responsibility of developing model syllabi and instructional packages in ten core curricular areas, of which protection of environment is one.

The National Council of Education, Research and Training (NCERT) has integrated many environmental dimensions into its curricula. Science exhibitions covering environmental topics and audiovisuals on environment have also been introduced.

In **India**, NCERT began in - service training for teachers in 1978. A variety of masters and Ph.D. level programmes have also been developed at various universities, technology institutes and the Indian Institute of Science. Many universities offer Environmental Science courses (for instance, at Jawaharlal Nehru University, North Eastern Hill University, Madars University, Pondicherry University etc.) whereas engineering colleges concentrate on environmental engineering. In addition, many universities participate in coordinated environmental research programmes sponsored by the Ministry of Environment and Forests.

The Ministry of Human Resource Development (MHRD) has taken a major initiative in the field of environmental education through the launching of the Environment Orientation to School Education scheme. Under this scheme special cells have been created in the state departments of education. Support is also extended to NGOs to facilitate the development of locale-specific programmes and materials.

The Ministry of Environment and Forests supports two centres of excellence in the area of environmental education. These are the Centre for Environment Education. Ahmedabad, and the CPR Environmental Education Centre, Madras. The Centre for Environment Education, Ahmedabad, is involved in developing innovative programmes and materials to increase awareness about the environment.

The National Museum of Natural History (NMNH), New Delhi, is a unique facility which provides people an opportunity to acquire a direct understanding of the world of nature, the inter-relationships among plants, animals, and the environment, and the need to develop a new approach and ethic towards the natural environment. NMNH also has centres at Mysore, Bhubaneshwar and Bhopal.

The Ministry of Environment and Forests set up the Environmental Information System (ENVIS) in 1982 as a decentralized system using a network of databases to ensure integration of national efforts in collecting information related to environment.ENVIS has ten centres working in diverse areas such as pollution control, coastal ecology, environmentally sound and appropriate technology etc. It has a documentation service and processes queries from national and international users. A quarterly abstracting journal Paryavaran Abstracts is published after scanning nearly five hundred scientific journals. ENVIS maintains a close liaison with other

national information systems like National Information System on Science and Technology (NISSAT) and Biotechnology Information System (BTIS).

The National Environmental Awareness Campaign (NEAC), which began in 1986, is a major programme of the Ministry of Environment and Forests. The programme seeks to increase environmental awareness through the involvement of governmental and non-governmental organizations. Activities under the NEAC include seminars, workshops, rallies, teacher training, eco-clubs, environmental camps etc.

NGOs in India have played a vital role in raising awareness about the issues related to environment and development and in mobilizing people to take action. They have employed a variety of techniques and media. The Kerala Sastra Sahitya Parishat, which was the catalytic agency involved in mobilizing public opinion against the Silent Valley hydroelectric project, uses traditional and folk media to communicate its messages. The Centre for Science and Environment (CSE), New Delhi, has brought out three widely circulated volumes on the state of India's environment, in addition to several other publications. CSE has also played a key role in bringing in the South perspective in international discussions of environment and development issues. Eklavya, Bhopal, develops innovative and relevant school programs and material. The Assam Science Society which has a membership of professionals and students, attempts to enhance science education.

The Narmada Bachao Andolan has brought together scattered voices of protest against the damming of the river Narmada and has raised awareness not only in the affected area and in the rest of India, but also among the international community. The Vivekanand Kendra, Tamil Nadu, trains hundreds of workers in the fields of health, education and development. A major focus of its activities is in Arunachal pradesh where it runs 14 residential schools for tribal children. The People's Commission on Environment and Development, New Delhi, is a forum created to bring together and articulate citizens' concerns to put before the UNCED. Kalpavrikwsh, New Delhi, organizes awareness programs and carries out campaigns on specific issues by lobbying, holding demonstrations and fighting legal cases.

The Department of Education has incorporated environmental studies into national school curriculum, and on Social Forestry Day, all shcool children plant a seedling. At the country's only undergraduate institution, an environmental studies program is being developed and will soon be implemented. The Bhutan Forestry Institute, which trains **Bhutan**'s foresters, has revised its curriculum to include wildlife protection and protected area management, and the Natural Resources Training Institute emphasizes the sustainable use of the country's natural

resources. Community awareness, education, and participation are a crucial part of Bhutan's conservation policies.

In **Nepal** the extension program focusing on resource management, has essentially the leverage of two way communications towards raising level of awareness promoting newly acquired knowledge, and to encourage increased participation in land use practices and conservation farming. Various departments exercised this program to gain their respective sectoral objectives and the users groups have emerged for maximizing appropriate use of resources, regulating organized setting, as well as for managemental undertakings of the resources. There are various avenues developed for environmental communication; and consultative get-together with experts, policy makers, politicians and social workers are bearing effective reciprocation towards building up opinions and receiving valuable interactions. Following the NCS Implementation Project, NGOs have been quite active in Environmental Management Program in varied geographical belt to orient the thoughts of the rural community in protected areas, municipality as well as in considering urbanization issues. Environmental camp for Conservation or awareness have become quite popular; activities of conservation groups are held in good esteem; and women' groups/organisations are getting progressively active with emerging leadership. The program of "Street Theatre" seeks to revive the traditional practice of activating effective means of revolutionising the ideas of the people for essential adaptations, and encourages various organisations to make respective inputs.

The newsletters coming out have become effective in propagating the knowledge of investigational activities going on in the environmental sphere. In someway it has become catalytic media in building up advanced opinions at various levels and sectors.

Iran has also introduced environmental curricula at various levels of education. The TV, radio and the print media is also increasing their coverage of environmental issues. Moreover Iran has undertaken a number of specific projects to improve the level of environmental education awareness and research. These projects relate to establishment of new libraries and expansion or existing ones; setting up environmental documentary centres and data banks on environment; publishing environmental journals, bulletins, books, regional monographs, pamphlets, brochures etc; purchasing, translating and producing video/films on environmental education; organizing short and long term courses for the departmental personnel. Work on at least 15 research projects is also going on important environmental issues, specially those of major public concern including air and water pollution, garbage and waste disposal, recycling of wastes and garbage etc.

Sri Lanka has the highest rate of adult literacy among the SACEP countries. It also has better coverage of radio and printed media which helps environmental education and awareness.

Sri Lanka has developed a general system or public awareness with the people actively participating in environmental conservation and improvement activities. This type of field based education becomes a way of life with the people resulting in lifelong practice of what has been learnt.

In **Bhutan** due to a high rate of population living in the villages and a low literacy rate the state of environmental education and awareness is at low key. The press and media coverage in this field also desires much to be done.

In **Maldives** also has a low literacy and urbanization rate. The network of radio, TV, and the print media has not yet been spread in an adequate manner to make a significant impact on the level of environmental education and awareness.

In **Pakistan** due to low rate of literacy, poverty, lack of sources of information both in formal education and informal means and methods of education and creation of awareness, level of environmental education and public awareness regarding environmental issues is very low. Now this level is showing an improvement due to inclusion of environmental curricula at different levels and interests shown by scientists, researchers, planners and the NGOs in environmental issues. The media, including the radio and TV is increasingly projecting environmental issues in a manner which can easily be understood and followed by the people. Attractive modes of publicity are being adopted for this purpose. The print media including the dailies and periodicals are also increasing coverage of environmental problems and highliting the responsibility of the people for their mitigation. The NGOs are also doing a better job at the grass roots level in some basic areas like family planning, health, water supply, sanitation, plantation etc.

The past decade has also witnessed the rapid growth of environmental awareness partly due to such diverse phenomena as extreme floods, droughts, cyclones, and the fear of possible drastic effects from climatic change, including possible sea level rise. The regions media and some of the more active NGO's such as the Indian Environment Society have also played an important role. It has become particularly clear that mass media such as radio, television and press constitute a very effective means of reaching wide and varied audience even though these are outside the mainstream of conventional education. Public awareness and participation programme can help to achieve a change in attitude which can support environmental

conservation or prevent damage. Both public awareness and public participation support education and training.

Again, the region's countries have been quick to develop some unique programmes aimed at creating public awareness. Bangladesh has initiated extensive programmes at the local level. "Mati O Manush" (Man and the soil) a very popular programme of Bangladesh Television is contributing towards understanding of nature and best utilisation of its potentials. National dailies in Bangladesh publish regular weekly features on environment. India fosters such activities as development camps which reach a large number of school children. In general, the high level of public environmental awareness is mainly due to a committed press, the media and non-governmental organizations.

CHAPTER-20

REGIONAL, SUB-REGIONAL AND GLOBAL RESPONSES

Introduction

Environmental problems do not confine them within any geographical boundary. What may start as a local problem would ultimately transcend into national, regional and global horizons. No single nation can effectively control, manage and conserve the total aspect of environment without regional, sub-regional and in the final perspective, global initiatives and coordinated actions. Environment, as it is understood today embraces the entire human development process. Economic, social and political issues are all finally turned into human development issues related to the environment. It is therefore essential that regional, sub-regional and international efforts and resources are pooled together to provide a strong foundation for solution of environmental problems. Today all development activities are closely linked with environmental considerations. Developing countries in the South Asia Region unfortunately suffer from scarcity of both developmental and environmental resources. So a these countries have no option but to seek and ensure collaboration from regional, sub-regional and global and global institutions and agencies.

Need for Regional, Sub Regional and Global Responses

Environmental pollution emanating from one politicogeographic location will be carried by wind and water across national boundaries. Therefore, even though the agents causing the ecological perturbation, whether anthropological or natural, may be localized in one particular nation, the environmental impact in varying degree will have local, national, regional and global implications. Incase of major environmental disasters like floods, cyclones earthquakes, etc. no advance limitation measure is possible, but post-disaster amelioration of human suffering usually brings all mankind together. But repeated incidence of environmental problems, natural calamities and other issues like sea level rise, climate change and different types of regional issues has made it essential that a sustainable approach to solution of these problems are sought in regional, sub-regional and global responses.

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 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 acceptablity of the legitimacy and urgency of these concerns and 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 development 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 analyses relevant input from competent non-government 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.

(h) To consider, at an appropriate time, the results of the survey to be conducted expeditiously be 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 thought 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.

It is mentioned in the context of global responses that all the SACEP countries participated in the UNCED at Rio and some of the countries including India Pakistan, Sri Lanka, Bangladesh and Nepal played vital role on behalf or the developing countries in the UNCED preparatory process and in formulating the Agenda 21.

