

Environmental Protection and Sustainable Development in Bangladesh

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Preface

The emerging environmental issues have by now been considered in Bangladesh as one of the greatest development challenges. The reason is not only the complexity of environmental issues themselves but also the complex linkages between growth, population, poverty and the environment. Unless these issues are properly addressed and incorporated in the development plan proper environmental protection and sustainable development can not be achieved. To improve the management of environmental issues, it is, therefore, essential to choose the future pattern of development in such a way as environmental degradation could be minimized through judicious use of limited resources.

This study is an attempt to highlight the state of the environment in Bangladesh and to develop a conceptual framework for improving environmental protection and sustainable development. It also attempts to identify the major reasons of environmental pollution, its impact on development and the societies as well as the trend of the environmental problems in Bangladesh. On the basis of presentation and interpretation of collected data, policy options and recommendations are given. The results of the present study would presumably be utilized as training inputs on environmental management issues and also serve as policy options for the concerned government agencies. It could also serve for building awareness amongst the stakeholders about the importance of environmental protection and sustainable development.

Moreover, it may be used as a reference document for the interested researchers, planners and trainers who would in future carry out further study on this issue.

Dr. Ekram Hossain

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Abbreviation and Acronyms

BCAS	:	Bangladesh Center for Advanced Studies
BELA	:	Bangladesh Environment Lawyers Association
BEMP	:	Bangladesh Environment Management Project
BIDS	:	Bangladesh Institute for Development Studies
CBD	:	Convention on Biological Diversity
CFSD	:	Center for Sustainable Development
CSD	:	Commission on Sustainable Development
DESA	:	United Nations Department of Economic and Social Affairs
FAO	:	Food and Agriculture Organization
GEF	:	Global Environmental Facility
GOB	:	Government of Bangladesh
HYV	:	High Yield Variety
IPF	:	Intergovernmental Panel on Forests
IUCN	:	World Conservation Union (International Union for Conservation of Nature and Natural resources)
LCG	:	Local Convenors' Group
LNR	:	Land and Natural Resource
MISP	:	Multi-Stakeholder Integrative Sustainability Planning
MOEF	:	Ministry of Environment and Forest
NCSD	:	National Council for Sustainable Development
NEC	:	National Environment Council
NEMAP	:	National Environment Management Action Plan
NRM	:	Natural Resource Management
ODA	:	Official Development Assistance
SARD	:	Sustainable Agriculture and Rural Development
SD	:	Sustainable Development
SEMP	:	Sustainable Environment Management Program
SIDA	:	Swedish International Development Cooperation Agency
UNCED	:	United Nations Conference on Environment and Development
UNCTAD	:	United Nations Conference on Trade and Development
UNDP	:	United Nations Development Program
UNEP	:	United Nations Environment Program
UNGASS	:	United Nations General Assembly
WTO	:	World Trade Organization

CHAPTER – I

1.0 INTRODUCTION

1.1 Overview

1.1.1. Man is distorting the delicate balance of environment maintained through millennia rapidly and severely because of unrestrained and unplanned exploitation of the nature. This unplanned exploitation of the natural resources through various development projects and the uncoordinated programs result into desertification, deforestation, soil erosion, air and water pollution which creating severe environmental degradation. Scientists are predicting that the combined effect of these not only raise the mean temperature of the world, changing weather pattern, melting of polar ice cap, rise of sea level, but also depletion of ozone layer, etc., where the entire human race faces extinction. This environmental degradation is not confined within political boundary. Every country in the world will have to share this burden in varying degrees no matter whether they are responsible for such degradation or not.

1.1.2. The global environmental concern was first expressed over a century ago by French Mathematician J.B. Fourior in 1827 followed by Swedish physical chemist Savant Arrhenius, in 1896 predicted that there would be global warming of 3.2-4.0 degree Celsius, which could be attained sometime in the next century. Since then, the theory of environmental degradation and protection passed from conception to hypothesis to the consensus view that it is both real and probable driving force for global climate charge¹. Today global warming or green house effects are no longer hypothetical predictions. Most scientists are in agreement that a global warming is under way caused by the accumulation of greenhouse gases primarily due to fossil fuel use in industrialized countries. Recent estimates predict that a global temperature increase of 1.5 to 4.5 degrees Celsius can be expected as early as 2030. This will raise the average temperature of the oceans and will cause the polar ice to melt raising the sea level. The low lying delta regions like Bangladesh are threatened to be inundated creating millions of environmental refugees.

¹ Erik Arhemins and Thomas W. Waltz. The Greenhouse Effect: Implications for Economic Development, World Bank Discussion Papers No. 78. The World Bank, Washington D.C. 1995.

1.2. *Importance and Justification of the study*

1.2.1. The importance of environmental studies in a country like Bangladesh can hardly be over emphasized. Bangladesh is facing several major environmental problems arising from population pressure, lack of development and the consequences of development process itself, including human intervention on natural system inside and outside its territory. The problems are degradation of soil condition and fertility, depletion of natural resources, natural disasters like floods, droughts, cyclones and storm surges, climatic changes and sea level rise. Over the years the consequences of environmental hazards are being increasingly felt in Bangladesh unlike other developing countries. But, the database on these problems and their likely implications for Bangladesh at present is too scanty. Some tentative conclusions have been drawn regarding the possible changes in storm frequency and severity, sea level rise and flooding of coastal areas of Bangladesh, which would be explicitly catastrophic for the country. However most of these discussions are speculations. Hence a study on the linkage between environment and sustainable development in Bangladesh could contribute not only to the database, but also to generate more academic interest and public awareness as well as to help public policy formulation.

1.3 *Scope of the study*

1.3.1 It is recognized that, the environmental problems in Bangladesh are complex, unparalleled and deeper, like many developing countries, which has got unique character in nature. The issues are being compounded by socio-economic realities - endemic poverty, population size, illiteracy and widespread lack of awareness. Some of these problems originate in the country while others are manifestations of human actions at regional and global level.

1.3.2 At the regional level too Bangladesh is exposed to severe challenges because of its geographical location, which renders the country vulnerable to any imbalance in the nature. Bangladesh suffers from annual flooding and alternate drought because of the various activities undertaken by other neighborhood countries of the region; specially deforestation in India and Nepal and construction of numerous dams and barrages on the common rivers by India. Situated in the belt of Himalayan ecosystem, the countries of the

region share more or less the same river system originating mostly from the Himalayas. Bangladesh, the lower riparian, is geographically situated in a position bear the disproportionate burdens of any disturbance in the nature of this region created by the indiscriminate and uncoordinated developmental activities of the upper riparian countries. Moreover, problems of environmental pollution and degradation in this region are closely interwoven with such issues as over population, poverty and underdevelopment on the one hand and politico-strategic dimension of inter-state relations on the other.

1.3.3 At the national level also environmental degradation is taking place in the form of massive deforestation to meet the need for fuel consumption of the increasing population, soil erosion because of unsustainable land-use practices to receive quick return, water pollution because of unawareness of general mass regarding proper sanitation and throwing of industrial and chemical wastes. Underdevelopment and population pressure are the main causes of environmental degradation within the country. Such degradation may, in the long run, result in the further weakening of already fragile socio-political and economic structure of the country leaving it even more vulnerable.

1.3.4 Government of Bangladesh on the occasion of *World Environmental Day* on 5th June called upon all to protect the environment and create healthy atmosphere. Prime Minister said, "there is no alternative but to protect the environment to make it habitable for the present and future generation". She also said it was not possible for a government alone to solve the problem, "Every citizen has responsibility in improving his own environment irrespective of country and public awareness is very important in this regard". Theme of the World Environmental Day was "*For life on the Earth*" in 1997 and "*For life on Earth save our Seas*" in 1998 and "*The Environment Millennium the Time to Act*" in 2000⁹. This statement has got far-reaching implication for environmental management in Bangladesh in future as well as potential scope to undertake intensive research study on this issue.

1.4 *Objectives of the study*

1.4.1. The present study attempts to elaborate the concepts of environmental protection and sustainable development, and establishing a linkage between them in the context of development imperatives of Bangladesh. The study also highlights the state of environmental, causes and consequences of environmental degradation in Bangladesh and the nature of integration of development programme and environmental concern. Finally, some recommendations are also put forward to take an integrated approach to maintain sustainable development.

1.4.2. More specifically the proposed study attempts to examine the following objectives :-

- a) to assess the trend of environmental problems in Bangladesh with particular reference to air pollution in Dhaka City,
- b) to explore a conceptual framework for improving environmental protection and sustainable development.
- c) to identify major reasons of environmental degradation and its impact on the society and
- d) to identify the appropriate policy options and recommend the ways and means by which sustainable the environment can be protected.

1.5 *Methodology of the study*

1.5.1 The authors believe that no single data gathering method is comprehensive enough to cover and highlight all the aspects of a study, because each and every method has its own strengths and limitations. Therefore, the authors have adopted the following methods, which are considered not only appropriate for the present study but also implementable within the specific period of time.

(a)Primary sources : Two sets of questionnaire have been used for collection of primary data. One set was used for general people who have basic idea about environmental pollution, while the other set involved selected officers and staff associated with environmental activities.

(b)Secondary sources : Secondary data and statistics have been mainly collected from published documents, research reports and books available in the library. Moreover, relevant books, articles and professional reports were consulted in order to have the broad idea about proposed issue as well as to formulate conceptual framework of the proposed study.

1.6 Plan of Presentation

1.6.1 The study is planned to present its subject matter into four chapters following the objectives mentioned in the preceding sections. First, chapter-I deals with the background of the study with reference to importance and justification against global and regional context as well as aim and objectives of the study. Chapter-II attempts to highlight the major environmental concern of South Asian countries in general and of Bangladesh in particular and their trend and impacts. Chapter-III proposes the conceptual framework of environmental management in terms of *bottom-up and top-down approaches* for managing impact of environmental degradation at both national and local level in Bangladesh context.

1.6.2 Chapter –IV make an effort to highlight the major reasons for environmental degradation and linkage between environment and development as well as to justify the importance of sustainable development for our survival. On the basis of the presentation and interpretation of collected data, policy opinions, and recommendations are provided in the last Chapter-V.

CHAPTER – II

2.0 Major Environmental Concerns Trends and Impacts

2.1.1 The most serious problems in South-Asian countries are environmental degradation, soil erosion, water pollution, deforestation and loss of biodiversity as well as atmospheric emissions. These problems are caused by a variety of reasons such as pollution from rapid urbanization, industrialization, and increasing energy use; land degradation due to deforestation and unsustainable agricultural practices; unsound management of water resources and ecological damage attributable to large infrastructure projects; and loss of biodiversity due to widespread developmental and population pressures. Environmental problems are crosscutting in nature, and their impacts in one sector often have cascading effects across other sectors.

2.1.2 Bangladesh like other South-Asian countries is also confronted with a host of environmental issues and problems owing to both natural and human factors. The concerns are directly related to the programs and activities in various sectors, and are of variable nature and intensity. The main environmental issues that are addressed through different policy and planning documents, by the Government of Bangladesh like the National Environment Management Action Plan (NEMAP), the Fifth Five Year Plan (1997-2002), Environmental Policy, are described briefly below.

2.1.3 This chapter attempts to over-view the major environmental issues and trends in South-Asia in general and Bangladesh in particular. In the absence of comprehensive data, the present study uses data from specific country cases, in selected cities taken from various studies carried out by different organizations ranging from the UN to NGOs.

2.1.4 Water Pollution

2.1.5 Water pollution is the most widespread environmental problem in South-Asia. Water pollution comes from three main sources: domestic sewage, industrial effluents, and run-off from activities such as agriculture and mining. Domestic sewage is the primary source of water pollution in South Asia, especially in and around large urban centers. Sewage treatment is very limited or non-existent in most cities, and most

domestic sewage is dumped untreated into surface water. Rivers in this region have high levels of fecal contamination that, in the absence of good water treatment, present a major threat to human health and aquatic life.