Afghanistan, Bangladesh, Bhutan, Pakistan, Iran, Nepal and Sir Lanka signed the Climate Change Conventions and the Biodiversity Convention in 1992. Most of these countries have also signed/ ratified other important conventions such as the Bonn convention on conservation of Migratory species of Wild Aniwals, the Convention on International Trade on Endangered Species of Wild Fauna (CITES), the Ramsar convention on Wetlands, the Montreal Protocol, and the Basel Convention on Transboundary Movements of Hazardous wastes.

The following tables show the position of SACEP countries in respect of major global conventions.

Table I : Participation in Major Global Conventions

	Ozone Layer 1985	CFC Control 1987	Climate Change (a) 1992	Biological and Toxin Weapons 1972	Nuclear Accident Notification 1986	Nuclear Accident Assistance 1986	Hazardous Waste Movement (a) 1989	Regional Agreements (b)	
								UNEP Regional Seas	Other Regional Agreement
Afganistan			S	CP	S	S	S		
Bangladesh	CP	CP	S	CP	CP	CP	CP		
Bhutan			S	CP					
India	CP	CP	CP	CP	CP	CP	CP		
Iran, Islam Rep	CP	CP	S	CP	S	S	CP	K+	
Nepal			S	S					
Pakistan	CP	CP	S	CP		CP			
Sri Lanka	CP	CP	S	CP	CP	CP	CP		ASC

Table 2 : Participation in Major Global Conventions :

	Wildlife and Habitat						Oceans		
	Antartic Treaty and Convention 1959 & 1980	Wetland (Ramsar) 1971	World Heritage 1972	Endangered Species (CITES) 1973	Migratory Species 1979	biodiversity 1992	Ocean Dumping 1972	Ship Pollution (MARPOL) 1978	Law of the Sea (a) 1982
Afganistan			CP	CP		S	CP		S
Bangladesh		CP	CP	CP		S			S
Bhutan						S			S
India	CP.MLR	CP	CP	CP	CP	CP	CP	CP	S
Iran, Islam Rep		CP	CP	CP		S			S
Nepal		CP	CP	CP		S	S		S
Pakistan		CP	CP	CP		S			S
Sri Lanka		CP	CP	CP	CP	S			S

Global Issues

Global issues like the climate change, sea level rise, and tropical cyclones shall have serious impact on countries like Bangladesh, Maldives, some coastal areas of India and Sri- Lanka.

Sea Level Rise

The Intergovernmental Panel on Climate Change predicts a rise in mean sea level of 8 to 30 centimeters by the year 2030 and 301-110 centimeters by the year 2100, although scientific opinion is still divided on whether such changes will occur. It has been estimated that a 100 centimeter rise in sea level in the Bay of Bengal would result in 12-18 per cent of land area of Bangladesh being lost to the sea, including most of the Sundarbans. It is also suggested that the area subject to normal seasonal flooding would increase by 17 per cent as higher sea levels would slow drainage of floodwater (and the existing seasonal flooding would be likely to become deeper and more prolonged). Another important effect is a drastic increase in salinity of both soils and groundwater in affected areas. The sea level rise may prove more fatal to Maldives and the whole country may go under water in the eventuality of the worst scenario of the sea level rise.

Climate Change

Predications regarding the possible effects of global warming on the climate of SACEP countries are even more uncertain. However, the predictions for 2030 made by four General Circulation Models all suggest that there might be increased precipitation, with estimates ranging between 5 and 100 per cent increases in rainfall in some of these countries. Increases of these magnitudes, if they were to occur, would have significant implications for agriculture, flooding, river sediment loads and flood protection works for countries like Bangladesh, Sri Lanka, the Maldives and India.

Tropical Cyclones

An increased frequency, and perhaps severity, of tropical cyclones is also predicted, and this would have serious implications for coastal areas independently of any rise in sea level. The magnitude of impact of cyclones is now exacerbated in the coastal belt because of the extreme underdevelopment of these areas : extreme poverty, crowding, exposure and insecurity of tenure etc. which increases the vulnerability of the affected population and reduces its level of preparedness.

Although it is difficult to predict the timing and magnitude of all these global changes including sea level rise, climate change etc., it is anticipated that one of the most serious consequence for countries like Bangladesh, Maldives and the Coastal areas of Sri Lanka and India would be the reduction of an already minimal land person ratio and consequently exacerbating pressure on the remaining natural resources. Were the land area to be further reduced, a significant portion of the population would be displaced; and the land person ratio, would further rise. Hence the whole socio-economic structure would necessitate major adaptations. For example, this could entail a much more drastic change of direction from a natural resource-based to an entirely manufacturing-based economy, and from a mostly rural to an essentially urban society.

Although the SACEP countries contribute very little to the overall process of global warming, they are strong advocates for addressing and reducing the greenhouse effect on an international scale. They are also in favour of an international agreement for assistance to vulnerable countries to take necessary preparations and adopt measures to survive a sea level rise, increased flooding and more frequent storm surges.

Regional Issues

Upstream Deforestation and Water Regulation of Regional Rivers

Although still a point of controversy, one of the causes of floods in Bangladesh could be traced to Nepal and Assam where the river systems originate. The stripling of mountain sides of trees in order to grow crops and harvest fuelwood has been an increasing practice there. Stripped of trees, the Himalayas can no longer absorb monsoon rains, hence floods carry water surges south, causing extreme erosion of these banks; carried by the water rare tones of rick alluvial silt that build up the river banks, plug up irrigation works.

The other most severe upstream activity aggravating the flooding, as well as the drought in the dry season, is the Farakkha and several other Barrages in India. During the dry season, they divert water from the upstream of the rivers to irrigate the land and keep silt from building up in the different portion of India, thus leaving the Bangladesh portion of the rivers low when Bangladesh needs water most. If it were to deviate waters also in the wet season, Bangladesh's flooding problems could be somewhat alleviated. The low flow of the rivers is also the major cause of inland intrusion of sea water.

Pollution in the Bay of Bengal

In the port cities of the Bay of Bengal, nearly 1,000 ships and 40-50 oil tankers are handled annually, causing severe pollution of the water in the coastal reaches and the marine environment.

Such pollution causes serious threat to the massive and coastal resources and ecosystems.

Socio-political Issues having environmental dimension

There are a number of environmental issues in South Asia Region which are either source of socio political stress or its consequences. While a decreasing land-man ratio is causing environmental degradation within the national boundaries of each of the South Asian countries, this spills over into political tension and conflict between or among the countries of the region. This, in turn, affects the environmental quality as well as economic wellbeing of the people. These environmental degradations are often the product of various policies adopted by the status of the region to serve self-interests. Conversely, environmental degradation within one state often induces the people or the government of that state to take

a set of measures which deteriorates the bilateral or multilateral relations in the region. The need to produce more within limited resources not only causes the adoption of unsustainable production practices, limited resources are often the source of competing claim and counter-claim between or among the countries of the region which in turn affect the policies as well as security of the region.

The countries of the South Asian region share the Himalayan drainage ecosystem. The political boundaries in the region have been drawn on the basis of ethnic, religious, cultural and other related factors but the unified characteristics of the ecosystem have remained largely ignored. The countries of the region have undertaken different development programmes within that limited part of the ecosystem-each contained within their own political boundaries, irrespective of other considerations.

There are a number of key issues which stem from environmental degradation in the region:

Energy

Absence or scarcity of energy is one of the predominant factors in most of the environmental concerns in South Asia which interacts closely with the socio-economic and political situation and so influences stability or security.

Population, Resource and Production Axis :

Although some of the countries are rich in resources, the population explosion and decreasing land-man ratio is demanding quadruple production from the same land. In turn, this demands the expansion of irrigation, so creating pressure on water resources. Demand for land is also causing the forests to diminish at a rapid rate. Technological backwardness and absence of alternative energy create further pressure on the forest and water resources. Competing claims on water resources is one of the greatest sources of tension among the countries of the region, but deforestation in the upper reaches and its transboundary impacts on the downstream areas in favour of flood, siltation, salinity etc. are also reasons for tension between neighboring states.

On the other hand, need to produce more food through intense irrigation and fertilizer use has resulted in water-logging, soil salinity, diminishing return from the land etc. in many areas of the region. Similarly, fuel-scarcity has compelled people to use the bamboos, crop residues etc. for domestic as well as industrial energy consumption. Therefore, little organic nutrients

can go into the land. This factor is seriously affecting the fertility of huge tracts of agricultural land to the grave detriment of the stability of agro-based economy of the region. dislocating thousands of people from their homestead.

Single Dominant State

Disparity in size, population, resources economy, defence and political influence among the states of the region etc. often gives rise to mistrust about each other which complicates the handling of common issues including solution of common environmental problems.

Vulnerability of Smaller States

Vulnerability of the weaker states in geography, economy, polity often narrows down the policy choices available to them in their handling of contentious issues with the stronger partners in the region.

Transboundary Migration :

Environmental decline in the region (both man-made and natural) often results in shrinking economic opportunities within states, causing demographic displacement within or across the national borders, a political cause of tensions between neighbours.

Internal Strife :

Environmental stress in the region often induce a sub-national group to shift its allegiance from the centre to the periphery, increasing the possibilities of political disorder, civil strife and socio economic suffering.

Group Interests :

Environmental issues are often manipulated politically to serve narrow group-interests which jeopardizes the domestic power balance, contributing to political instability and in turn limiting the capacity of the states to address the environmental issues in an adequate an timely manner.

Biodiversity :

As a tropical humid climate covering mountains, plains and semi-arid regions, South Asia offers habitats for a wide range of plant and animal species. Many of these plant species have significant economic or political/commercial value, drawing increasing attention by the northern industrial concerns. Population pressure and indiscriminate exploitation threaten many species.

Regional Cooperation in the Field of Environment

Inadequate national policies and historical conflicts today dominate the geo-political and consequently overall environmental policy realities in the South Asian Region. In South Asia, the history of regional cooperation in the field of resource management or in any other area is not significant. Two decades age, South Asia was described by Peter Lyon as "a region without regionalism." Most regional cooperation in South Asia at both official and unofficial levels till recent past has been exclusively bilateral, rather than multilateral in character and has been confined largely to various forms of economic, educational and cultural cooperation, with economic interchanges predominating. Specific initiatives to solve major environmental and ecological problems were absent.

Ecosystemic approaches or recognition of large river-basins or watershed based joint management has been lacking, for example. The World's largest mangrove forest, the Sundarbans is divided between the coastal areas of West Bengal, India and Bangladesh. Despite a common administrative legacy, there has yet not been any significant initiative for joint management practices of this global heritage and reservoir of one of the worlds largest animal species and biodiversity. Again, the mountains of the Himalayas being shared by Indian, Nepal, Pakistan and Bhutan, all neighboring countries but they have not yet initiated a coordinated mountain management system.