2.1.6 Industrialization compounds the water pollution from domestic sources, because most industries are located in or near cities and discharge their wastes into the same water bodies. As the region's industrial structure shifts into highly polluting sectors such as chemicals, electronics electroplating and machinery, industrial effluents increasingly contain heavy metals and non-degradable toxic and hazardous waste, posing high health risks. For example, the level of dissolved mercury in South Asian rivers far exceeds the recommended standard, especially during times of low flow. Ground water sources are also increasingly contaminated by leaching from industrial wastes.

2.1.7 Water resources are also contaminated by non-point pollution, such as run-off of agrochemical from farms and leaching of tailings from mining activities. Increased use of both fertilizers and pesticides has polluted surface water and groundwater in many agricultural regions, with complex impacts on aquatic life and other animals higher in the food chain.

2.1.8 Moreover, Excessive withdrawal of groundwater has lead to the lowering of groundwater tables, loss of water pressure, and salt water intrusion. These problems are widespread in Pakistan, India, Sri Lanka and Bangladesh. For example, increased pumping of groundwater in Dhaka City caused a decline of about 50 meters in groundwater levels during the period of April to June, and has created problem of getting supply water to the city dwellers. Since a large part of Asia's population lives in cities along coastal areas, increased use of groundwater for domestic and industrial purposes increased the incidence of another problem - saline intrusion into groundwater, making it unfit for consumption.

2.1.9 There are many industries in residential areas, causing air and water pollution through smoke emission and dumping of untreated effluents. Industrial wastes have polluted the water of the rivers Buriganga, Sitalakhya, Karnaphuli, and others, Effluents from tanneries are extremely harmful to human beings, since they contain high

concentrations of chromium compounds. About 250 tannery units clustered in the Hazaribagh area within Dhaka city are causing serious environmental pollution, and are a health hazard that makes the area unsuitable for human habitation. The tanneries at Hazaribagh in Dhaka city, the textile and dying units at Narayanganj and Gazipur near Dhaka, and the commercial shrimp culture in the coastal regions of Khulna and Chittagong are some of the environmental "hotspots" that have been identified in the country.

2.1.10 More recently, arsenic contamination of the groundwater has emerged as a serious problem threatening public health. In the past decades, groundwater was considered a source of safe drinking water, and was promoted through the installation of thousands of tube wells in rural areas throughout the country. During this period there was remarkable success in providing pure drinking water, free from pathogenic microorganisms, and a concomitant improvement in public health. Then a few years ago, arsenic contamination of groundwater was detected in 44 of the country's 64 districts. Although the real causes of arsenic contamination are yet to be identified, the government has launched a US\$50 million project with assistance from donors, and coordinated by the World Bank, for on-site mitigation of arsenic contamination, and the creation of a National Arsenic Mitigation Information Centre (NAMIC).

2.2 Air Pollution

2.2.1 World Health Organization (WHO) data indicates that twelve of the fifteen cities with the highest levels of particulate matter, and six of the fifteen cities with the highest levels of sulfur dioxide, are in South-Asia. Of the seven cities worst ranked for air pollution by the Population Crisis Committee based on a range of physical indicators, five are in Asia.

2.2.2 The major sources of air pollution in South-Asia are the transport, energy and the industrial sectors. Transport contributes the most to air pollution in many Asian cities, and this contribution is rapidly growing. While South-Asia has a small population of motor vehicles compared to world totals, the vehicle population has been rapidly expanding - at rates above 10 percent per annum in several countries - and studies indicate a doubling of the vehicle population by 2000. Diesel vehicles and motor cycles

powered by two-stroke engines, both highly polluting technologies, make up a large share of the vehicle population. Also, many of the vehicles have no pollution control, and the fuels used are among the dirtiest in the world, especially with regard to sulfur and lead.

2.2.3 Air pollution is further exacerbated by pollution from industry, energy generation and domestic sectors. While air pollution loads from industry are often significant in large cities, there are also large numbers of small cities in Asia that have very severe air pollution problems resulting from their development as industrial centers close to raw materials - such as Delhi, Calcutta and Madras in India and Dhaka, Chittagong and Rajshahi in Bangladesh. In some cities, especially those in Calcutta and Madras, pollution from coal uses for domestic cooking and heating is a major source of air pollution. In addition, burning of biomass for cooking creates severe indoor air pollution problems in lower income urban households and in rural areas throughout South-Asia.

2.2.4 Both outdoor and indoor air pollution causes considerable sickness and death. The links between respiratory diseases and air pollution are fairly well documented, and recent studies have also linked mental dysfunction's to lead poisoning in children. The health impacts of indoor air pollution are less quantified, but evidence indicates that pollution levels are often higher in rural households using bio-fuels than in even the most polluted urban environments.

2.3 *Solid Waste*

2.3.1 While the per capita amount of solid waste generated in South-Asian cities is small because of the large population base, the total amount of waste generated is significant. Currently, large metropolitan areas in this region generate over a million tons of waste per year, and this is expected to increase rapidly with economic growth and continuing urbanization. The growth of solid wastes has strained the capacity of cities to collect and dispose of them. Uncollected solid waste presents major health hazards to populations, in most of the cities of Bangladesh particularly Dhaka City.

2.4 *Toxic and Hazardous Waste*

2.4.1 Toxic releases from industry include heavy metals, cyanides and pesticides, and can be discharged into the air, water, or as solid wastes. The only estimates to date of the toxic wastes generated in Asia are based on the production parameters of OECD countries. Monitoring is typically done only for the conventional pollutants of biochemical oxygen demand (BOD), chemical oxygen demand (COD) and total suspended solids (TSS) in the effluent stream; and there is very little monitoring of toxics. Hence, the most Asian nations, regulators and industrial managers are largely ignorant of the extent and range of pollutants being released into the environment. In addition, many cities dump industrial toxic and hazardous waste along with domestic waste, further aggravating health problems and increasing the cost of future cleanup - as toxics require special handling and treatment.

2.5 *Fertilizers and Pesticides*

2.5.1 Modernization of agriculture has led to extensive use of fertilizers and pesticides. Although production of food grain and some other crops has increased significantly, but, as result of indiscriminate use of these chemicals the quality of the land has suffered. In addition, farmers spraying pesticides because of ignorance often suffer from heart and skin diseases, Cows, goats, and other domestic animals eating pesticide-affected grasses also suffer from the health impacts. Fish populations in the rivers and other water impacts, Fish populations in the rivers and other water bodies have drastically decreased due to water pollution by chemicals, including fertilizers and pesticides. Application of both fertilizers and pesticides are still very low in Bangladesh, compared to developed countries. Judicious use of these chemicals is essential.

2.6 *Land Degradation*

2.6.1 It is estimated that nearly 20 percent of the vegetated area in South-Asia was affected by human induced land degradation between 1985 and 1990. Soil degradation is a broad term that includes not only erosion, but also loss of soil fertility (due to loss of vegetation, nutrient depletion, waterlogging and salinization), and structural decline (such as compaction). Although it can be safely generalized that soil degradation is a significant problem across all agro-ecological zones in South-Asia, both the nature and scale of this

degradation varies widely among and even within countries in the region. In India, for example, it is estimated that about 50 percent of the total land area is degraded, and up to 25 percent is susceptible to erosion.

2.6.2 For erosion, the most widespread hazard is water erosion, caused by excessive exposure of bare soil mainly due to poorly managed logging operations, indiscriminate land clearance, widespread use of annual crops in farming systems. Soil erosion can cause considerable on-site and off-site costs. Agricultural production data do not yet reveal absolute declines in output due to soil erosion, partly because very little work has been done to measure the impacts of soil erosion. However, one detailed study in Bangladesh estimated the total of onsite and off-site costs of soil erosion at \$340-400 million per year in 1997.

2.6.3 Waterlogging and salinity are particular problems in Sri Lanka, India and Pakistan. India has the highest amount of land affected by salinity (estimates vary, but range from 10-20 million hectares), followed by China (7 million hectares) and Pakistan (3 million hectares). Increased waterlogging and salinity in soils leads to reduction in output, loss of irrigated cropland, and increased salt lounges on return flows and aquifers in Bangladesh.

2.7 Deforestation

2.7.1 The forest resource base in South-Asia is being rapidly depleted. Countries of this region were historically self-sufficient, have become a major importer; and are facing excessive and non-sustainable rates of deforestation. During 1991-95, the highest deforestation rates in the world were in continental South-Asia (India, Pakistan and Bangladesh) followed by other Asian countries (Indonesia, Malaysia, and the Philippines). Deforestation rates in both these sub-regions increased by more than 50 percent over the previous decade. In Indonesia, more than 500,000 hectares are deforested annually. In India, Malaysia, Myanmar, and Thailand the extent of deforestation exceeded 100,000 hectares per annum in each country.

2.7.2 Deforestation is caused by a variety of factors; conversion to agricultural land, demand for fuel-wood and fodder, and commercial logging for timber, although it is

difficult to assign proportionate blame to these factors. It is estimated that between 30 and 80 million people are involved in shifting cultivation, affecting between 75 and 120 million hectares of land. Fuel-wood and charcoal production accounts for nearly 77 percent of the total wood production in the region. In poorer countries (Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka) fuel-wood production accounts for more than 90 percent of the round wood production for migrant settlers and for the shifting cultivation that follows in the wake of logging.

2.7.3 The economic impact of deforestation can be partially measured in terms of the loss of income due to inefficiency, over-exploitation of resources, and loss of future production. A natural resources accounting framework estimated the costs of forest depletion in India, at nearly \$20 billion in the six years between 1990 and 1995. An even more immediate indicator of the impact of deforestation is the estimate of future import requirements by countries that have traditionally been wood exporters. Based on current trends, imports of timber and forest products will cost Asian countries nearly \$20 billion a year by 2000.

2.7.4 There are other indirect economic impacts of deforestation and degradation, most of which are not easily quantifiable. Deforestation impoverishes rural population dependent on nearby forests for their basic needs (including nonwood products like protein and shelter in addition to fuelwood and fodder). Deforestation in upper watersheds has been associated with increasing soil erosion, damsiltation, and increased flooding in the wet season followed by droughts during the dry season. Forests play an important role in sequestering carbon, and hence mitigate global warming. It is estimated that the destruction of tropical rainforests in this region has increased the global atmospheric loading of carbon by 6 percent. Finally, deforestation is the most important cause of habitat loss leading to loss of biodiversity.

2.8 *Loss of Biodiversity*

2.8.1 Deforestation is the major cause of habitat loss in South Asia, threatening the region's extraordinary range of biological diversity. About 20 to 25 percent of the earth's plant species and the greatest number of fauna in the region is found in the rainforests of Southeast Asia. Biological diversity in the wet forests of southwestern Sri Lanka, forests

of eastern Himalayas, and the moist deciduous forests of the Western Ghats in southern India are under serious threat, as well as some low-diversity systems such as the mangroves in the Sunderban, Bangladesh. In addition, biodiversity is also threatened by loss of wetlands, degradation of marine resources, loss of grasslands, and a variety of other indirect mechanisms such as introduced species, over-exploitation of plant and animal species, pollution of soil, water and air, and global climate change.

Table:1.1 Loss of Original Habitat in the South-Asian region

Region	Loss of original habitat (%)
Bangladesh	94
Sri Lanka	83
India	80
Pakistan	76
Nepal	54
Bhutan	34

Source: United Nations, 1991, "World Urbanization Prospects 1990".