The South Asian Association for Regional Cooperation (SAARC).

There has been a new momentum in the eighties after the launching of the South Asian Association for Regional Cooperation (SAARC) in May 1980. The member countries of this regional forum are Bangladesh, Bhutan, India, Sri-Lanka, Maldives, Nepal and Pakistan. A collective bid to protect the environment was first discussed at the third SAARC summit in Kathmandu in November 1987. Accordingly the Group of Experts meeting in July 1988 identified the specific areas of national priorities requiring action and of common areas of

regional cooperation. Environmental concerns were placed in the top of the 1988 SAARC summit agenda in Islamabad and the 1999 summit in Male declared the year 1992 as the 'SAARC year of Environment'. In pursuance of the recommendation of the First Meeting of the Committee on Environment (Dhaka, 17-19 February, 1992), the Special Session of the Committee on Environment was held in Islamabad (1-3 November, 1992) to evolve specific programmes, activities and modalities to implement the thirteen recommendations identified by the Committee at its First Meeting in Dhaka and submit them to the 17th Session of the Standing Committee (Dhaka, 7-9 December, 1992). The Seventeenth Session considered the Report of the Special Session of the Committee on Environment and noted that the Special Session had prepared concrete modalities and programme activities on the thirteen recommendations identified by the First Meeting.

The Committee on Environment was subsequently designated as the Technical Committee on Environment which has its first meeting in Islamabad during 13-15 December, 1993. The Islamabad meeting made substantial progress in some areas including examination of the recommendations of the regional study on "Greenhouse Effect and its Impact on the Region". It also made some recommendations for better and timely coordination among member countries for preparation of action programmes in some priorities areas.

SAARC RECOMMENDATION FOR GLOBAL COOPERATION

In addition to its effort to institutionalize initiatives for environmental improvement within the region through better cooperation among the member countries, the first meeting of the SAARC Technical Committee on Environment also made some recommendations for global cooperation.

1. Monitoring Climate Change :

It is essential to establish a global system of acquiring and maintaining data and information on numerous atmospheric, terrestrial, and ocean parameters, including the role of oceans acting as sinks for carbon dioxide and process relevant to climate change. Developing countries should be fully involved in this effort. Such data/information should be freely available to all countries.

2. **Natural Disasters :**

Several categories of natural disaster, including but not limited to cyclones and storm surges, are likely to become more frequent and/or more destructive as a consequence of climate change. Global action is necessary for the establishment and development of capabilities in Management Information Systems in combating such natural disaster. Adequate assistance is also necessary from the global community for special projects for disaster preparedness and management. Additionally, the global community should establish an emergency fund for tackling natural disasters linked to climate change.

3. **Sea Level Rise :**

The global community, and in particular developed countries, keeping in view their commitments under the United Nations Framework Convention on Climate Change, should assist SAARC member states in monitoring the effects of seal level rise at a regional level, and in establishing scenarios at more localized levels. In this, priority should be given to countries which are more vulnerable to the effects of sea level rise. Coastal protection projects in SAARC Member States should be financed adequately by the global community.

4. **Forests :**

Forests are important natural resources in their own right, besides comprising important sinks for carbon dioxide helping to mitigate climate change impacts, and maintaining rich biological diversity resources, which may facilitate the development of adaptation strategies for climate change impacts, in particular in agriculture. The SAARC member states call for global action for large scale afforestation and urge the early ratification and implementation of the United Nations Convention on Biological Diversity.

5. **Awareness :**

The global community should launch concerted and effective campaigns worldwide to generate and heighten public awareness about the problem of climate change. Such increase and informed awareness will facilitate the adoption of policies for abatement and adaption, and lead to greater direct public involvement in such efforts.

6. **Technology Transfers :**

The United Nations Framework Convention on Climate Change casts a clear duty on developed countries to transfer technologies bearing on adaptation and abatement strategies to developing countries. Norms for such technology transfer should be evolved in the appropriate global fora with the full participation of developing countries. These must not be restrictive and should allow for transfer of appropriate, including "state of the art" technologies. Further, the "full incremental costs" of abatement and adaptation strategies must be defined to include the costs of such technology transfer, without restriction on the depth to which technology is transferred.

7. **Trans National Corporations :**

The global community should seriously consider the formulation of a code of conduct on technologies employed by transnational corporations in host countries, in particular with respect to the environmental dimensions of such activities.

8. **Finances :**

The SAARC Member States call upon the global community, and in particular the developed countries, to fulfil their commitments under the United Nations Framework Convention on Climate Change, and provide adequate new and additional funding for adaptation and abetment measures in developing countries. In particular, adequate funds must be provided countries. In particular, adequate funds must be provided to the poor and vulnerable countries in adopting protective measures, as well as to facilitate the transfer to, and adoption by them, of appropriate technologies for such purposes.

South Asia Co-operative Environment Programme (SACEP)

The idea of having regional co-operation among the South Asian Countries relating to environmental issues was discussed at an Inter-Governmental Expert group Meeting held in Bangalore, 10-15 March 1980. Subsequent to this, another high Level Meeting of Officials was held in Colombo, 18-21 February 1981, where Focal Points for various Priority Subject Area were designated. South Asia Co-operative Environment Programme (SACEP) became a Legal Entity on January, 1982 when the minimum required number of member countries

ratified the Articles of Association of SACEP. The members of this forum are Afghanistan, Bangladesh, Bhutan, India, Islamic Republic of Iran, Maldives, Nepal and Pakistan. The scheme of things were so designed that the Focal Points will play an important role in the formulation and operation of the Regional programmes in the respective Subject Areas.

Since its inception SACEP has played a vital role in improving the state of cooperation and collaboration among the member states for a better understanding of the state of environment in region and exchange knowledge, data, information and experience for improvement in the relevant field. It has completed a number of important projects in the areas of Environmental Legislation, Conservation of Corals, Mangroves and Island Ecosystems. Environment Impact Assessment and Cost/Benefit Analysis, Decertification etc.

Currently it has undertake a programme to implement 14 project concepts which cover the following key areas of activity :

i) Capacity building and awareness raising;

ii) Systematic information exchange and intra-regional technology transfer;

iii) Environmental management for training and institutional development for training;

iv) Regional Co-operation in management plans for mountain Ecosystem/watersheds and coastal resources;

v) Wildlife and wildlife habitat conservation in the region.

United Nation's Environment Programme (UNEP)

The United Nations Environment Programme has always recognized the special problems of Asia pacific Region in the field of sustainable development. A basic requirement for achieving the goal os sustainable development is scientific environmental assessment. The United Nation's Environment Programme (UNEP) has been urged by the United Nations General Assembly and other bodies to play an active role in enabling all countries, particularly developing countries, to enhance the capability for scientific environmental assessment. UNEP, in response, has modified the emphasis of its Environment Assessment Subprogramme with a view to strengthening national and regional organizations to build their capabilities for

environmental assessment for sustainable development. Besides environmental assessment and reporting, the Sub programme emphasizes adequate data management, harmonization and dissemination. Based on an assessment of the data and information capacities in the Region for environmental assessment, regional and national institutions will be assisted in obtaining the required hardware and software, in cooperation with international and bilateral aid agencies as weal as vendors. Assistance will also be provided to the establishment and/or strengthening of environmental agencies for evolving integrated digital databases. Such collaboration in envisaged initially with 16 countries viz., Bangladesh, Bhutan, Cambodia, People's Republic of China, Fiji, India, Indonesia, Lao P.D.R., Maldives, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, Viet Nam and Western Samoa. It is envisaged that other national environmental agencies in the Regional will eventually be included in this activity.

UNEP Regional Seas Programme

UNEP has promoted the development a number of regional seas programmes in the Asian and Pacific region with a view to promoting and enhancing the conservation of the coastal and marine environment of ocean resources. The first phase of the programme consisted of the development of action plans for the regional seas programmes incorporating, where applicable, the development of umbrella conventions and specific protocols, while the second phase is the co-operative implementation of action plans by the countries concerned. Coordinating bodies for these action plans are COBSEA for the East Asian Seas region, SPREP for the South Pacific, and SACEP for the South Asian Seas region.

All the member countries of SACEP have already endorsed the need for an early adoption of the action plan. There is a consensus among the SACEP members that an evolutionary approach for the South Asian Regional Seas Programme through the actual implementation of specific programmes including those considered to be priority ones, by the member countries be adopted. There is also an emphasis that the proposed activities on oil spilt contingency planning should be addressed in greater depth. Steps are being taken by SACEP member countries including Bangladesh to ensure that the South Seas Regional Programme really becomes operative in addressing the relevant issues in this region.

ESCP and Environmental Cooperation in the Region.

ESCAPE has been playing a very dominant role in identifying the major environmental problems in the region, investigating into their causes, assessing the depth of the problems and coming up with pragmatic recommendations and collaborative action oriented programmes for

their mitigation. Human resources development, capacity building, institutional strengthening etc. in the region have been priority areas which got attention from ESCAPE. The countries of the region including Bangladesh are being immensely benefitted by ESCAPE's deep involvement in the environmental concerns and its environment related programmes and activities.

ESCAPE - Coastal Environmental Management Plans

In the 1980s, the ESCAPE secretariat initiated the preparation of a series of coastal environmental management plans for maritime countries in the region. Studies for the plans carried out in various countries, including Bangladesh, Pakistan, Sir Lanka, Thailand and Tong, were able to identify the effects of industrial, urban and agricultural development on the marine environment, over exploitation and damaging practices in harvesting the resources, the socio-economic problems of the coastal population, as well as institutional shortcomings in the management of coastal zones. The studies not only identified the problems but also proposed measures to mitigate them, focusing on investment projects (those suitable for investment by funding institutions) and creating awareness of the benefits of environmentally sound and sustainable development.

ICIMOD and Regional Environmental Cooperation

International Centre for Integrated Mountain Development (ICIMOD) was established in December 1983 against the background of a sharply growing concern about the alarming deterioration of the mountain environment and resource base, and the concomitant impoverishment of mountain populations. The member countries of this organizations are : Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan. The primary objectives of the Centre were defined in its Statues as "to help promote the development of an economically and environmentally sound mountain ecosystem and to improve the living standards of mountain populations of the Hindu Kush-Himalayan area". In pursuance of these objectives, ICIMOD was to function as a multidiciplinary documentation centre, as a focal point for applied and problem - solving research activities, as a focal point for training, and as a consultative centre for expert services.

Taking stock now two decades after the alarms was first raised and one decade after ICMOD's establishment it must be concluded that, from the overall point of view, nature has lost and continues to lose in this struggle : the clearing of forests and felling of trees exceed regeneration; steep hills are encroached and fields are cropped too intensively, resulting in

decline in soil fertility and in soil erosion and landslides; the depletion of plant cover in turn causes accelerated water runoff and flooding during the rainy season and the drying up of springs during the dry season. The number of off-farm employment and income opportunities created is far too few, and the reassure of population on limited natural resources continues to rise. As a result of these trends, for large parts of the Kndu Kush-Himalayan Region, the deterioration in the quality of life of the population and in the production potential and soundness of natural resources and the environment continues.

Fortunately, there are also some areas where, as result of successful research and extension efforts, the productivity of traditional farming systems has been sufficiently enhanced to feed the present population while, at the same time, sustaining suchpotential for the future. Furthermore,

There are other areas in which additional income -earning opportunities have been developed,and still others in which a complete revamp of production systems,based on comparative advantage,has been undertaken,leading to greatly enhanced income earning and population carrying capacities.What is needed is that these positive trends,which are an exception now,will become the general rule n the future.In pursuing this objective,ICIMOD has been closely examining so called success stories in order to determine what preconditions need to be net to ensure successful replication.

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

Introduction

The United Nations Conference on Environment and Development (UNCED) was held in Rio in June, 1992.

Agenda 21 is perhaps the most remarkable achievement of the UNCED. It contains the essence of the whole UNCED process and its final outcome. It is an evolving programme for cooperative action which integrates issues of environment and sustainable development for the present and coming 21st century. It is the agenda for mankind as a whole wheather in the North or South, rich or poor, developed or developing to ensure the future and sustainable existence of the globe and all that man has so far achieved.

The implementation of Agenda 21 presupposes drawing up of a National Agenda 21 and develop policies, strategies, plans and programmes for action. Agenda 21 has 115 programme areas covering all aspects of environment and development, most of which being inter-sectoral and cross-sectoral in nature. It is very difficult to set the programmes into actions and make the players in different government machineries act simultaneously due mainly to perception gap and their priority attachment.

The main document prepared by the UNCED secretariat and debated during the Prepcoms was called Agenda 21 which consisted of 40 chapters in four sections coming to a total of over 800 pages of text. Some of the most significant issues raised are the following:

- International cooperation to accelerate sustainable development in Developed Countries (Section I, Chapter 2).
- Poverty (Section I, Chapter 3).
- Consumption Patterns (Section I, Chapter 4).
- Demographic Dynamics and sustainability (Section I, Chapter 5).

- Protection and Promotion of Human Health (Section I, Chapter 6).
- Promoting sustainable Human Settlements (Section I, Chapter 7).
- Policy-making for Sustainable Development (Section I, Chapter 8).
- Protecting the Atmosphere (Section II, Chapter 9).
- Land Resource Use (Section II, Chapter 10).
- Conservation and Rational use of Forests (Section II, Chapter 11).
- Halting the Spread of Deserts (Section II, Chapter 12).
- Protecting Mountain Ecosystems (Section II, Chapter 13).
- Meeting Agricultural Needs Without Destroying the Land (Section II, Chapter 14).

- Sustaining Biological Diversity (Section II, Chapter 15).
- Environmentally Sound Management of Biotechnology (Section II, Chapter 16).
- Safeguarding the Ocean's Resources (Section II, Chapter 17). Protection and Management of Freshwater Resources (Section II, chapter 18).
- Safe Use of Toxic Chemicals (Section II, Chapter 19).
- Managing Hazardous Wastes (Section II, Chapter 20).
- Seeking Solution to Solid Waste Problems (Section II, Chapter 21).
- Management of Radioactive Wastes (Section II. Chapter 22).
- Action for Women: Sustainable and Equitable Development (Section III, Chapter 24).
- Social Partners for Sustainable Development (Section III. Chapter 25-32). These include Youth (Chapter 25), Indigenous People (Chapter 26), NGOs (Chapter 27), Local Authorities (Chapter 28), Workers and Trade Unions (Chapter 29), Business and Industry (Chapter 30), Scientific and Technological Community (Chapter 31) and Farmers (Chapter 32).
- Financial Resources and Mechanisms (Section IV, Chapter 33).
- Making Environmentally Sound Technology (Section IV, Chapter 34).
- Science for Sustainable Development (Section IV, Chapter 35).
- Promoting Environmental Awareness (Section IV, Chapter 36).
- Building National Capacity for Sustainable Development (Section IV, Chapter 37).
- Strengthening Institutions for Sustainable Development (Section IV, Chapter 38).
- International Legal Instruments and Mechanisms (section IV, Chapter 39).
- Bridging the Data Gap (Section IV, Chapter 40).

Each of the chapters list the major issues being faced in implementing action programmes by international and regional organizations, governments, NGOs and other communities and groups. In some cases, cost estimates for proposed actions are also included.

Agenda 21 - the blue print for sustainable development is not a legally binding instrument, but the nations are committed to implement the same. What culminated in agreement through a process of intergovernmental consultation was merely an indicative plan of actions - the Agenda 21, but implementation of which is to be pursued through concrete actions by the states, regional and international organizations involving all actors in a society.

Following approval of the UNGA the Commission on Sustainable Development has since been established. The charter of responsibilities of the Commission among others; are :

a. to monitor progress in implementation of Agenda 21;
b. to consider information and reports provided by the governments;
c. to review progress in the implementation of the commitments on the provision of financial resources and technology transfer, and adequacy of fund mechanism of funding to achieve the objectives; and

The CSD had its first meeting in June, 1993 and it undertook to oversee the implementation of Agenda 21 in a structured manner. The commission suggested that the Chapters of Agenda 21 be clustered and taken up for consideration on a multi-year basis;

For yearly review : first comprehensive review in 1994

Critical elements of Sustainability, Chapters 2-5.

Financial resources and mechanisms, chapter 33.

Education, science, transfer of environmentally sound technologies, cooperation and capacity-building, Chapters 16, 34-37.

Decision making structures, Chapters 8, 38-40.

Roles of major groups, Chapter 23-32.

For review in the first year (i.e. 1994)

Health, human settlement and fresh water, Chapters 6,7,18 and 21.

For review in the 2nd year (1995)

Land, decertification, forestry and biodiversity, Chapters 10-15.

For review in the 3rd year (1996)

Atmosphere, oceans and all kinds of seas, Chapters 9 and 17.

Toxic chemicals and hazardous wastes, Chapters 19,20 and 22.

It was also decided that an overall review will be made in 1997.

The review by CSD is based on the reports obtained from the national governments. Accu
of information and data and timely response by national governments are therefore impor
in the whole gamut of things. Thus the importance of national reporting cannot be over-emphasized.

Challenges to Sustainable Development in the South Asia Region

The holding of the United Nations Conference on Environment and Development (UNCED) and all the efforts which resulted in drawing-up the agenda 21, singularly aimed to met the challenges to sustainable development. Developing countries of the South Asia Region and various sub-regions within this region face some formidable challenges to sustainable development. Most of these challenges can be viewed from a Southern perspective. Some important issues are stated below very briefly:

Economic Disparity

As has been highlighted in the Human Development Report 1992 of UNDP, the richest billion people in the world have 150 times the incomes of the poorest billion and over 80 times the trade volume. Moreover, market barriers cost developing countries $500 billion a year, or nearly 10 times the volume of foreign aid they receive. This disparity is not only in income but also in all the opportunities. The bottom one billion of the world's poor, get only 1.4%

of the world income, less than 1% of the world trade, and only 0.2% of the world's commercial credits. Unless such gross economic disparities are addressed, sustainable development problems in the developing world including the south Asia Region can hardly be solved.

Population Versus Consumption

Global population growth rate have slowed, but 97 million people are still being added every year, the bulk in the poor South. At any level of development, increase in population means an creased energy use, resource consumption and environmental stress. If energy consumption and emission of greenhouse gas is considered alone, it would appear that in developing countries it will increase in the future. Nevertheless, most Southern countries will continue to have much low level of energy consumption compared to the North for many decades to come. From a recent analysis it has been observed that present consumption pattern of the North is more likely to affect climate change than population increase in the South. It is essential that both problems of population increase in the developing countries including the South Asia Region and wasteful consumption pattern of the South be addressed concur.

Poverty

Poverty is closely associated with population growth leading to increasing environmental stress in poor countries. Indeed poverty is a major underlying cause of environmental degradation. Recent estimates by UN agencies indicate that more than one billion people live in absolute poverty in developing countries. The Human Development Report, 1992 highlighted that many of the most deprived people live in the most ecologically vulnerable areas of the world. Some 80% of the poor in Latin America 60% of the poor in Asia and 50% of the poor in Africa live on arid, infertile land, on slopes, and in urban slums and squatter settlements. Poverty grows and the environment suffers as people exploit the ecosystems to survive. Only 27% of ODA is allocated to those developing countries, where 72% of the poor people live and less than 10% of aid is earmarked for basic human needs, like education,primary health care, family planning ad nutrition.

It is the human being as the pivot around which the environment and development should revolve. To achieve sustainable development, it is needless to say that poverty as the biggest polluter in the South should be eliminated. For elimination of absolute poverty that affects more than 1.1 billion people in the world today, priority should be given on this sector in the allocation of ODA. In this area the countries of South Asia Region should not wait and

depend for flow of resources from the develop countries. They should themselves undertake priority plans and programmes for alleviation of poverty. This is an area where very close cooperation can be developed among the countries of this region.

Participation

The Human Development Report of 1993 focuses on the issue of participation. Studies show that the poor, women and rural dwellers are excluded from participation in practically all development activities that are needed to be taken for sustainable development. Almost all the countries in South Asia Region follow a top down policy of planing for development where participation form the common people is almost nil. Such programmes in most cases do not reflect the actual requirements of the people and fail to ensure their participation in the implementation of these programmes.

The government of Bangladesh has now started a people based and bottom up policy of planning for economy development. This process is now being followed to prepare the 20 year perspective plan for development. A pro-active and pro-people process of ex consolation with the people was follow in formulating the draft National Environm Management Action Plan (NEMAP). Another very important initiative to enlist mass participation by the people is the ongoing movement to transform social forestry activities into a sustainable social movement. Over the last three years tree plantation activities in Bangladesh have been able to ensure active and spontaneous participation by the people at all levels including the people at the very grassroots level in the villages. The countries of South East Asia can learn from the experience of Bangladesh in this respect and a really people based philosophy and plan of action can be developed to ensure people's participation at all levels for sustainable development.