2.8.2 According to the one estimate, nearly three-quarters of the natural habitat in the region has been lost or irreversibly degraded. Within individual countries, natural habitat loss has been very acute in India, Bangladesh, Sri Lanka, and Pakistan. It is estimated that South Asia will lose a higher proportion of its species and natural ecosystems than any other region during the next twenty-five years.

2.9 Population and Poverty

2.9.1 Asia, with the two most populous countries in the world (China and India), is home to about 2.8 billion people, or about half the global population. The huge size of the population and the large proportion of youth ensures great momentum for continued growth. Despite recent declines, fertility remains over replacement levels: total fertility is above four children per woman in most Asian countries. By 2025, Asia will have added another 1.5 billion people to its population. In 1985, more than 35 percent of Asia's population were children under 15 years of age. Although the percentage of young dependents to total population has declined by the year 2000, the absolute number has increased. The old age dependency ratio is also expected to increase from 7 percent in 1995 to about 9 percent in year 2001.

2.9.2 South Asia contains half of the world's poor, and nearly half of the region's population lives in poverty. In East Asia, nearly a fifth of the population live in poverty, most of them in China. Further economic growth is necessary to sustain the gains already made in poverty alleviation and to make further advances.

2.9.3 Population growth contributes directly to environmental damage, as economic, social and political systems fail to keep up with the growing demands. Market and policy failures have already been mentioned. Social and political rigidities, in the face of tangible human needs and at times of rapid change, also lead to non-sustainability. In rural areas, traditional land resource management systems fail as population increases and land parcelization leads to overuse. Skewed land distribution often compels the poor to survive by cultivating marginal land - erosion-prone slopes and cleared forests - leading to erosion and other environmental problems.

2.10 Urbanization and Industrialization

2.10.1 In urban areas, environmental problems are largely caused by the high concentration of domestic and industrial wastes that, in the absence of adequate collection, treatment and disposal, overwhelms the assimilative capacity of the environment. In addition, ecosystems are destroyed as urban and industrial development consumes land in environmentally sensitive areas.

2.10.2 Nearly one third of Asia's population currently live in cities and towns. Urban population growth accounted for 45 percent of total population growth since 1960, tripling the number of city dwellers from 266 million to 840 million. This dramatic demographic shift is continuing unabated - the urban population is expected to triple again to 2.5 billion by 2025, when nearly 60 percent of Asia's population will be living in cities and towns. This will account for more than 100 percent of total population growth over the period, implying some net reduction in the rural population.

2.10.3 The rapid population explosion is concentrated in a few cities in the region. Megacities (cities of more than 8 million people) are growing rapidly in size and number in Asian countries. In 1950, there were no megacities in Asia; by 1990, there were nine,

accounting for nearly half the megacities in the world. By the turn of the century, there will be thirteen in Asia, again accounting for nearly half of the worldwide total . Bombay, Calcutta and Shanghai will each have more than 15 million inhabitants.

2.10.4 With further rapid urbanization in the region, even with lower incidence of poverty in urban areas, increasing numbers of the poor will be found in the cities and towns of Asia. It is estimated that nearly half the households in poverty will be living in cities by the turn of the century. By then, rural poverty is expected to show a slight decline, while urban poverty will increase to match the level of rural poverty. already the poor account for 60 percent of the populations of Calcutta and Jakarta, 45 percent of Karachi and Madras, and 35 percent of Manila.

2.10.5 Urbanization is fueled by economic growth. The location advantages and the economies of scale of large cities enable them to generate goods and services far in excess of their share of the national population. Shanghai, with only 1.2 percent of China's population accounts for about 12.5 percent of the nation's industrial output. Bombay, India's leading financial and business center, has just over 1 percent of the country's population but generates 10 percent of India's industrial jobs and handles more than a quarter of foreign trade. It is estimated that the Bangkok metropolitan region, with 16 percent of Thailand's population, accounts for 48 percent of GNP, and 75 percent of manufacturing. In Bangladesh, nearly half the manufacturing jobs are in Dhaka, inhabited by just 6 percent of the country's population. Given these advantages, economic growth and urbanization are bound to remain linked.

Table-1.2 The World's Twelve Largest Cities, 1995

	Population (millions)	Average Annual GrowthRate(1990-95)in %
Mexico City, Mexico	15.6	0.73
Bombay, India	15.1	4.22
Beijing, China	12.4	2.57
Calcutta, India	11.7	1.67
Seoul, Republic of Korea	11.6	1.95
Tanjin, China	10.7	2.88
Delhi, India	9.9	3.80
Karachi, Pakistan	9.9	4.27
Cairo, Egypt	9.7	2.24
Dhaka, Bangladesh	7.8	5.74
Istanbul, Turkey	7.8	3.67
Lima, Peru	7.5	2.81
Source: United Nations (U.N.) Population Division, World Urbanization Prospects, 1994 Revision (U.N.) New York, 1995),		

2.10.6 Similarly, industrialization will continue to be the driving force of economic growth in Asia, although this trend is more pronounced in countries in the East Asia Region. While industry accounts for nearly 20 percent of GDP across all of Asia, China, Indonesia, Malaysia and Korea have industrial sector shares of more than 40 percent. The rapid pace of industrialization is expected to continue as countries in the region liberalize markets and relax trade regimes. Also, most of the industries are located in urban areas and add to the concentration of urban pollution problems.

2.10.7 Population growth combined with economic development and industrialization is generating an extremely rapid growth in demand for energy. At current growth rates, energy demand in Asia is doubling every twelve years (compared to a global rate of every twenty-eight years). In addition, energy intensity (the amount of energy per unit output) in Asia is the highest in the world.

2.10.8 Serious problems of environmental degradation are resulting from unplanned urbanization in Bangladesh. The present pattern of urbanization is leading to various problems like land use alterations; inadequate shelter, water, sanitation, and other facilities in slums and other urban poor areas. Degradation of community ambient environment; industrial waste emissions; and environmental pollution due to inadequate management of human and domestic wastes do not have any control.

2.10.9 The capital city of Dhaka is among the fastest growing cities in the world, with an average population growth of 6 per cent per annum. The environmental problems of Dhaka have become a major concern to all strata of society, including the government, NGOs, and scientists, as well as the country's development partners and aid agencies. The World Bank and the Asian Development Bank have sponsored a number of studies and public consultations on environmental issues in Dhaka city. Apart from air pollution, house hold solid waste poses a serious threat to the city's environment. According to an estimate, 700-800 tons of household and commercial solid wastes are produced in the dry season, and 900-1100 tons during the monsoon season. The wastes are dumped untreated in nearby low-lying areas and water bodies, where they pollute surface water and generate a foul odor. The hazardous medical wastes from a large number of clinics and hospital are believed to go through the same type of untreated disposal.

2.10.10 *Global Warming and Climate Change*

2.10.11 There is firm scientific evidence that the concentration of greenhouse gases, such as carbon dioxide, methane, and nitrous oxide, in the earth's atmosphere is increasing, largely due to human activities. The consequences will be progressive global warming and climate change. The outlook for any particular country is still not fully clear, because of large uncertainties regarding the rate and magnitude of warming.

2.10.12 However, preliminary studies in the past few years have yielded scenarios of Bangladesh's probable vulnerability to climate change. It is expected that Bangladesh may get warmer and wetter owing to global warming. Higher precipitation may increase the area and depth of flooding, which will require additional measures for protection and adaptation. Other probable impacts include, disruption of the monsoon rhythm, prolonged drought, and increased frequency of cyclones. The most serious consequence of climate change for Bangladesh will be a rise in sea level along the Bay of Bengal coast, causing submergence of 10 to 20 per cent of the land (including the Sundarbans), as well as saline intrusion in the rivers. Although climate change is a long-term process, the implications for Bangladesh are vital for further policy planning.

2.10.13 *Agricultural Resource Base*

2.10.14 The vast majority of the population depends on agriculture and natural resources

for a large part of their food and income. As a result, agricultural resources in Bangladesh are under severe pressure and environmental strain already. The mechanization of agriculture, and emphasis on high-yielding varieties to grow more food, has resulted in the loss of many traditional varieties of rice and other crops. In addition, the practice of mono cropping has caused serious deterioration of soil characteristics, and a decline in productivity. There are also competing demands on land for non-agricultural uses. Thus, a more dynamic agricultural sector, better use of natural resources, and increased concern for environment are essential. An emphasis on the preservation of biodiversity is necessary to sustain and improve agriculture, forestry, livestock, and fisheries production systems. The indigenous flora, fauna, and ecosystems are important in order to keep future options open, as they form a buffer against harmful environmental changes, and as raw material for scientific and industrial innovations.

2.10.15 Biomass

2.10.16 In Bangladesh biomass plays an important and complex role, especially in the rural areas where about 80 per cent of the people live. At present, there is an acute crisis of biomass fuel, which constitutes 73 per cent of total energy consumption, and the per capita supply is declining. The problem is not merely the supply of wood for fuel or food. There is an increased use of crop residues and dung as fuel, which is depriving the soil of valuable nutrients and organic matter.

2.10.17 Wetlands and Fisheries

2.10.18 Bangladesh has a high proportion of wetland areas, which of late have been declining. They are significant sources of sweet-water fish, and many other natural resources. The decline in fish production has been attributed to a general deterioration of the wetlands, characterized by silting up of bed levels, water logging, as well as water pollution.

2.10.19 Mangrove Ecosystem

2.10.20 The Sundarbans, located in the southwestern part of Bangladesh, is the largest single expanse of mangrove forest in the world. It is a dynamic, fragile, and complex ecosystem, with a delicate balance of land and water. It is a good habitat for offshore fisheries, offers natural coastal protection, highly valuable forest resources, and tourism

and recreational possibilities. But a gradual degradation of environment in the Sundarbans has been taking place due to rapid deforestation, top-drying of trees, saline water intrusion, killing of wildlife, inadequate reforestation, and lack of efficient conservation programs.

2.10.21 *Salinity in the Coastal Area*

2.10.22 Diversion of the Ganges water upstream through construction of a barrage by India has drastically reduced the downstream flow of its distributaries. Consequently, saline seawater enters the mainland through the rivers. This has adverse effects on agriculture, and sweet-water shrimp cultivation, and also on availability of potable water for domestic and other uses. The situation worsens during the dry season, when salinity penetrates further and deeper into the mainland.

2.10.23 *Health and Sanitation*

2.10.24 The present sanitation conditions are quite unsatisfactory, particularly in rural areas. Only 36.9 per cent of the population has acceptable sanitary systems for safe disposal of excreta. Raw sewage contamination of water systems in Bangladesh is the major factor in transmission and spread of various communicable waterborne diseases, including diarrhea, cholera, typhoid, etc. Industrial wastes, indiscriminate defecation practices, and unhygienic disposal of human waste often pollute surface water, which is an important source of water for human use, including drinking. The coliform count of most surface water resources is beyond the acceptable standard for any domestic use. The high infant mortality in Bangladesh is attributed to the high prevalence of various waterborne diseases, and unhygienic sanitation practices.

CHAPTER –III

3.0 *Conceptual Framework of Environmental Management*

3.1.1 Given this situation the challenge before Bangladesh therefore, is to find ways to make fundamental trends in economic and population growth more sustainable, and to reverse the pollution and resource degradation trends that are already apparent. What the resulting form of sustainability will ultimately "look like" is the subject of strong debate, and must be addressed on the basis of socio- economic conditions preventing in Bangladesh.

3.1.2 This section seeks to build a conceptual framework for improving environmental management in Bangladesh context. As the authors of the present study believe that effective planning and managing of any project and program requires a conceptual framework which not only helps to proper planning and designing but also helps the concern authority to formulate action plan for implementation. Reports and studies published so far on the environmental management of Bangladesh do focused on many issues for planning and managing but they do not unfortunately deal with conceptual framework for improving environmental management in Bangladesh context. Keeping this view an attempt has been made in the present study to provide a conceptual framework that would serve as a guiding tools in formulating any future plan and policies of environmental management as well as to implementation of the sectoral projects and development activities.