Natural Resources

Human requirements are currently placing natural resources under severe stress. It is estimated that demands on natural resources could easily be doubled in the next two decades if population and per capita income grow at their projected rates.

According to preliminary findings of FAO the rate of deforestation in the tropics averaged about 1% per year during the 1980s. The reason may be accredited to excessive dependence of the developing countries' economy in the tropics on their renewable natural resources.

Agrarian character of the economy in the South and over population have resulted in shrinkage of the forest cover for bringing more land under crop cultivation and for meeting housing needs. It is in fact very difficult on the part of national governments in the South to make a quick shift from this pattern of development in absence of alternative arrangement compromising the interest of teeming millions. On the other hand most of these resources flow to the North and a lot of that meet the high consumption and wasteful life-style of its people.

Natural resources are yet to be valued properly taking into account the ecological service value in renders which however is not marketable. For example, lumber as a forest product is a marketable commodity and has therefore a value. But forests in themselves are not valued for their ecological functions, as carbon sinks or as a source of biodiversity. Unless a mechanism is develop for realization of such unaccounted for value from end-users, management of the forests in future would be very difficult.

The countries of the South Asia Region should adopt a common strategy to ensure be utilisation of their natural resources, help each other in such efforts, exchange know data, information and experience in arresting the process of resource depletion augmentation of the resources.

Environmental Problems

There is no denying of the fact that environment of the South Asia Region is under serious stress due mainly to anthropogenic interference which took place in the last two or three decades. As it appears now a disproportionate 25% of the world's population in the industrialized countries is consuming 80% of its energy and producing 75% of its pollutants apart from their excessive level of per capita natural resources consumption.

In developing countries, however, pressure on the environment comes from lack of choices imposed by poverty and over dependence on natural resources to an extent beyond sustainable limit.

Since, environmental problems transcend national boundaries, the South as well shares the ill effects of pollution from North. Sea level rise, climate change and depletion of stratospheric ozone, marine pollution etc. are some of such examples. A common strategy and collaborating plan of action therefore needs to be devised and adopted by the countries of the South Asia Region to face the impact of global environmental problem.

Technology and Industrialization

Technology transfer from industrialized countries to developing countries is indeed a pre-requisite for industrial development. But transfer of inappropriate northern technologies has progressively destroyed the more ecological indigenous production systems in the South, besides destroying natural resources. The prospect of transfer of environmently sound technologies to the South on acceptable terms is still bleak. The efforts of the South to develop appropriate and environment friendly technologies are also not getting positive response from the North, which is again frustrating.

In this context it is essential that the South Asia Regional countries pool their expertise and resource together and use their centers of excellence in different fields to develop less costly, and environment friendly technologies to augment their process of sustainable industrial development.

Institutional Issue

In order to achieve the goal of sustainable development, recognition must be given to interaction between economic, social and environmental trends. Appropriate institutions are to be inter built up and mechanisms developed both nationally and internationally which can coordinate policy and programme needs and requirements in order to integrate environmental consideration into planning and decision-making processes. International and Regional institutions can play a key role i strengthening up national institutions. This will inter-alia, strengthen national capacity in reporting progress. But progress in this direction is not very significant.

It has however been established from the interactions among the South Asian Countries in the regional fora like SAARC, SACEP, ICIMOD that in many fields, a number of countries have developed a lot of expertise and institutional capabilities which can be very profitably shared by other regional countries. This process of interaction and exchange of facilities need to be speeded up and further strengthened.

Out Flow of Resources from South to North

Despite political independence, the third world countries are trapped in a vastly unequal international economic order. The division of labour - raw material production in the South and industrial production in the North is continuing as in the case of world trade - selling

cheaply to and buying expensively from the North. This has resulted in continuous outflow of resources from South of North. Over and above, the intrinsic value of natural resources in the context of ecological crisis is yet to be accounted for and reflected in the transfer of resources. The countries of South Asia Region must take common strategies to effectively arrest outflow of their resource to developed countries. This can be done by establishment of regional cooperation in production, trade and industrial development. The idea of setting up of a common market in this region can also be a very effective tool for mutual strengthening of the present status of development and reduce the flow of resources from this poor countries to the developed countries.

Awareness and Prioritization of Actions

A quick shift from traditional development model to sustainable development model warrants environmental awareness at all levels in the government - from policy level to execution level. Inadequate representation of governments from developing nations in the preparatory proc of UNCED as well as in the negotiating process of the conventions has had a negative in generating awareness in different disciplines in government.

Further, appropriate actions to increase the environmental knowledge base are either absent or too inadequate. As a result proper appreciation of needs and requirements for sustainable development is often lacking. Unless this is ensured the progress of implementation of UNCED commitment would suffer serous setback in absence of priority attention. Since countries of this region share a number of common environmental problems and a lot of commonalities in the status of education and awareness they can set up common action plans for cooperation in this vital area which would enhance peoples involvement in sustainable development.

Regional Institutions

Implementation of the commitments having regional dimensions will call for either creation of new institutions or strengthening the existing ones with extended responsibilities. The regional institutions like SAARC, SACEP, ICMOD at various committee levels have been mandated to address some of the issues. But it appears that these are gaining momentum due mainly to fund constraints.

Availability of Resources

According to preliminary estimation, the need for additional fund for implementation of Agenda 21 alone is about US $125 billion. The current ODA level is too inadequate to meet the needs. The pledges which were made in Rio by some of the donors are yet to be fulfilled.

Apart from various international and regional funding institutions, establishment of GEF has been a positive step but with poor replenishment. The issues like "incremental costs" and "global benefits" are some of the controversial issues which are still awaiting an acceptable definition and solution. The countries of South Asia Region have a lot to learn from the very little progress in the implementation of many decisions and agreements which promised flow of resources, technology and other inputs for economic and environmental development of poor nations. The flow of finances to this region since the UNCED is hardly worth mentionable. Experience of most of these countries regarding financial help from GEF upto date is also not at all encouraging. It is therefore essential that these countries work out a r of creating a common pool of resources for addressing their priority problems in envir and development.

Follow-up of Agenda 21 and the SACEP Countries.

As indicated earlier the concept of sustainable development pre-supposes a shift from the existing paradigm to development through innovative through innovative formulation and use of prices policies, economic instruments like environmental accounting, development of environmentally sound technologies, free access to international markets and a range of regulatory measures. All these measures call for fundamental changes in the attitude of those concerned in decision making for hastening the process of integration of environment and development.

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.

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.

As a result of the vagueness of the definitions and absence of common consensus 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.

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 decertification. Most of these people live in developing countries like the SACEP region.

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 opti

Environmental Regulations

Rapid economic growth is an imperative in the developing countries like those in the SACEP region. 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, between the North and the South, among the countries of the South, and among those in the South Asia Region.

Issues

We may have to focus on a number of issues in implementing Agenda 21.

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 Cooperation

There is a great need to have regional and sub-regional cooperation and consultation, than at the international level. Agenda 21 has serious implication 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 planed 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 Coope through exchanges of ideas, technologies, and expertise, to ensure the succes. 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.

CHAPTER-22

PROSPECTS FOR THE 21ST CENTURY : A REGIONAL PERSPECTIVE

Introduction

At the fag end of the twentieth century human civilization and the existence of the globe itself stands at a threshold. In addition to the over riding environmental catastrophic, that threshold is also complicated by a conglomeration political, geo-political, economic, ethnic, social, cultural and a host of other local, national, regional and international factors. An environmentally sustainable future for the globe or any region within it can not therefore be conceived in isolation of the existing realities in the world and in the region. A regional perspective for South Asia Region in respect of the prospects for the 21st Century can therefore also be drawn without taking into consideration the challenges and opportunities which exist in the global and the regional context.

The Global Realities

Briefly assessed, the predominant global realities in the field of environment and development which have direct and indirect bearing on the regional perspective in South Asia Region including the SACEP region are the following:

1. The world is now dominated by an unipolar power structure after the disintegration of the Soviet Union which maintains a power structure broadly dominating all major aspects of political and economic development. In the present changed scenario, the major political and economic decisions evolve from and revolve around the overall national and global interest of this single power structure. The developing countries including those in the South Asia Region no longer have any option but to follow the dictates and interest pattern of this monolithic power and economic structure. It means that both in the field of economic development and environmental management they, now, have a very limited option in respect of strategies and actions.

2. The International aid scenario has undergone a tremendous change due to the situation now prevailing in East European Countries which are commonly known as economies in transition. They are now getting maximum priority and preference over other

countries including those in the South Asia Region in matters of development funds and assistance for environmental improvement.

3. The Earth Summit at Rio was expected to materialize the dream of bringing all nations of the world, rich and poor, north and south, east and west, to appreciate the hard reality that the UNCED might have been the last chance for them to agree to work together to achieve a better common future for mankind which is environmentally safer and socio-economically more sustainable. Whatever the UNCED achieved, these accomplishments are only in their earliest and most tentative stages. It is clear that a new phase of difficult work around the implementation of UNCED is faced by all both in the North and South. This work-in the United Nations, in national capitals, is research institutes and by community-based non-governmental organizations (NGOs) will be much less dramatic than the media events in Rio de Janeiro but will influence the ultimate success or failure of international or regional cooperation to safeguard the future of the planet.

4. In some ways, of course, the Earth Summit was a disappointment. Many point weakening of the climate change convention, which was stripped of specific tar[illegible] and timetables for carbon emission reduction. The biodiversity convention, while setting new parameters for the use and protection of the planet's biological resources, was undermined by the refusal of the United States to sign on. Environmentalists are disappointed that the plans for a forest convention were derailed by both some of the southern states and United Sates negotiating intransigence. In his final remarks to the conference over which he presided, even UNCED Secretary-General Maurice F. Strong lamented the lack of an overall commitment to a stronger Agenda 21 and subsequent financing.

5. While the Rio Declaration on Environmental and Development represents an important new set of guiding principles, it too falls far short of original hopes for a more comprehensive and visionary "Earth Charter" sought by Maurice Strong and several governments earlier in the UNCED planning process. Nevertheless, it is a substantial effort to define some of the key issues facing both the North and the South. Strong hopes the present Rio Declaration will "evolve towards what many of us hope will be an Earth Charter that could be finally sanctioned on the fiftieth anniversary of the United Nations in 1995."

6. The biggest stumbling block to realizing the ambitious targets for action set in Agenda 21 is the lack of sufficient funds committed to achieving global sustainability by Northern governments.

7. Japan will increase aid for such "sustainable development" from $3.1 billion over the last three years to $7-7.7 billion over the next five years. The European Community pledged $4 billion, and Germany agreed to meet the long unmet ODA target of 0.7 per cent of GNP for development aid, in this case sustainable development aid. This target will mean approximately $6.3 billion a year from Germany each year. The United States government came to the table with an underwhelming figure of approximately $175 million per year.

8. The Global Environment Facility (GEF), meanwhile, is likely to be beefed up to about twice its current $1.3 billion level by next year. It has already begun to dispense funds to combat global warming, although the final structure to the facility, jointly run by the World Bank. UNEP and UNDP has been revised to some extent with towards being more open to Southern country participation. For the time being, will remain the major funding mechanism specifically designed for sustainable development.

9. UNDP has announced that it will be increasing funding for environment projects from $700 million to $2 billion over the next five year. It also plans to launch a worldwide sustainable development network to facilitate the exchange of information on the environment, a Brazilian based international sustainable development center, and a major capacity-building program in support of Agenda 21.

10. For it, the World Bank will be seeking an "Earth Increment" for environment projects in the upcoming replenishment of the International DEVELOPMENT Association, its soft-loan window.

11. All told, however, new funding pledges for the environment were estimated at $6 to $7 billion a year-less than the $10 billion Maurice strong had realistically hoped for, and way below the $70 billion a year in additional ODA which Agenda 21 called for.

12. Perhaps one of the changes that will have the most lasting effect form the Earth Summit is the democratization of international negotiations highlighted by the increased participation of non-governmental organizations. Tens of thousands of

citizens were mobilized to take part in the preparatory process, the four negotiating sessions of the UNCED Preparatory Committee, and in all of the internationals NGO parallel meetings that were organized by issue, area and sector.

13. The real commitment to post UNCED success, however, rests with governments and what the political leadership of governments are willing to commit.

Delays in implementing the UNCED decisions

Maurice Strong could rightly envisage that road from Rio would be more difficult than road to Rio. The consensus forged in Rio and commitment made by the world leaders are waning day by day. The momentum of Rio is gradually being lost at the national government levels. As a result it is becoming more and more difficult to implement the commitments of Rio.

This is happening incase of most of the major agreements drawn and principles agreed ur including the Rio Declaration Conventions on Biodiversity and Climate Change and the Principles. Recent developments in Uruguay Round of GATT run counter to the enuncia principles of the Rio Declaration in terms of right to development, the responsibilities o developed countries, trade policies, eradication of poverty, etc. It is, therefore apparent that mere adoption of these principles in the national policies of the South, including those in the South Asia Region would mean little, unless the same are pursued by the North in right earnest. As with the Climate Change Convention, the contending issues of technology-transfer, intellectual property rights, funding, defining incremental costs and global benefits in the Biodiversity Convention are yet to be addressed. Incase of "Forest Principles" the developing countries who are rich in forest resources are not very responsive to these principles in absence of a compensation mechanism to forego exploitation of forest resources. Hopefully the Decertification Convention will be concluded as scheduled. But it is presumed that like all other agreements, the financial support under this agreement would remain a major impediment in the smooth implementation of the activities envisaged.

North-South Related Issues

The success of economic development and environmental improvement in the globe as a whole and particularly in the South Asia Region will continue to suffer in the present and also in the 21st Century due to the failure in resolving the fundamental differences in the points of view, strategies, action plans, and programmes between the North and South. The important issues relate to economic disparity, different perceptions in respect of population and

consumption patterns, poverty, disparity in natural resources, different attitudes in respect of prioritization of environmental problems, technology transfer, flow of financial resources from North to South, outflow of resources from South to North and selection of proper institutions and strategies for solution of economic and environmental problems.

Regional Challenges

In the contemporary world and also in the regional perspective environmental problems cannot be solved if other relevant political, social, ethnic, cultural and economic problems are also not addressed concurrently. Today South Asia faces almost all the conceivable types of development problems and environmental degradation at an alarmingly rapid rate. Besides there are many socio pollical and ethnic tensions among and between many member countries in the region.

In addition to the above, countries of the region face a number of common problem wh are inter-alia, the following:

- Population pressure
- Unsustainable development strategies
- Degradation of important ecosystems
- Pollution of common rivers
- Unsustainable use of freshwater resources
- Unsustainable patterns of energy consumption
- Deforestation and decline of soil fertility
- Degradation of wetlands
- Natural calamities
- Soil erosion, sedimentation and rise of salinity
- Socio-economic problems including poverty, illiteracy lack of adequate health care, water supply, sanitation, housing and other basic facilities.
- Lack of adequate trained human resources, necessary funds and environmental technology
- Lack of public awareness and participation in environmental and development issues.

The region accepts the need to take a balanced and integrated approach to environment. Therefore, each nation of the region has some political commitments at the highest level on development and environment and environmental cooperation. All the developing countries of the region also need international cooperation for their sustainable development efforts.

Economic policies of individual countries and international economic relations both have great relevance to sustainable development. Developing countries need external economic support for their development at the same time determined policies at national level. Development cannot take place if major part of the GNP of developing countries goes as debt services. Therefore, for the developing countries policies to attract direct investment be strengthened instead of unsustainable level of debt. Developing countries should have access to markets and trade should develop to improve sustainable development.

Challenge of poverty alleviation is a common problem of developing nationas of this region. It is multi-dimensional, complex and generally directly proportional to the state of development of respective countries. Poverty alleviation programmes need to be tackled with country specific approach as well as with an overall improvement of the socio-economic conditions of the region through a sustainable development strategy involving human resource development. Those who mainly depend on environmental resources must take due account of conservation of resources. So sustainable development process should put emphasis conservation of resources and development of total literacy, rights of women an democratic participation, among other issues. International support is essential for incon. generation programmes and to make significant progress for the poverty alleviation challenges in the 21st Century.

Consumption pattern of resources and production, mainly by industrialized countries has its affect in aggravating poverty and imbalance. Demand for natural resources particularly from underdeveloped nations for unsustainable patterns of consumption and production should get special attention to minimize depletion and reducing pollution. Present consumption pattern does not cover needs of the larger section of humanity. The richer section's, life style creates excessive demands for consumption which places immense stress on environment. Change in life style both globally and regionally for simple living can reduce stress on environment.

Development of efficient technologies can definitely reduce waste and enhance production, reduce pollution and increase financial efficiency. Human resource development, particularly production of high-tech human resource, to develop or acquire and maintain efficient technologies to replace old and less efficient technologies, certainly require national regional and international steps and cooperation. However good incentive for development of indigenous efficient technologies can also play major role in improving the situation.

Demographic trends and sustainable development have strong linkages. All countries of the region have the affect of high density population growth which places severe stress on life

Collaborative plans of action by countries in the region:

The following steps could be taken to manage the shared ecosystems, common environmental problems as well as the problems emerging out of disjointed and unilateral undertaking of programmes by different member states in the South Asia Region.

- The countries of the South Asia Region must give due consideration to the solution of existing political, ethnic and other type of tensions and conflicts between and among them. This will release a tremendous amount of resource and goodwill which will strengthen cooperation for development and solution of environmental issues.

- As developing countries they should adopt a common strategy to solve economic and environmental problems. They may also consider taking a bold step of reducing non development expenditure including expenditure on defence. This will need creation of better political understanding and harmony among the states.

- Both bilateralism and multilateral approaches should be adopted to solve political, economic and environmental problems.

- The regional states should try to adopt common positions, strategies and policies while dealing with other regional organizations and also in international fora for solution of development and environment related issues.

- Cooperation in the existing regional institutions light SAARC, SACEP, ICIMOD, etc. should be strengthened.

- Emphasis should be given to the identification of priority areas where co-operative regional and global research and action programme is essential. The national research and action -bases should be sufficiently strengthened for effective regional co-operation.

- More efforts should be taken for affiliation of the countries of the region to a wider network of international organizations and determination of methodology for maximizing the benefit obtained from such affiliation.

- An effective system for co-operative monitoring and abatement of cross-boundary flow of pollution should be worked out among the countries of the region and the

neighboring countries concerned. Upgrading of pollution monitoring capacity, particularly along the border areas would be required.

- Regional and global data base should be developed relevant to the environment of the countries of the region. The national data bases should be upgraded to meet the international standard.

- Combined steps should be taken to seek assistance from the internal donor community in determining a legislative framework among the co-basin states of Ganges-Brahmaputra Meghna, for co-operative sustainable development of the water-resources. The assistance from the international organizations may be in the form of support for research activities in this particular field. National and International N.G.O's may also have a vital role to play in this respect.

- One of the priority areas should be to build up national and regional data-base wi effective linkage with international environmental data networks. Special emp should be put to those classes of data and technical information which would lead to research on environmental topics requiring regional and global co-operation.

- Priority should be given to the identification of major sources of environmental degradation and hazards lying outside the boundaries of member countries and utilize the experience and knowledge of the international organizations for finding solutions.

- Flood may be identified as one of the major environmental disasters of Bangladesh and the region. The need for mitigating floods and its accompanying environmental degradation for Bangladesh and her neighbors, may form the starting incentive for UNEP sponsored regional study and research programmes which may lead to a comprehensive Ganges-Brahmaputra-Meghna basin-wide water-resources management strategy, with consequent cross-sectoral benefits.

- Urgent steps should be taken to develop regionally integrated systems for protection against natural disaster. Effective data exchange for maximizing hazard forecast lead time should be a major component of this system.

- Strategy for conservation of genetic diversity in the regional ecosystem should also be guided by national and regional priority consideration and to some extent on cost-effectiveness.

- Steps should be taken to develop a viable methodology with the help of UNEP, ESCAP and other relevant international organizations, for conservation of living resource in the Bay of Bengal and other seas of the region, both within and outside the territorial and EE waters.

- Creation of public awareness as to the problems which would in turn create pressure on the policy-makers to take any programme regarding management of shared resources should be accorded due emphasis.

- Population control and literacy programme in an institutionalized form with various rewards and incentives, attached to it must be an immediate agenda for all countries of the region.

- Creation of various small income generating projects which would reduce th dependence on land would substantially help the cause of poverty alleviation environmental upgradation.

- It should be noted that adoption and implementation of a sustainable development strategy where every programme should be taken not only with consideration for all other sector of development, but there should also be considerations for renewal or regeneration of the basic materials of development.