3.1.3 The proposed framework has got five major components such as (i) Setting Priorities (ii) Reforming Policies (iii) Strengthening Institutional Capacities (iv) Increasing Public and Private Sector Investment and (v) Improving Technological transfer focusing on four key areas of national environmental strategies: designing cost-effective policy instruments; improving institutional capacity; increasing public and private sector investments ; and improving technology, even in areas not fully supported by the market. Finally, in order to apply this framework as practical as possible an attempt has been made to highlight two types of approaches such as national level (top-

down) and local-level (bottom-up) for handling the economic and social impact of improved environmental policies and the issues of concerned on the basis of the situation.

3.2 *Setting Priorities*

3.2.1 Formulating any national plan on an important aspect means that the first element of any framework is to set priorities. In practice, priorities are best set as the result of a process involving both technical and public inputs, and taking into account scientific, economic, and medical evidence. Priorities for action are ideally based on collection and analysis of available data, careful valuation of the costs and benefits of various types of interventions, assessment of the administrative burden of alternatives, and participatory decision making.

3.2.2 Based on these inputs, governments and communities set priorities among different environmental problems. First, governments must decide what level of environmental quality is politically and economically feasible. Second, governments must decide what instruments should be employed in achieving its environmental objectives. If all social costs and benefits of each incidence of environmental degradation were available, then optimal levels of intervention could be determined. However, neither available data nor current methodologies allow this. Environmental objectives and instruments must be determined by linking available data and valuation of costs and benefits with such factors as the feasibility of enforcement and the intensity of public concern over risk.

3.3 *Reforming Policy*

3.3.1 The second element in the framework is to design cost-effective policy instruments that minimize costs, economize on scarce administrative skills, and are broadly acceptable to society. Environmentally appropriate policies are not inconsistent with policies that foster growth and trade, but they do attempt to correct the bias of market and policy failures that lead to over exploitation of non-priced and under-priced environmental resources.

3.3.2 Although the exact descriptions and intensities of environmental problems vary by country, the underlying causes of the degradation vary little. The causes can be traced to both market failures (such as lack of information, price externalities, public goods and free riders, and inadequate property rights) and policy failures (concerning pricing or

trade policies). Policy reforms used to improve sustainability can be clustered into three distinct groups:

- market-based policies, which use pricing, taxes, or marketable permits to modify behavior;
- regulatory or administrative policies that impose quantitative restrictions, enforce property rights, and investments (both public and private); and
- extra-regulatory approaches to pollution control, such as the introduction of public use of the court system in environmental discrepancies.

3.3.3 Most South Asian countries have developed environmental policies that draw heavily upon the second group - which is consistent with the traditional path taken by the OECD countries as well - but less so on the more innovative approaches of the first and last groups. The emphasis on regulatory policies has had relatively high administrative costs as well as relatively low economic efficiency. For both reasons, efforts to encourage reform in the other two groups promise both greater cost-effectiveness and better use of scarce administrative skills.

3.4 *Strengthening Institutional Capacity*

3.4.1 The third element in the framework is to build sufficient institutional capacity to accomplish the important steps of priority setting and policy reform. Weak institutions in Bangladesh typically lack both the technical skills and political authority to change the behaviors of organisations, households, and farmers. Weak enforcement agencies often lack both the information (such as emissions data) and means (such as consistent and fair enforcement capabilities) to implement policy. Weak legal and administrative procedures undermine the government's ability to enforce environmental compliance in almost all sectors - whether compliance by polluters to pollution standards, or access by migrant farmers to state-owned forests.

3.4.2 Political commitment to protecting the environment is increasing throughout this region and almost all countries have promulgated legislation to protect their air, water and land. Many of them have created Ministries of Environment and/or specialized agencies at the Divisional and district levels. While some of them have produced guidelines and standards in order to enforce the legislation, others are currently involved

in this process. It is at the level of implementation - monitoring environmental impacts and enforcing regulations - that government institutions are weakest. Institutional strengthening would not progress significantly in any of these areas without a long-term political commitment to environmental goals.

3.5 *Increasing Public and Private Sector Investment*

3.5.1 The fourth element in the framework is to mobilize private sector investment, in line with more sustainable pricing policies, and public sector investment, in line with environmental priorities. The overall costs of sustainable policies have been shown to be large in absolute numbers, but small in relative terms. The World Bank estimates that developing countries need to expend 2 percent to 3 percent of GDP per year to achieve greater sustainability.

3.5.2 Several issues arise concerning the financing of these investments. First, to what degree can they be made financially viable? The most financially viable environment-related investments are those that are good for both economic development and the environment, including energy conservation, waste minimization in industry as opposed to end-of-pipe investments), recycling in the urban and industry sectors, fuel efficiency in the transport sector, soil conservation, and sustainable forestry. Increased private sector investment should be promoted through pricing and policy reform, and through improved access of the private sector to information, commercial loans, supplier credits, and, under special circumstances, to government incentives.

3.5.3 Second, to what degree can public-sector investments - which are presumed to be economically viable using shadow prices, be made more self-financing? Viability issues arise in such public services as water and sanitation infrastructure, agricultural extension and research, and education and family planning programs.

3.5.4 Third, to what degree do investments under consideration address environmental problems with cross-border or global impacts, such as global warming, ozone depletion, biodiversity, and pollution of the seas? In these cases, strong arguments exist for international cost-sharing to help finance the investment costs. Such payments should not be thought of as development assistance, but as economically efficient allocations of costs and sharing of benefits. These concepts are recognized in the GEF and the Montreal Protocol.

3.5.5 Finally, to what degree do market-based policy reforms assist, through efficiency gains, to financially strengthen agencies investing in environmental sustainability? for example, price reform for stumpage fees in Indonesia would transfer significant rents now accruing to the private sector to the public sector, providing needed revenues to invest in environmental protection.

3.6 Improved Technologies and Technology Transfer

3.6.1 The last element of the basic environmental management framework is the need to foster technological improvements and efficiency gains, even when research, development and demonstration costs are not fully borne by the market. Improvements in productivity and efficiency are essential to making continued economic growth possible at a time of growing populations, urbanization, industrialization, and an increasingly degraded resource base.

3.6.2 Economic and trade openness is fundamental to technology transfer. In the polluting sectors (urban, transport, industry, and energy), "clean" technologies will be most available in those Asian countries with open trade regimes and business climates that foster foreign investment. Combinations of supplier credits, export-import financing, technology sharing agreements, royalty agreements, and joint ventures make the importation of such technologies easier and less expensive. In these markets, relatively little public sector intervention is required - except for, perhaps, information dissemination to smaller firms.

"Top-Down" Versus "Bottom-Up"

3.6.3 The framework of environmental management outlined above has got various approaches in terms of its application in the concerned sectors. In the present study two types of approaches are highlighted that would help us to implement the local policies, monitoring and enforcement or specific investment project (Table 2.1).

3.6.4 The distinction between this two approaches is not only useful in laying out the administrative plan of an environmental strategy but also reinforces the notion that a sustainable economy does not consider the environment a separate add-on, but mainstreams environment concerns at all levels. In pursuing improved environmental

management Bangladesh should include both top-down and bottom-up components in its strategy.

Table-2.1: A Framework for Improving the Environmental Management

Key Elements	National-level (Top-down approach)	Local-level (Bottom-up approach)
Setting Priorities	- National priorities, as analyzed and expressed in national environmental action plans, capital budgets and sectoral planning documents. - Openness in decision-making.	- Local determination of local priorities. Decentralized capacity to address local issues. Local participation.
Policy Reform	- Sound economic policies. - Market-based environmental policies (pricing and taxation). - Regulatory and legal reforms. - Public disclosure.	- Policies for local environmental management i.e., incentives and regulations based on the local ambient pollution and resource base. - Adequate data collection and monitoring.
Institutional Strengthening	- Capacity-building for national-level policy analysis and implementation (e.g. tax, pricing, and legal reforms). - Choice of policy instruments in light of institutional capacities.	- Capacity-building for local-level policy implementation, monitoring and consistent and fair enforcement. - Community organizations and NGOs.
Financing for Public and Private sector Investment	- Favorable business environment. - Donor lending for sector adjustment and policy reform.	- Pricing and institutional reform to increase the viability of investments favoring the environment. - Increased "commercialization" of public infrastructure.
Technology Transfer	- Open trade policies. - Favorable business environment for technology transfer.	- Public and donor involvement in selected research, development, and demonstration, particularly in the areas of agriculture and forestry. - Public information services for small and medium-sized firms.

Source : Adapted and modified from Carter Brandom & R. Ramankutty, Toward an Environmental Strategy for Asia; World Bank Discussion Paper, No.224. Washington. DC. 1997.

3.6.5 The fundamental issues that emerge after the above discussions are (a) first, in order to make a realistic and practical use of any initiative would be meaningless unless it is supported a conceptual framework which has already been applied elsewhere as a test case in practical situation. Keeping this view in mind, an attempt has been made to use this framework in the present study which would provide a guideline for solving our environmental problems in our situation with some improvement and modification. Moreover, it would also help the other concerned official and professionals in order to address the issue in a systematic and logical way as well as to the planner and policy makers to formulate and plan this aspects in future.

CHAPTER – IV

4.0 Major Reasons of Environmental Degradation

4.1.1. This chapter attempts to highlight the major reasons of prevailing environmental conditions with reference to Bangladesh. In order to discuss the issues in detail, the present chapter has been divided into two major sections. First section is based on the opinions given by the respondents and the second section involves on the Air Pollution of Dhaka City and the Global Warming and Climate Changes of Bangladesh. In discussing these two issues most of the data is drawn from secondary information found in different studies undertaken by various scholars and research organizations. Last and final part of this chapter focuses on the management steps taken by the government of Bangladesh in order to manage the environmental degradation.

4.1.2. Section - 1

4.1.3. There is a widespread impression amongst all of us that the environment is being polluted by the various anthropo-genic activities. An attempt has been made in this section to highlight the opinion given by the respondents about the prevailing environmental conditions of Bangladesh on the basis of specific issues covered in the following paragraphs.

4.1.4. Demographic and educational profile

4.1.5 As mentioned in the objectives and methodology of the present study that the respondents would be drawn from two major sections having reasonable idea about environmental issues this section provides brief demographic and educational background of the respondents covered in the study.

4.1.6 Demographic and educational background are not only very important aspect for collecting and gathering unbiased information of a given study, but also ensures reasonable accepted opinions from the respondents. Since the issue of the present study is technical in nature, authors tried to collect the opinions and feed back from those persons having reasonable idea about environmental degradation and pollution.

4.1.7 Age group of Respondents

Age distribution of the respondents of the sample covered in the present study has been classified into three age categories. The first category includes the age of

respondents from 25 to 35 years, the second category ranges from the age of 36 to 45 years and the third category includes the respondents from 46 and above. Distribution of the respondents age category is shown in the table 1.2.

Table 2.2 Distribution of respondents age

Age limit	No of respondents	Percentage
25-35	92	42.79
36-45	76	35.34
46 and above	47	21.87
Total	215	100%

Source : Field Survey

Table 2.2 indicates that the age category of the range between 25 to 35 years covers 42.79 percent of respondents and the age group of 36 to 45 consists 35.34 percent, while the age group of 46 years and above covers only 21.87 percent of respondents.