- Environmental impact assessment (ETA) should be a must in all programmes undertaken and those projects that are considered environmentally unsound should be abandoned.

- Since the Himalayan ecosystem is vital for the stability of the environment of the region, due consideration must be given to restore the forests and land quality there. A massive reforestation programme should be undertaken. Since every country in the region is and would be affected by the degrading quality of environment, every country should proceed with whatever contribution, financial or otherwise, they can muster to restore the Himalayas. Outside assistance would be fruitful in this campaign. Moreover, research centres on the study of restoration of the Himalayas would be most effective and in shortest possible time such institutions might be established.

- Since forests are fast disappearing as a result of supplying fuel wood, search for and use of alternate energy is a must. Every country in the region should make most efforts in this regard. Necessary help, expertise and inputs should be extended to those countries with the potential of generation of hydro-electricity. Assistance should be offered by every country as well as from outside donor agencies. However, such exploitation of power should be environmentally sound which necessitates proper study and research on this.

- Apart from hydro-power, solar power could provide a considerable alternative energy source for the region. Research and assistance in this regard would be fruitful if directed towards using cheap and easy mechanisms that would interest the rural people in the region.

- Decentralization of industry and economic base from the centre or capital to other parts of the country should be encouraged which would reduce the pressure on the capital and the unhealthy growth of slums.

- Energy efficiency should be improved so that system loss is reduced. This is applicable not only in the case of supply of electricity but also in other sectors, even to the rural stoves that are used in the open air whereby a huge amount of energy is lost.

- Due consideration should be given towards other's interests while exploiting the commons rivers. Research and assistance in assessing the required amount of water for every country would be more effective, if undertaken by experts and research centres or NGOs who are above emotional attachment or any deep-rooted bias towards any particular country. Regional Governments concerned, should be open-minded to accept the expert suggestions in this case.

Basinwide management of the Ganges, Brahmaputra and Meghna river systems for flood control measures and for sustainable harnessing of the resources should be established through an international cooperative forum like South Asian Association for Regional Cooperation (SAARC) or any other standing commission.

For mitigation damage caused by flood, forecasting system should be strengthened by climate-hydrological data exchange between the cobasin states. Cyclones hitting Bangladesh originate in the Bay of Bengal, Orissa and Andhra Pradesh. Therefore, weather data exchange between

Bangladesh and India should be a regular feature for early forecast of cyclones for disaster preparedness of all concerned.

A system for effective monitoring of cross-boundary flow of pollutants by water and air should be introduced as early as possible. Monitoring of marine pollution and interference in the coastal environment as a whole should be introduced for early detection and for prevention of hazards to the environment and to life support system of the coastal environment.

The following actions are recommended for maintaining genetic diversity.

- Monitoring of the endangered species and commercially important species.

- Maintenance of the natural habitat of the endangered and also the migratory species.

- Coordination and cooperation with region wide partners to create gene pools so that maximum number of species, particularly those important as food, forage, medicir and timber are preserved without duplication.

- Countries that are vulnerable in the face of sea level rise should get more attention form other countries of the region as well as from the world. Measures at every level viz-global, regional and national should be taken to help these countries.

APPENDIX

BANGLADESH

APPENDIX - I.a

MAIN AREAS OF ENVIRONMENTAL CONCERN AND THEIR MAJOR PROBLEMS

1. **Mahananda Basin** : Frequently flooded, and also subject to droughts.

2. **West-Central Barind** : being desiccated through improper land-use. Low water-table and poor soils affect crop agriculture.

3. **Middle Karatoa floodplain** : affected by drying-up of Karatoa river. Double-cropping of HYV Rice has led to severe Sulphur & Zinc deficiencies.

4. **Brahmaputra-Jamuna floodplain** : entire stretch affected by Brahmaputra Right Bank embankment, which has breached 4 out of the last 5 years. The main river may be shifting westwards. Large floating population in the char-lands. Sand-deposits after floods often ruin cultivable land.

5. **Chalan Beel** : Once one of the largest permanent wetland areas of Bangladesh, now seriously degraded by FCDI projects.

6. **Atrai-Hurasagar drainage basin** : due to construction of ill-conceived embankments & regulators drainage has been impeded and water-logging has become a serious problem.

7. **South west Jessore** : this area is climatically subject to wide variations in rainfall and temperature. Due to reduced flow in the Ganges in the dry season salinity has increased and freshwater flow has decreased.

8. **Northern Khulna** : large-scale shrimp farming has increased salinity and farmer conflicts and reduced rice production.

9. **Khulna City & Mongla town** : problem area due to industrial pollution, oil spills from ships end urban congestion.

10. **Sunderban** : increased salinity, increasing amounts of ship oil, industrial chemicals etc. has led to the top-dying of several species of trees. There has also been overcuting of the Forest for industrial use.

11. **Patakhali-Bhola-Noakhali Char areas** : affected by water-logging, salinity, and diluvion.

12. **Garo Hills Piedmont** : erosion, flash floods, and loss of tree cover has led to decreasing agricultural productivity.

13. **Tangail** : affected by silting of rivers, increase in sudden flooding.

14. **Madhupur Tract** : deforestation and improper use of sloping land has led to topsoil erosion. This in turn has silted rivers all around this important watershed area.

15. **Sitalakhya River** : industrial plants at Ghorashal, Palash and Demra discharge toxic chemicals into this river leading to suspected loss of fisheries and creation of hazard for public health.

16. **Dhaka City** : industrial and traffic pollution reates serious health hazard; urban expansion is destroying class 1 agricultural land and some of the best horticultural land in the country.

17. **Haor Basin** : reduction in fish spawning areas, due to embankments cutting out fish migration routes, and to increase in boro cultivation, with consequent increase in the use of pesticides.

18. **South Sylhet** : affected by deforestation, flash floods, and soil erosion.

19. **Lalmai Range** : deforestation, erosion and soil removal have reduced productivity and may reduce future potential.

20. **Lower Meghna** : affected by floods, riverbank erosion, stagnant productivity, loss of fisheries and population pressure.

21. **Central Noakhali** : affected by water logging in the wet season due to impeded drainage and lack of irrigation supply in dry season due to saline groundwater. This has led to decreasing agricultural productivity.

22. **Sandwip** : thickly populated island being eroded rapidly. New land formations not consolidated. Frequently affected by cyclones and surges.

23. **Sitakunda Range** : affected by deforestation and sheet erosion with consequent loss of productivity. This area is major source of thatching grass and therefore urgently requires Land Use Planning.

24. **Chittagong City & Port** : industrial pollution, oil spills, and cutting down of hills leading to increasing erosion and consequent silting of rivers have degraded the environment.

25. **Chandraghona** : industrial units discharge large quantities of chemicals into Karnafuli river, destroying fisheries and posing health hazards.

26. **Hill Tract :** slash & burn cultivation (jhoom) and improper use of hill slopes by immigrants has greatly increased erosion on the hill slopes and flooding of valleys, with consequent loss of productivity. There has also been a serious decline in tree-cover.

27. **Chakaria Sunderban :** a forest area totally destroyed for use as shrimp farms. Now yields are declining and soils are becoming highly acid.

28. **Chittagong Coast-Kutubdia island :** severe bank erosion, loss of land and increase in salinity has led to environmental degradation.

29. **Cox's Bazar :** tropical moist forest with unique biodiversity is being destroyed through clear-felling and planting operations, unchecked encroachment and illicit felling of trees.

30. **Jinjira island & reef :** Coral reef being destroyed through over-exploitation of corals and molluscs.

31. **Muhuri Basin :** successful agricultural project utilizing surface water irrigation, has in turn led to excessive use of fertilizers and pesticides and likely pollution of important fishing areas in lower Big Feni river and Sandwip channel.

APPENDIX - 1.b.

List of Endangered and Threatened Wildlife in Bangladesh

English Name	Scientific name	Past status (about 50 years ago)	Present status
Amphibia			
Bull Frog	Rana tigrina	VC[1]	T[2]
Green Frog	R. hexadactyla	U[3]	T
Reptilia			
Salt water/Estuarine Crocodile	Crocodylus porosus	C[4]	E[5]
Gharial	Gavialis gangeticus	C	E
Olive Ridley Turtle	Lepidochelys olivacea	C	E
Green Turtle	Chelonia mydas	C	E
Hawksaw bill Turtle	Eretmochelys imbricata	C	E
Loggerhead Turtle	Coratta coratta	C	E
Leatherback Turtle	Dermochelys coriacea	C	E
Batagur Turtle	Batagur baska	C	E
Bostami Turtle	Trionyx nigricans	C	E
Land Tortoise	Geochelone emys	C	E
Grey Lizard	Varanus bengalensis	C	T
Monitor/Ring Lizard	V. salvator	VC	T
Yellow Lizard	V. flaviscens	C	T
Clouded/Black Lizard	Varanus nebulosa	C	T
Rock Python	Python molurus	FC[6]	E

[1] VC = Very Common; [2] T = Threatened;
[3] U = Uncertain; [4] C = Commom;
[5] E = Endangered; [6] FC = Fairly Common

cont'd

English Name	Scientific name	Past status (about 50 years ago)	Present status
King Cobra	Ophiophagus hannah	FC	E
Dogfaced Water Snake	Cerberus rhynchops	C	T
Hook-nosed Sea Snake	Enhydrina schitosa	VC	T
Annulated Sea Snake	Hydrophis cyanocintus	U	T
Banded Sea Snake	H. fasciatus	C	T
Estuarine Sea Snake	H. obscurus	C	T
Common Narrow-headed Sea Snake	Microcephalophis gracilis	C	T
Cantor's Narrow-headed Sea Snake	M. cantoris	C	T
Aves			
Little Grebe	Podiceps ruficollis	VC	T
Darter/Snakebird	Anhinga rufa	FC	T
Purple Heron	Ardea purpurea	FC	E
Grey Heron	A. cinerea	C	T
Openbill Stork	Anastomus oscitans	C	E
Lesser Adjutant	Leptoptilus javanicus	FC	E
Whitenecked Stork	Ciconia episcopus	FC	E
Glossy Ibis Ple	Plegadis falcinellus	FC	E
Spoonbill	Platalea leucorodia	FC	E
Greater Whistling Teal	Dendrocygna bicolor	C	E
Whitwinged Wood Duck	Cairna scutulata	FC	E
Comb Duck/Nukta	Sarkidiornis melanotos	FC	E