4.1.8 Level of Education

4.1.9 An attempt has also been made to identify the level of education of all the respondents covered in the present study. There is a common impression that educated people are not only concerned about the environmental pollution but also are well informed about the impact of environmental degradation. Keeping this view in mind, careful attention was given during the selection of respondents.

4.1.10 The education level of the respondents has been classified into three major groups on the basis of the level of respondents education. Distribution of education level of the respondents is highlighted in the Table 2.3.

Table 2.3. Respondents level of Education

Level	No. of respondents	Percentage
SSC-HSC	38	17.68
<u>Graduate</u>	83	38.60
Post-Graduate	94	43.72
Total	215	100%

Source : Field Survey

4.1.11 Distribution of education level of the respondents indicates that all respondents in the present study are literate. Table 2.3 shows that majority of the respondents i.e. 43.72 percent have post-graduate degree followed by graduate level 38.60 percent and SSC/HSC level of respondents is only 17.68 percent.

4.1.12 Occupation of the respondents

4.1.13 Occupational structure of the respondents has also been taken into consideration in the present study. The study of occupational background play an important role in environmental point of view. Occupational profile of the respondents is given in the table 2.4

Table 1.3 Occupational Profile

Name of occupation	No. of respondents	Percentage
Service in Public Sector	103	47.90
Service in NGO	25	11.28
Business	87	40.46
Total	215	100%

Source : Field Survey

Table 2.4 indicates that about fifty percent of respondents employed in public sector followed by 40.46 percent engaged in business and only 11.28 percent of respondents working in NGO.

4.1.14 Awareness about Environmental Degradation.

4.1.15 As indicated in the methodology of the present study that two sets of questionnaire were used for collection of primary information. One set of questionnaire was designed for local experts and professionals of environmental degradation, while other set was for selected personnel having reasonable idea about environmental activities. On the basis of this idea, an attempt has also been made in the section to assess the level of awareness of the respondents about the environmental pollution.

4.1.16 The respondents were asked to mention as to what extent and how long they are associated as well as their knowledge about environmental degradation. Based on their response, they have been classified into three major types such as (a) Partially aware, (b) Moderately aware and (c) Fully aware. The distribution of the level of respondents according to these categories is shown in the table 2.5.

Table 2.5 : Awareness regarding environmental pollution

Level of awareness	How long	No. of respondents	Percentage
Partially	2-5 years	23	10.69
Moderately aware	5-7 years	121	56.28
Fully aware	More than 7 years	71	33.03
Total		215	100.00

Source : Field Survey

4.1.17 Table 2.5 shows that majority i.e. 56.28 percent of respondents are moderately aware for about 5 to 7 years about the environmental pollution of the country. While 33.03 percent of respondents are fully aware for more than seven year about environmental degradation and only 10.69 percent of respondents are partially aware about environmental pollution.

4.1.18 Types of Pollution

4.1.19 Respondents were asked to express their opinions about the types of environmental pollution occurred in their respective areas of living. Based on their opinions and feedback, three broad types of pollution have been commonly identified.

Table 2.6 : Major types of Pollution

Types	No. of respondents	Percentage
Air	215	100
Water	215	100
Soil	215	100

Source : Field Survey

4.1.20 Table 2.6 provides a clear picture of respondents idea about the types of pollution being occurred in their respective localities. Overwhelming majority (e.g. 100 percent) of respondents have got the idea about the types of environmental pollution. Three types of pollution were identified from the over all opinion of the respondents.

4.1.21 Extent of Pollution

4.1.22 Respondents were also requested to express their opinions about the extent of environmental pollution. Table 2.7 shows the opinions about the extend of environmental pollution in Bangladesh.

Table 2.7 : Extent of Pollution (in percent)

Criteria	Highlight	Moderate	Severe	Extreme	Total
Air	18	47	37	-	100%
Water	34	42	24	-	100%
Soil	111	51	38	-	100%

Source : Field Survey

4.1.23 It indicates from the above table 2.7 that 45 percent of the respondents considered that the prevailing air of the country has been moderately polluted, while 37% percent considered that the air of Bangladesh is severely polluted and according to 18 percent the air is highly polluted . In case of water, 42 percent of the respondents expressed their opinion that the water of the country is moderately polluted, 24 point consider that water is severely polluted and 34 percent think that the water is highly polluted. While 51 percent considered that soil of Bangladesh has been moderately polluted followed by 38 percent severely polluted and only 11 percent considered that soil is highly polluted.

4.1.24 Table 2.8 provides a clear picture of the respondents idea about the extent of pollution of the country. Majority 45% 42 and 51% of the respondents considered that air water and soil of Bangladesh have been moderately polluted, while 37% 24% and 38% of respondents passed their opinion that these variables have been severely polluted . Only 18%, 34% and 11% of the respondents mentioned that these were lightly polluted. The data also revealed that soil of Bangladesh in comparison with air and water has been more polluted. These findings further indicate world famous fertile soil of Bangladesh is going to be contaminated that would affect adversely production of various types of crops throughout the country.

4.1.25 An attempt was also made to identify the Division-wise environmental trend of Bangladesh in comparison with South Asia context on the basis of fourteenth types of pollution factor. The respondents were requested to make their opinion on the previously identified major polluting factors. Table 2.9 shows the feedback given by the participants which indicates that the environmental trend of Dhaka Division is faster than the trend of other divisions of Bangladesh, and in some cases i.e. air, solid waste and loss of habitat and species are higher than that of other countries of South Asia.

Table 2.9 Environmental Trends in Bangladesh by major polluting factors

	Major Polluting Factors	Dhaka		Chittagong		Khulna		Rajshahi		South Asia	
		90-95	95-2000	90-95	95-200	90-95	95-2000	90-95	95-2000	90-95	95-2000
1	<i>Land</i>										
a)	Arable land	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
b)	Land degradation	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
5)	Desertification	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
2	<i>Forests</i>										
a)	Deforestation	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
b)	Plantation	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
3	<i>Biodiversity</i>										
a)	Loss of habitat and species.	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
4	<i>Inland Water</i>										
a)	Consumption	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
b)	Quality	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
5	<i>Marine Environment</i>										
a)	Coastal Pollution	↑	↑	↑	↑	↑	↑	↑	↑		
b)	Resources loss	↑	↑	↑	↑	↑	↑	↑	↑		
6	<i>Atmosphere</i>										
a)	Air Pollution	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
b)	Greenhouse gases	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
7	<i>Solid Waste</i>										
a)	Generation	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
b)	Management	↓	↓	↓	↑	↓	↑	↓	↓	↓	↓
8	<i>Population</i>										
a)	Growth Rate	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
b)	Poverty	↑	↑	↓	↓	↓	↓	↑	↑	↑	↑
9	<i>Human Settlements</i>										
a)	Urbanization	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
b)	Slum & Squatters	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
10	<i>Agriculture</i>										
a)	Food Security	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
b)	Agro-chemical use	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
11	<i>Industry</i>										
	Industrialisation	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Industrial Pollution	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Resource Use	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
12	<i>Energy</i>										
	Commercial Use	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Pollution	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
13	<i>Transport</i>										
	Vehicles	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
	Vehicular Pollution	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
14	<i>Tourism</i>										
	Volume	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

Environmental Degradation	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
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Source: ESCAP: State of the Environment in Asia and the Pacific, 1997.

4.1.26 In the present study, considering the time and resources only two concerns have been selected for discussion and analysis. The selected concerns are Air Pollution of Dhaka City and Global Warming and Climate Changes have been discussed for example in order to explain and demonstrate the prevailing situation in terms of Bangladesh and its impact on global and regional as well as national level.

4.1.27 *Air Pollution in Dhaka City*

4.1.28 Air is indispensable for the survival of all living organisms on earth, including human beings. It is even more important than water-without water a person can survive for days, but without air no more than a couple of minutes. Air pollution is one of a variety of manmade environmental disasters that are currently taking place all over the world. Air pollution may be defined as an atmospheric condition in which various substances are present at concentrations high enough above their normal ambient levels to produce a measurable effect on people, animals, vegetation, or materials. 'Substances' refers to any natural or manmade chemical elements or compounds capable of being airborne. These may exist in the atmosphere as gases, liquid drops, or solid particles. It includes any substance whether noxious or benign; however, the term 'measurable effect' generally restricts attention to those substances that cause undesirable effects.

4.1.29 Recently, air pollution has received priority among environmental issues in Asia, as well as in other parts of the world. Exposure to air pollution is the main environmental threat to human health in many towns and cities. Particulate emission is mainly responsible for increased death rate and respiratory problems for the urban population. This problem is acute in Dhaka being the capital of the country and also the hub of commercial activity. The other urban areas i.e. Chittagong, Khulna, Bogra and Rajshahi have much lesser health problem related to urban air pollution. The ambient atmospheric conditions have progressively deteriorated due to the unprecedented growth in numbers of motor vehicles, and continuous housing and industrial development.

4.1.30 *Air Quality in Dhaka City*

4.1.31 Air quality of Dhaka City has deteriorated both due to human activities, and natural phenomenon such as wind blown dust particles etc. There are two major sources of air pollution in Dhaka City, vehicular emissions and industrial emissions. In addition to these usual sources of fuel, spent or used rubber wheels of vehicles are also burnt, which emit black carbon and toxic gases. These are all hazardous for health. The emissions caused by these sorts of practices sometime exceed the mechanisms for the natural rate of purification of the local atmosphere giving rise to severe episodes of local air pollution.

4.1.32 Per capita energy consumption in Bangladesh is increasing with time, which affects the air quality indirectly. In Bangladesh from 1972 to 1980, per capita consumption of commercial energy increased from 24 to 32.8 kilogram oil equivalent (KOE). It grew to 41.3 KOE in 1985, and 56 KOE in 1989.-90. The total per capita energy consumption of Bangladesh in 1989-90 stood at 164 KOE, where commercial energy accounts for 34.6 per cent of the total energy used in the country. The rest is from non-commercial resources like agricultural waste, fuel wood, cow dung, etc. Table 3.3.1 depicts inter-links of pressures, states, impacts, and policy responses regarding air pollution. Detailed program responses are discussed in Section 3.3.5.

Table 3.3.1 Pressures, State, Impacts, and Responses to Air Pollution

Pressures	State	Impacts	Policy Responses
1. Urbanization	Increase in vehicle emission	Urban air quality deterioration	Bangladesh Environmental Conservation Act (ECA), 1995 and Environment Conservation Rules, (ECR), 1997.
2. Industrial Pollution	Emission of SO ₂ , No _x , Pax, Gases, Vapours	Air quality deterioration ➤ Harmful for human health. ➤ Plant quality and growth affected ➤ Corroded building materials ➤ Ecosystem disturbed	Bangladesh ECA'95 and ECR'97 More stringent enforcement of ECA and ECR enabled through capacity building of DOE.
3. Emissions from Vehicles	PM, CO, . SO ₂ , VOC	➤ Human health hazard ➤ Plant quality and growth affected ➤ Corroded Building Materials ➤ Ecosystem disturbed	Bangladesh ECA'95 and ECR'97
4. Building Construction	PM, CO, No _x , SO ₂ :	Health Hazard	The Brick Burning (control) Act, 1989 & The Brick Burning(control) Amendment Act 1992, Bangladesh ECA'95 and ECR'97
5. Building Construction	PM	Health Hazard	Bangladesh ECA'95 and ECR'97
6. Open dumping of Wastes for disposal	Gases, Vapour, Odors	Air quality deterioration	Bangladesh ECA'95 and ECR'97
7. Wood Biomass/Coal Consumption	PM, VOC, SO _x	Health Hazard	
8. Fuel quality	VOC+others	Health Hazard	

Source: SoE study Team

4.1.33 Rapid Urbanization

4.1.34 Urbanization is an inherent part of the process of economic development in Bangladesh, and its rate can be indicated by the large population growth in urban areas. In 1981 the total population in urban areas was 14.08 million, which increased urbanization, the number of vehicles is also increasing rapidly, and contributing to more and more air pollution. The major urban centers in the country are the metropolitan cities of Dhaka, Rajshahi, Khulna and Chittagong, Dhaka, the capital of Bangladesh is one of the most densely populated cities in the world. This is the center for the major economic and commercial activities, too.

4.1.35 In the urban areas ambient air quality is dependent on many factors like air movement, traffic volume, congestion, emissions from motor vehicles, and resuspended dust particles. Various other activities related to the extremely high population density also result in severe air and other forms of pollution. The salient parameters of air pollution are suspended particles, sulfur oxides, nitrogen oxides, hydrocarbons, carbon monoxide, lead, ozone and other gases.

4.1.36 Aircraft, railway engines, power plants, open-burning incineration, solid waste disposal sites, and dust particles also contribute to air pollution. Dust pollution due to road diggings, constructions and other development activities further aggravate the air pollution situation in cities. In order to accommodate the growing population, the construction of multi-storied buildings is increasing rapidly. Along with these buildings, the number of slums are also increasing. The tremendous pressure of population has made it almost impossible to maintain a clean environment in the capital city of Dhaka.

4.1.37 Emissions from Vehicles

4.1.38 Due to rapid and unplanned urbanization the total number of vehicles has increased enormously. Most of the cars, jeeps, auto-rickshaws, motorcycles, etc., ply in the cities. This has really led to a deterioration of air quality, particularly in Dhaka. Table 3.3.2 shows the different types of automotive vehicles plying in Dhaka, which indicates their rate of growth (BBS, 1997a).

4.1.39 Although the percentage of two stroke autorickshaws is around 8 per cent, some recent studies have shown that they contribute around 40 per cent of PM10 and 50 per cent of HC in Dhaka City. The second largest polluters are trucks and buses, although they constitute only 10 per cent of the total automotive vehicles in Dhaka. These cause about 44 per cent of the PM10 pollution.

4.1.40 The Department of Environment, and other concerned agencies and organizations, have identified the two-stroke engines used in autorickshaws, tempos, mini trucks, and motorcycles as major polluters. These vehicles with two-stroke engines have the worst emission levels of all types vehicles. As present, there are about 65,000 baby taxis among the more than 296,000 motor vehicles that play in Dhaka city alone.

4.1.41 In a survey conducted by the Bangladesh Road Transport Authority (BRTA), it was found that the two-stroke petrol engines are less fuel-efficient, and emit about 30-100 times more unburned hydrocarbons than four-stroke engines; and diesel engines emit 13 times more smoke than non-diesel four-stroke engines

Table-3.3.2 Year-wise trend of different types of Vehicles in Dhaka City

Date	Car/Jeep /Stn. Wn.	Scooter/ MCycle	Autorick shaw	Tempo & Others	Buses	Goods Vehicles	Total
Apr-71	16,289	9,644	3,843	888	1,531	3,640	35,835
Apr-72	17,165	10,265	3,851	1,096	1,714	4,027	38,108
Apr-73	18,018	11,486	4,680	1,086	2,078	4,424	41,772
Apr-74	19,081	12,957	5,065	1,086	326	4,711	45,226
Apr-75	20,128	14,433	5,065	1,107	2,495	4,998	48,226
Apr-76	20,606	16,582	5,161	1,110	2,534	5,309	51,302
Apr-77	22,140	17,916	5,324	1,120	2,560	5,391	54,451
Apr-78	24,223	19,754	5,688	1,168	2,753	5,672	59,258
Apr-79	25,986	19,936	5,765	1,228	2,884	5,903	61,702
Apr-80	28,692	22,946	6,318	1,587	3,493	6,631	69,667
Apr-81	31,443	26,756	6,786	1,605	3,695	7,156	77,441
Apr-82	33,840	29,372	6,902	1,630	3,843	7,566	83,153
Apr-83	35,666	32,184	6,982	1,733	4,003	7,907	88,475
Apr-84	38,124	37,782	7,098	1,849	4,255	8,325	97,433
Apr-85	41,650	46,396	7,256	1,969	4,418	9,103	110,792
Apr-86	44,167	53,454	8,147	2,303	4,542	9,610	122,223
Apr-87	47,346	58,467	10,016	3,051	4,798	10,095	133,773
Apr-88	50,660	62,733	11,100	3,733	4,892	10,740	143,858
Apr-89	53,394	66,265	12,433	4,219	5,032	11,124	152,466
Apr-90	55,548	69,063	14,015	4,508	5,217	11,246	159,596
Apr-91	58,243	72,412	15,626	4,677	5,427	11,324	167,708
Apr-92	60,529	76,537	17,736	4,779	5,695	11,958	177,233
Apr-93	63,695	79,550	19,802	5,020	5,911	12,601	186,578
Apr-94	69,058	82,739	25,523	5,327	6,385	13,727	202,758
Apr-95	75,740	85,245	32,433	5,753	6,910	15,020	221,101
Apr-96	83,965	87,282	41,153	6,285	7,538	16,559	242,784
% in 1988	35%	44%	8%	3%	3%	7%	100%

Source: BBS, 1997a

4.1.42 The automobiles on the roads are often very old, overloaded, and poorly maintained. Other old vehicles, including 40-year old trucks and dilapidated mini-buses, are also plying the city streets emitting smokes and gases. According to an assessment made by DOE, 90 per cent of the vehicles that ply Dhaka's streets daily are faulty, and emit smoke far exceeding the prescribed limit. Black smoke which is primarily unburned fine carbon particles is emitted by diesel vehicles. Table 3.3.3 indicates the low numbers of vehicles that are actually fit to be driven according to the Government standards for emissions versus the total numbers.

4.1.43 *State of Air Pollution in Dhaka City*

4.1.44 A continuous monitoring scheme is essential to evaluate air quality and for the development of any plan for mitigation of health risks caused by polluted air. The six "criteria pollutants", particulate matter (PM 10, PM 2.5), CO, SO₂, NO and ozone have to be monitored more or less continuously at a reasonably large number of locations. Other pollutants (e.g., ammonia, hydrocarbons, lead, carbon dioxide, etc.) should also be measured, where their levels are considered to be significant.

4.1.45 Again, the salient problems in the cities of Bangladesh are not like those in other developed countries. The developed countries are able to manage these problems, but in Bangladesh cost is a major criteria. There is also a general lack of expertise to evaluate the problems, or prepare cost-effective solutions, and therefore, the air quality is not yet managed effectively.

4.1.46 Monitoring of ambient air quality in Bangladesh is a very recent phenomenon, initiated on a very limited basis by DOE using high volume samplers, with the help of development partners. However, the acuteness of the problems caused by air pollution, and awareness campaigns organized by different mass media, have made the government aware of the necessity of monitoring ambient air quality. Accordingly, the Department of Environment has set up four monitoring stations at four divisional towns, namely, Dhaka, Chittagong, Khulna, and Bogra. Monitoring has been done mostly in Dhaka at various places, and samples collected analyzed for the three pollutants SPM, SO₂, and NO_x. Very limited monitoring has also been done at Chittagong for these three parameters. In addition to monitoring through these stations, the DoE conducts vehicular emission measurements in Dhaka city occasionally. In Dhaka City, the locations are: Tejgaon, Farmgate, Manik Mia Avenue, Gulshan, Lalmatia, and Agargaon. These areas represent industrial, commercial, and residential areas of the city.

4.1.47 In addition to DOE, a number of other organizations are monitoring air quality, as well as emissions from automobiles. The Department of Civil Engineering, Bangladesh University of Engineering and Technology (BUET) has been conducting ambient air quality surveys since 1995. The most recent one, conducted by the Department of Civil Engineering over a prolonged period in 1998, includes the measurement of SO₂ and NO_x

at 14 different locations of Dhaka city at different times of the day.

4.1.48 The air quality standards are different for residential, industrial, commercial, and sensitive areas. According to various studies the worst affected areas in Dhaka city include: Hatkhola, Manik Mia Avenue, Tejgaon, Farmgate, Motijheel, Lalmatia, and Mohakhali. Surveys conducted between January 1990 and December 1999 showed that the concentration of suspended particles goes up to as high as 3000 micrograms per cubic meter (Police Box Farmgate Station, 1999 December), although the allowable limit is 400 micrograms per cubic meter. The nitrogen oxides concentrations at these spots (maximum of 77 micrograms per cubic meter) were below the permissible limit. The sulfur dioxide in the air near Farmgate was found to be 385 micrograms per cubic meter, which is higher than the maximum permissible limit of 100 micrograms per cubic meter.

4.1.49 In the Tejgaon Industrial Area the maximum concentration of SPM was 1849 micrograms per cubic meter (Jan 1997), as opposed to the allowable limit of 500 micrograms per cubic meter. The maximum concentration of air pollutants in Dhaka was during the dry months of December to March, according to a survey conducted by DoE.

4.1.50 The increase in emission of different pollutants over the period 1985 to 1985 is shown in Table 3.3.5. The increase in SPM, SO₂ and NO_x emissions in Dhaka is alarming, and the air quality is obviously deteriorating with time. The air quality in the secondary cities and towns was comparatively better. The DOE has published air quality data in terms of concentrations of SPM, NO_x and SO₂ in Dhaka City. The increase in concentrations of these pollutants over the last four years is shown in Table 3.3.6 and Figure 3.3.1 shows the seasonal variation of pollutants concentration in the farmgate area in the Dhaka City.

Table 3.3.5 Emission Rate (ton/day) Of Different Pollutant Particles in Dhaka City.

Year	SPM	SO ₂	NO _x	CO	HC	CO ₂
1985	4	2	30	118	29	3037
1990	5	3	37	157	42	3885
1995	7	3	44	205	59	4828

Source: DoE, 1990

Table 3.3.7 Average Suspended Airborne Particulate Matter (ug/m) during the Collection Periods in Urban Areas of Bangladesh.

Location		Coarsen(PM 2.5 PM10)		Fine (PM 2,5)	
		Average	SD	Average	SD
Urban: Dec.'96-June '98	LRF	68.5	38.5	73.5	25.5
	MRF	61.9	42.3	41.2	22.1
	HRF	27.1	10.3	36.2	23.2
	Overall	58.4	39.9	51.7	27.6
Urban: Aug.'93- June '94	LRF	13.9	67	88.0	42.0
	MRF	42.0	28.0	34.0	16.0
	HRF	13.1	4.7	16.8	4.8
	Overall	72.0	69.3	50.7	42.9
Urban: Jan. '95-Jan. 96	LRF	63.2	23.1	35.1	9.9
	MRF	41.9	37.0	23.7	10.2
	HRF	10.9	4.9	12.2	3.9
	Overall	35.0	32.9	21.1	10.7

Note: LRF-Low rainfall period; MRF-Medium rainfall period; and HRF-High rainfall period

Table 3.3.8 Average Elemental Carbon (ug/m) in the Fine Fraction of Airborne Particulate Matter during the Collection Periods in Urban And Rural Areas of Bangladesh

Location	Overall		LRF		MRF		HRF	
	Average	SD	Average	Average	Average	SD	Average	SD
Urban: Aug-'96- Dec.'94	17.30	16.26	32.33	19.32	10.24	03.32	06.60	01.48
Urban: Dec.'96- Jun.'998	19.45	10.47	25.64	08.89	18.82	10.14	08.81	02.34
Rural: Jan.'95- Jan.'96	07.08	03.76	11.00	03.37	07.62	04.31	04.20	01.29

Note: LRF-Low rainfall period; MRF-Medium rainfall period; and HRF-High rainfall period

rural areas of Bangladesh during 1993-1998. This study was based on the realization that from the point of view of health effects, the particle size of Airborne Particulate Matter (APM) is important, as well as its suspension time in air, and hence extent of long distance transportation. In 1993, as part of an internationally coordinated research program by International Atomic Energy Agency (IAEA), BAEC started work on the analysis of the size fractionated A.P.M. Size fractionated samples were collected from both rural and urban areas of Bangladesh over a period of three years. The average mass load in the air during the low rainfall period (LRF) for both fine and coarse fractions during 1997-98 has been published. It was found that the mass loads of both the A.P.M. of particulate mass PM 10 and PM 2.5 were higher than USEPA and WHO standards.