Cont'd

English Name	Scientific name	Past status (about 50 years ago)	Present status
Blackwinged Kite	Elanus caeruleus	C	E
Whitebellied Sea Eagle	Haliaeetus leucogaster	C	E
Pallas's Fishing Eagle	H. leucoryphus	FC	E
Greyheaded Fishing Eagle	Ichthyophaga ichthyatus	C	T
Whitebacked Vulture	Gyps bengalensis	VC	T
Assam Black Partridge	Francolinus francolinus	FC	E
Rain Quail	Coturnix coromendelica	C	E
Common Peafowl	Pavo cristatus	FC	E
Pheasant-tailed Jacana	Hydrophasianus chirurgus	FC	T
Pasnted Snipe	Rostratula bengalensis	FC	T
Brown Fish Owl	Bubo Zeylonensis	C	E
Great Hornbill	Buceros bicornis	C	E
Hill Myna	Gracula religiosa	C	T
Paradise Flycatcher	Terpsiphone paradisi	FC	T
Mammalia			
Slow Loris	Nycticebus coucang	FC	E
Common Macaque	Presbytis entellus	FC	E
Crabeating Macaque	Macaca fascicularis	FC	T
Hoolock Gibbon	Hylobates hoolock	C	E
Large Civet	Viverra zibethina	C	E

Cont'd

Appendix II cont'd

English Name	Scientific name	Past status (about 50 years ago)	Present status
Fishing Cat	*Felis viverrina*	FC	E
Jungle Cat	*F. chaus*	FC	T
Tiger	*Panthera tigris*	FC	E
Leopard	*P. pardus*	C	T
Clouded Leopard	*Neofelis nebulosa*	FC	E
Asiatic Elephant	*Elephas maximus*	C	E
Barking Deer	*Muntiacus muntjak*	C	T
Sambar	*Cervus unicornis*	C	T
Serow	*Capricornis sumatraensis*	FC	E
Hispid Hare/ Assam Rabbit	*Caprolagus hispidus*	C	E

Appendix - 2

ENVIRONMENTAL DATA REPORT OF BANGLADESH

- Population (millions) mid. 1991 - 110.6
- GND per capita (Dollars) 1991 - 220
- Average annual growth rate (%) 1980-1991 - 1.9
- GDP 1980-91 - 4.3
- Agriculture 1980-91 (equivalent), 1991 - 2.7
- Industry 1980-91 - 4.9
- Manufacturing 1980 - 91 - 2.9
- Service etc. 1980 - 91 - 5.6

- Avg. Annual Growth rate (%) Energy production 1980-91 - 11.3
- Avg. Annual Growth rate (%) Energy consumption 1980-91 - 7.7
- Energy consumption per capita (kg of oil equivalent 1991 - 57

- Life expectancy at birth years 1990 - 51.8
- Infant mortality per 1000 live birth 1990 - 111
- Daily calorie supply as % of requirements 1988-90 - 88

- Adult literacy rate % 1990 - 35
- Combined primary and secondary enrolment ratio 1987-90 - 42
- Real GDP per capita PPP$ 1990 - 872

- Survival (Child Mortality 1991: per 1000) - 133
- Nutrition (Child Malnutrition) - 66%
- Education (Children reaching grade: 5) - 7%
- Family Planning (Average birth 1991, per women) - 1.8
- Progress for Women (Maternal death per 1000,000) - 600
- Health (Child vaccinated) - 53%

- Life expectancy at birth (years) 1990 - 51.8
- Adult literacy rate (as % of age 15) Total 1990 - 35, 47, 22
- Literacy rate (as % of age 15-19) 1990 - 46
- Mean years of schooling (25 +) Total 1990 - 2 + 3.1 + 0.9

- Educational attainment 1990 - 0.58
- Population with access to health services (%) 1987-90) - 74
- Population with access to safe water (%) 1988-90 - 78
- Population with access to sanitation (%) 1988-90 - 122
- Daily calorie supply (as % of requirements) 1988-90 - 88

- Per capita daily calorie supply as a percentage of requirements 1985 - 78
- Food staples self sufficiency ratio 1986 - 1988 - 98

- Rural population 1988 - 87
- Agricultural population 1988 - 70
- Rural population below poverty line 1988 - 86
- Average rural household size (no.) 1984-1988 - 5.6
- Dependency ratio (per cent) 1985 - 95.4

- Smallholder farmer population 1988 - 63
- Landless population 1988 - 20
- Small and artisanal fishermen population 1988 - 6.4
- Households headed by women as a percentage of rural households mid. 1980s - 16

PAKISTAN

APENDIX ---I

Indicators for Environmentally sound and sustainable Development.

Fast increasing environmental problems and the pressing need of economic development and security for citizens has lead to evolve measures to address both problems at a time.Such measures or steps of tackling both contribute to sustainable development. The balance between the two is very sensitive and acts as indicators of sustainable development.There are several indicators,and it is complex process.Some indicators appear with time and some give early alarm.However,sustainable development trend may be asscessed by Socio economic development at the same time sustainablity of Natural environment to the pressure of such development.

I Indicators of socio-economic development.

1. Growth in GDP per anum.
2. Per capita income and growth rate.
3. Energy consumption and energy production ratio.
4. Total external debt and debt service %age of
   a) G.N.P.
   b) Exports
   c) Foreign exchange earnings.
5. Income distribution.

6. Selected poverty indicators;

i. Head count indicators.

ii. Number of poor.

iii. Average income short fall.

iv. Basic needs unmet.

7. Demographic features and population size.

8. Human resource development level

i. literacy rate.

ii. Employment level,and details:

a) Availablity of institutions with number of Scientists,technologists, Managers to help institutions.

b). Effeciency,punctuality,interest in work ,innovations / inventions,development of own technologies.

9. Health features and details:

a). Survival pattern,preventives,living conditions, including availablity of fresh air and clean water, quality of food, non basic consumptions.

b). Health awareness,hygeanic living habits,attitude towards smoking,drinking,narcotics etc.

c). Capacity to face human distress natural as well as anthropogenic.

10. Trade and industry with details of access to market,availablity of commodities.

11. Development level of rural sector with details: Employment level;population growth trend, population migration, health facilities, electricity,education,cleanwater ,hygeanic conditons, housing, attitude towards smoking,drinking and narcotics.

12 Transport efffeciency,including highways, railway,air transport and sea transport,including punctuality and cleanliness..

II Indicators of state of Natural Environment and Natural resource endowment

A. International resources:

1a. Quality of air including capacity to sink toxic emmissions of a region.

1b. Status of migratory species.

B. Marine and coastal areas Resource.

a) marine biodiversity state.

b) sustainable levels of food resources.

c) pollution sink levels

d) sustainablity of other resources.

C. Regional resources.

1) Mountain chains

a) State of Forests and biodiversity

b) Human settlements and agriculture.

c) State of exploitation of other resources.such as mining,timber extraction.etc.

d) Stress from industrial development.

e) Stress from tourism,roads,hotels etc.

2) Rivers passing through international territories.

a) State of water resource for irrigation,silting.etc.

b) B.O.D Capacity for pollutants.

c) Wet lands of International importance for migratory water fowl (Draining, disturbance. pollution).

3) Breeding and wintering areas for Migratory bird species (in regard to state of disturbance ,pollution and over exploitation of vegetation)

C National resources.

i. Mountains : State of forests,human habitations agriculture,industry,tourism and pollution.

ii Rivers : State of turbidity, fish rources and state of BOD (due to pollution) diversion,daming etc.

iii Wetlands State : Pollution,draining,silting state of fish,state of winter habitats of migratory waterfowl.

iv State of range lands.

v State of deserts and advancement of desertification.

vi Breeding and wintering areas for birds.

vii local Biodiversity conditions.

viii State of air quality viz.GHGs both natural and anthropogenic.

ix State of coastal areas and marine resources.

Economic indicators of Pakistan.

- Pace of GDP reviveed from 2.3 %in 1992 - 93 to 4 %.
- Foreign exchange reserves gone beyond $ 2 billion.
- Agriculture Sector has grown by 2.63 % against a negative growth of 5.28 % in 1992 - 93.
- Minor crop, livestock, fishing, forestry showed growth rates of 3.71, 5.98, 3.38 and 8.03 % respectively.
- Growth of manufacture sector stood at 5.63 %.
- Construction sector growth rate was 3.7 %.
- Electricity sector growth rate was 6.1 %.
- Transport & communications sector growth rate 3.72 % .
- Trade growth rate was 2.63 %.
- Ownership of dewellings growth rate was 5.28 %.
- Services sector growth rate was 6.53 %.

Prices

Consumer price Index in 1992 – 93 was 9.26 % and in early 1994 was 5.5 %.

Energy

Demand growth 12 % per annum.

Suplly 7% per annum.

Human Resource development.

Labour force participation 28.11 %.

Literacy rate 36.8 %.

G.D.P. = 3.96 %.

Per capita income improvement 0.8 %.

– at current market price improvement 12.3 %.

Pakistan's total exports	$ 6,464 million.
Share in world exports	$ 0.18 million.
Imports	$ 9,485 million.

External debt:

Debt-servicing	$ 1,731 million.
Principal	$ 1.071 million.
Interest	$ 660 million.

Data sources: 1. Economic Survey of Pakistan 1994.
Finance Division, Govt. Pakistan.
2. 8th Five year Plan. 1993 - 98. Planning Commission, June 1994.
[redacted], Govt. Pakistan

PAKISTAN

Appendix 2.

Asia-Pacific Environment data reporting.

Most countries of South Asia region are developing.They have similarity of problems.All enderveour to sustainable development.Intera region cooperation and collaboration is being sought to overcome the constraints in achieving sustainable development of the individual countries.The measure of success will be the data on indicators of environment for intra-region particpatory efforts.Information sharing is necessary for the new levels of cooperation to protect integrity of regional environment and to achieve sustainable development of individual countries.

On the basis of National reports on environmental states, environmental monitoring and assessment of environment, there may be a draft regional report.This draft Asia-Pacific environment data report may be discussed with appropriate Agencies for preparation of final draft.

SRI LANKA

Appendix I

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 accelarated 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 inseperable 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 seperate 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 seperate 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 seperate 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 higherto 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 criterio 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), Urbon Development Authority (UDA), National Acquatic 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, Urbon 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) Environmantal 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, unwholsome 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,
- Breweries 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.

4.1 Ministry of Environment and Parliamentary Affairs :

In March 1990, a seperate 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.

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(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 dispossition 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 sceanic 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 Procument 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 procument 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 is 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.

SRI LANKA

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.

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
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