4.1.51 In a paper by M. Khaliquzzaman, S.K. Biswas, S.A. Tarafdar, and A. Islam, at the Mid-Term Review Meeting on 'Air Pollution and Its Trends' (Singapore, October 18-22, 1999), results were presented on the average air particulate mass during the collection period in rural and urban areas of Bangladesh, and average elemental carbon in the fine fraction of airborne particulate matter in these areas. The results are shown in Table 3.3.7 and 3.3.8. Results from monitoring the quality of air in urban areas showed that the concentration of suspended particles in ambient air is many times higher than normal. The conclusion was that the PM 2.5 masses and chemical concentrations are lower in most cases compared to the corresponding PM 10, and the amount of black carbon in the APM are reduced during the high rainfall (HRF) period in both rural and urban sites by about 25 per cent and 20 per cent, respectively.

4.1.52 The Bangladesh Atomic Energy Commission (BAEC) and the Bangladesh Council of Scientific and Industrial Research (BCSIR), in association with the DOE, recently conducted research studies primarily aimed at measuring the concentration of lead in the ambient air. The Dhaka Shishu (Children's) Hospital also conducted research in association with the BAEC on the level of lead in the blood of children of Dhaka city, and also studied the possible impact of leaded gasoline on them. The Bangladesh Road Transport Authority (BRTA) is also setting up a vehicle emission monitoring station at Mirpur, Dhaka.

4.1.53 The survey conducted by the scientists of Bangladesh Atomic Energy Commission (BAEC) prior to introduction of unleaded gasoline showed that the air that city dwellers breathe on the roads contains lead in concentrations almost ten times above the government safety standard set by the DoE. The BAEC study found alarmingly high quantity of lead in the air of Dhaka city which was 463 nanograms per cubic meter-the highest in the world. Figures for lead concentrations in other major cities in the world, in nanograms per cubic meter as reported in the same report were 383 in Mexico City, 360 in Bombay, and only 70 in Los Angeles.

4.1.54 The Department of Environment also conducted a study for lead levels in three different areas of Dhaka city, from November 96 to March 97. They found the level to be 123-252 nanograms per cubic meter at Farmgate area, and 61 to 76 nanograms per cubic meter in Tejgaon Industrial area. However, during July 1999 the GoB executed the decision to provide only unleaded gasoline in the country. According to recent measurements between late 1999 and 2000 by BAEC and Eastern Refinery Ltd (ERL), the gasoline dispensed at pumps in Bangladesh is now confirmedly free of lead (Shah et. al., 1999). However, measurements on lead levels in ambient air after introduction of unleaded gasoline are still not available.

4.1.55 This is a classic example of heightened awareness campaigns initiated by civil society (see boxes).

Box-1

UNLEADED GASOLINE IN BANGLADESH- A MAJOR SUCCESS STORY

On July 1, 1999, the Government of Bangladesh executed the landmark decision of providing only unleaded gasoline. According to recent measurements by the Bangladesh Atomic Energy Commission and Eastern Refinery (late 1999 and early 2000) have confirmed that gasoline dispensed at pumps in Bangladesh is now free of lead. By going lead-free virtually overnight, Bangladesh has become a model for other countries in the developing world that are working to eliminate the harmful pollutant from gasoline.

Lead is a major environmental health hazard and is the number one environmental disease among young children in developing countries according to the World Bank, which has been providing technical assistance to the Government of Bangladesh and other countries the lead phase-out issue.

The full impact of lead poisoning on the health of children and adults is becoming clearer to most countries, and many governments have begun to take action. Bangladesh joins the ranks of countries such as the US, UK, Germany, and Thailand that have taken aggressive steps to combat lead poisoning, which has resulted in significant health and economic benefits in the countries. In developing countries, however, actions have been slower and sporadic.

Box-2

How it was done in Bangladesh

The problem of lead pollution in the capital city Dhaka was identified as early as 1980. However, little data was available until 1991 when high levels of lead in samples of suspended particles in air were reported. The chemical analysis of the samples clearly identified the presence of lead and their gasoline origin. In 1995 the need to address lead pollution was raised by different government agencies, environmental and health advocates and international organizations such as the IAEA and the World Bank. The issue received considerable attention in seminars, symposia, and the press, and the options for introducing unleaded gasoline were discussed with the Eastern Refinery, Chittagong which is the only installation producing petroleum products in the country.

Heightened awareness of the dangers of lead pollution prompted the agencies concerned with the production and marketing of petroleum products and the Ministry of Energy to begin taking action. In 1997, lead content was reduced from 0.8 g/liter in the 1980s to an average of 0.4 g/liter by blending locally refined leaded gasoline with imported unleaded gasoline. In 1998, low octane gasoline was made lead free, but high octane gasoline still contained 0.4 g/liter of lead. The increasing share of unleaded gasoline was achieved by importing only unleaded gasoline to make up for the difference between domestic supply and demand. Growing public pressure encouraged the National Environment Council to adopt a resolution to switch to unleaded gasoline in 1998, and subsequently the Ministry of Energy made the decision to go lead free last year.

Recently, Prof. Abul Husam of George Mason University, Virginia, USA, (August, 1998), detected 200 organic compounds by analyzing four air samples collected from the Shewrapara area of the city, and identified 35 of them.

4.1.56 One emerging problem is the ground level ozone pollution level in urban areas. This major component of "smog" forms when oxides of nitrogen and volatile organic compounds (VOCs) chemically react in warm temperatures and sunlight. Ground level ozone can create a serious health hazard. It can exacerbate the symptoms of asthma, cause significant damage to lung cells, and reduce the ability of lungs to fight infection.

4.1.57 *Impacts of Air Pollution in Dhaka City*

4.1.58 Areas in the South Asian region undergoing rapid urbanization and industrialization are now experiencing unacceptable air quality, and rapid growth of vehicle numbers. A person inhales an average of about 16 m³ of air per day, and thus its quality is obviously a concern for humans, as well as other living beings. Acceptable ambient air quality is also required for preserving structures and historical monuments. Air pollutants lead to acid rain falling on forests, crops and aquatic ecosystems, which compromises their condition. The country has a few studies on the impacts of air pollution on human health, and virtually no study on its impacts on ecosystems, livestock, and vegetation. The following Table 3.3.9 shows the pollutant sources and the impacts of air pollution in a broader context, highlighting international findings.

Table 3.3.9 Pollutants, Sources, and the Impacts of Air Pollution

Pollutants	Sources	Impacts
1. Suspended Particulate Matter(SPM)	Motor vehicles Wood-burning Industrial activities	Respiratory infection Throat irritation Aggravated asthma
2. Sulfur Oxides	Vehicles (diesel-using) Factory emissions	Affect respiratory tract and permanent lung damage Bronchitis. Emphysema, Asthma, Plant growth reduction, Beans and tomatoes with bleached colorless sports
3. Nitrogen Oxides	Vehicle motors Power stations	Respiratory diseases Chest congestion , Eye irritation, Headache, Suppressed growth of beans and tomatoes, Increase abscission and reduce yield in citrus plants, Spots and mild necrosis on cotton and bean plants, Acute leaf failure
4. Lead	Windblown dust, Vehicles, Coal & wood-burning, Metal production, Phosphate fertilizer	Affected central nervous system, Renal damage, Hypertension, Children are 3 times more at risk than adult, Effects on plants
5. Carbon Monoxide	Petrol vehicles (2 and 3 wheelers)	Reduces the ability of blood to carry oxygen Exacerbates heart disorders
6. Aromatic Hydrocarbons	Unburned fuel from diesel engines	Drowsiness, Eye irritation
7. Benzene	Unleaded petrol, Emitted from catalytic converters	Carcinogen, Affected central nervous system

4.1.59 From the above discussion following possible measures could be taken for mitigating air pollution:-

- Promulgation of new laws and modification of old laws to strengthen the controlling authority.
- Banning import of two-stroke engines
- Phase-wise plan to ban the two-stroke engines
- A suitable set of standards of emissions for two-stroke engines and other vehicles to be promulgated as the current standards are not appropriate
- Effective enforcement of vehicle compliance to these standards has to be ensured

- There should a provision for instant polluters pay
- Regular monitoring of the ambient air quality and vehicular emissions
- GOB decision on mandatory use of 2T(JASOFB) should be strictly enforced
- Traffic management should be stringent and effective operational mechanism for implementation
- Public awareness campaigns and motivating people through promotional activities
- Increase the number of public vehicles(double decker buses) to reduce the number of private cars.

4.2 SECTION – II

4.2.1 Impact of Environmental Pollution

4.2.2 In this chapter an attempt has been made to identify the major ecological concerns and environmental challenges facing Bangladesh and suggest possible measures to combat them. First, it deals with the impact of the major of environmental degradation and its broader implications, as well as the means and ways to face the challenges. For convenience, it has been divided into three major levels, viz., global regional and national challenges.

4.2.3 Global Challenge

4.2.4 Today there is no doubt as to the warming of the world. The process has already been started but the uncertainties remain in it. According to the report presented by the scientists of the UN commissioned IPCC (Inter-governmental Panel on Climate Change), among the principal sources of greenhouse gases, carbon dioxide (55%, annual increase 0.5%) tops the list originating from fossil fuel burning and deforestation. This is followed by chloroflouro-carbons (CFC) and related gases, viz. HFCS and HCFCs (24% annual increase 4%) which originates from various industrial uses, methane (15%, annual increase 0.9%) which originates from rice, enteric fermentation and gas leakage and the rest is by nitrous oxide (6%, annual increase 0.8%) which originates from bio-mass burning, fertilizer use and fossil fuel combustion¹⁰. On the basis of computer simulations of climate, the scientists predicted that if greenhouse gas emissions continue at their present rates, average temperature in the world will rise by a full degree celcius within the next thirty years¹¹.

4.2..5 The low lying developing countries are most vulnerable to such threats of which

Bangladesh would be among the worst victims. The Bengal delta, resting at the confluence of the Ganges, Brahmaputra and Meghna rivers, is the world's largest such coastal plain and comprises about 80% of the country's total area. Bangladesh is subject to annual floods both from the rivers and from oceanic storm surges. The average height of the country is estimated to be only 7.6 meters above the present sea level. A three feet rise in sea level would inundate 11.5 percent of the country's land area, displace 9 percent of the 110.8 million people and threaten 8 percent of the annual GDP¹¹. Approximately 8.5 percent of Bangladesh's agricultural output comes from the areas that would be flooded. The loss of land to inundation would also reduce the fish catch, which now supplies 80 percent of the animal protein. Approximately 7.5 percent of the major fishing centers would be flooded out¹².

4.2.6 A study made by a group of researchers headed by John D Milliman at the Woods Hole Oceanographic Institute, developed three possible scenarios under two estimates of sea level rise: a maximum of 13 centimetres by 2050 and 28 centimetres by 2100 which they termed as "best case scenario" and a maximum of 97 centimetres by 2050 and 217 centimetres by 2100 which they termed as 'worst case' and "really worst case" respectively¹³.

4.2.7 The 'third scenario' is referred to as the 'really worst' case. It assumes that excessive groundwater pumping from irrigation and other uses accelerate natural subsidence. To calculate the economic implications of these cases on both Egypt and Bangladesh, Milliman and his colleagues assumed present day condition, such as the estimated share of the total population now living in areas that would be inundated and share of economic activities that are derived from them¹⁴.

4.2.8 Taking these factors into account, Milliman and his colleagues estimated that the sea level will rise 209 cm along the Bangladesh coasts by 2050. Half the country lies at elevations of less than 5 meters. Loss of land under 13 centimeter rise in the 'best case' scenario is minimal – less than 1 percent of the country's total. In the 144-centimeter rise in the 'worst case', however, 16 percent of the nations land would be lost. In the 'really worst case', local sea level rise would be 209 centimeters and 18 percent of the habitable

land would be under water¹⁵. Table -I shows estimates of loss of land as a result of 1 and 3 meters rise in sea level. As a result, more than 17 million people would become environmental refugees. By the year 2100, the 'really worst case' scenario shows that 35 percent of the nation's population will be forced to relocate. The economic effects will be widespread, because 31 percent of Bangladesh's gross national product is realized within the land area that will be lost.

Table 3.1. Effects of Sea Level Rise on the Bengal Delta Under Two Scenarios

	Global Sea Level Rise	Local land Subsidence (centimetres)	Local Sea Level Rise	Loss of habitable land (Percent)	Population Displaced	Loss of Gross National Product
Bangladesh 2050						
Worst case	79	65	144	16	13	10
Really worst case	79	130	209	18	15	13
Bangladesh 2100						
Worst case	217	115	332	26	27	22
Really worst case	217	230	447	34	35	31

Source : Joha D. Milliman, et al. "Environmental and Economic Impact of Rising Sea Level and Subsiding Deltas. The Nile and Bengal Examples", Woods Hole Oceanographic Institute, Woods Hole, Massachusetts, unpublished paper, 1988, Cited in Jodi L. Jacobson, "Environmental Refugees : A Yardstick of Habitability", World Watch Paper, No. 86, Nov/1988, p.34

4.2.9 Sea level rise will enhance the process of shoreline erosion. Prof. Bruun of Technical University of Norway in a study showed that shoreline erosions are of the order of 0.3 meter per year. If sea level rises 1.5 meter by the year 2100, shoreline recession will be about 150 meters. Vast amount of low lying areas of Bangladesh will be flooded. This will add to the existing process of erosion due to tidal action which is the general reason of erosion in the coastal region of Bangladesh. It may be mentioned that during 1940-1963 the island of Sandwip suffered erosion in the order of 138 km, Hatia 96 km, Bhola 213 km and Chittagong coast 68 km.

4.2.10 A rising sea level will definitely intensify the process of coastal erosion in Bangladesh. According to the survey made in 1780, the island of Sandwip was of 417 sq miles. But its size reduced to 222 sq miles in 1916 and in 1984 it became 92 sq miles. During the last 200 years about 325 sq miles area of the island have been submerged¹⁶. From 1940 to 1963 about 3.5 kilometers area of the island of Bhola eroded. It was 3

kilometre during 1963 to 1984. An average 150 metre area of land eroded per year from 1940 in Bhola. The island of Hatia consisted of an area of 394 square miles in 1640 and according to the map of 1684 it was of an area of 184 square miles. Today the size of the old Hatia is only 8 square miles¹⁷.

4.2.11 Milliman notes that cyclones originating in the Bay of Bengal before and after the rainy season already devastated the southern part of Bangladesh on a regular basis. An average of 1.5 severe cyclones now hit the country each year. Phillip L. Woodworth of the Institute of Oceanographic Sciences (UK) observed that the major effect of a sea level rise in Bangladesh region is the increased likelihood of storm surge damage rather than simple flooding¹⁸.

4.2.12 Generally, cyclones develop in the southern Bay of Bengal where depressions develop and move north to the coasts of India, Bangladesh and Burma mainly during April-June and October-November. The damaging effects of cyclones are caused by the increased water level due to wind set up and low barometric pressure in combination with strong winds. In comparison with the neighbouring countries, cyclones approaching the coast of Bangladesh are more harmful. The reason is the funnel shape of the Bay of Bengal with Bangladesh at the bottom of the funnel where the waters are piling up. In addition, the near sea level in the eastern estuary increases during the monsoon by about 1 metre as a result of upland discharge, strong wind from the south-west and a low barometric pressure¹⁹. Therefore, it can easily be concluded from these situations that a rising sea (global rise + local rise due to local subsidence and coastal erosion) and a warmer climate would increase the frequency and intensity of cyclones and storm surges in Bangladesh.

4.2.13 It is even observed by experts that one of the reasons of the cyclone of April, 1991 which took catastrophic turn in terms of unprecedented loss of life and property, is the rising sea and warmer climate. Usually storm surges as much as 6 meters higher than normal can reach as far as 200 kilometers inland. But the height of the surge was 15 to 20 meters this time. Total property loss from the storm surges in the region between 1945 and 1975 has been estimated at \$ 7 billion, and some 300,000 lives were lost in 1970

when surge covered an estimated 35% of Bangladesh's land area²⁰. In the 1991 cyclone alone about 125,500 people died according to government assessment, while the non-government assessment is about 500,000. About 15 million people were affected of which 1 million people became homeless and 10,000 fishermen went missing. The financial loss were of such an extent that it was not possible to ascertain the exact amount. However World Bank's estimate is about \$2.4 billion²¹.

4.2.14 Challenges at the REGIONAL AND National Level

4.2.15 Within the boundary of the country too Bangladesh is exposed to various challenges because of fast rate of environmental degradation. The booming population and chronic poverty of the country are seriously affecting the limited natural resources as well as the ecological balance. Overuse and improper use of the limited natural resources have already had their impact on the welfare of millions of people, threatening their food security and quality of life and impeding the development rise in global sea level and a delta regional in equilibrium. The second scenario, called the 'worst case', assumes the maximum rate of sea level rise and the complete damming or diversion of the river system draining into the delta.

4.2.16 At the regional level too, Bangladesh is exposed to environmental challenges. Bangladesh is the lower riparian of the common rivers shared by the Himalayan basin states. Development activities in the upper reaches, like various flood control and irrigation projects on the common rivers as much as the continued deforestation process in the Himalayas and their impact on the environment, agriculture and the economy of Bangladesh significantly influence the relationship among the co-riparian states.

4.2.17 The Ganges river collects water from the southern slopes of the Himalayas, the Brahmaputra river drains the northern slopes of the Himalayas and the Meghna river arises in the north eastern hills of India bordering Bangladesh. These three rivers together with numerous others combine to carry the world's largest sediment load of 1-2-4 billion tons per annual to form the deltaic plain of Bangladesh. Because of this flat terrain the county is very much prone to annual flood. Main sources of flooding are spillover from rivers, drainage congestion of local run off due to this extremely flat nature of

topography, storm surges and tidal blockage. Deforestation in the water shed areas further intensify the problem already existing.

The various domestic factors contributing to environmental degradation are discussed in details as follows :-

4.2.18 Socio-Economic Factors

4.2.19 Population

4.2.20 Population is the most important factor in determining the ecological balance in the developing countries like Bangladesh. Growing population means growing demand on natural resources. High population density has contributed to the overuse of land, forest, fisheries, energy, water, etc., From 1951 to 1981, the population of Bangladesh doubled from 44.2 million to 89.9million. Present population is estimated to about 110 million with projections of 128 million by the year 2000. A population growth rate of 2.17% is putting tremendous pressure on already limited resources.

4.2.21 Agriculture

4.2.22 Agriculture and fisheries are the main sources of livelihood of the people (60.4%), followed by manufacturing (9.8%) and construction (3.1%). But there is sharp and continuous decline of the most vital economic sector, i.e., agriculture. Growing fragmentation of land tenancy, share cropping, unscientific farming system, uncertain and inadequate rainfall, lowering ground water level etc., have contributed to the reduction in per acre yield as well as profit from this sector.

4.2.23 Education

4.2.24 Education is very important in sound resource development but in Bangladesh literacy rate is one of the lowest in the world averaging 29.2% of the population. Moreover, there is disparity between urban literacy rate (34.8%) and rural rate (17.0) and between male (39.7%) and female rate (18.8%). Low level of literacy is very detrimental to successful implementation of social programmes like family planning, health and nutrition. Under these conditions awareness of the people on environmental issue is low and public participation in, or contribution to conservation is limited.

4.2.25 Health

4.2.26 Most health problems that relate to the environment arise from contaminated

water, either ground water or surface water. In urban areas only 26% of the households have access to tap water and the rest depend on canal, pond, river, etc., which are highly polluted. Supply of drinking water from tubewells is 53% in rural areas and the rest is from river, pond, canals whose water quality is far below drinking standard. All the solid wastes in the urban areas are thrown on the water bodies in an untreated form, so also the toxic chemical wastes and organic wastes.

4.2.27 Urban and Rural

4.2.28 Both in urban and rural areas, water bodies are the natural toilet to people because of acute shortage of sanitation system. As a result, diarrhoea, malaria and other waterborne diseases are spread very rapidly. This becomes further intensified during flood and other natural disasters. Urbanization has various environmental as well as socio-economic consequences. The census of 1981 revealed that 1.55% of Bangladesh's population was urban i.e. 15 million people in 500 urban centers. But this number is increasing at the rate of 6.5% which is putting additional stress upon an already strained system. It also signified a tremendous increase for a country that had less than 3% urban population at the beginning of the present century.

4.2.29 During 1950s, Bangladesh experienced a 45% increase in its urban population and in 1974-81 an increase of 115% with the projection of 35-40 million people by the year 2000 i.e. an increase of over 20 million people. Providing space for the newly emerging urban centers has already put pressure on agricultural land. Forest resources and fisheries in the vicinity of the urban centers are becoming over-exploited. Housing shortages cause urban dwellers to live in high density units often without proper municipal facilities. The density of population in Bangladesh is 700 per sq. km. but the number is 1300 in case of Dhaka. Living conditions among the urban poor are directly linked to their deteriorating health and nutritional states. Housing for migrants to urban slums consists of the barest necessities only. There is acute shortage of drinking water, proper sanitation and air circulation. These are closely linked to the spread of waterborne diseases. Continued filling of canal and ponds in the urban areas to create more land is also reducing access of the urban poor to water for washing and other uses. The incidence of diseases among them is high. The overall infant mortality rate in a central

slum area of Dhaka is 152 per 1000, compared to the national average of 124 per 1000.

4.2.30 Water

4.2.31 Water is highly important in maintaining ecological balance. The rain water and the flood water seep into the soil to enrich the underground aquifers. Haors and beels apart from providing spawning ground for fish and winter habitat for the migratory birds, act as a 'sponge' to absorb the water and slowly release it during dry season recharging reservoir and ground water level. The river waters carry a huge volume of sediments which during the flood are spread by the side of the river and settle down after the flood water subsides, thus fertilize the soil. Another important function of water, both on the surface and underground is to push back the intrusion of saline water inland.

4.2.32 Bangladesh is generally known as an area of abundance of water. However, due to seasonal variation in hydrological conditions there is too much water during monsoon whereas too little during winter. Usually 18% of the country is submerged during normal flood, while 36% of the country, equivalent to 60% of the net cultivable area, are submerged during severe flood years. On the other hand, during dry season the water becomes scarce not only on the surface but also in the ground. Peak discharge during monsoon season for the Brahmaputra, for example, is 121,000 cubic meters per second which drops to 3,650 in the winter.

4.2.33 Due to the increased demand for foodgrain production, domestic and industrial water supply and better living environment, the utilization and control of water for irrigation, water supply and drainage and flood protection has drastically increased in recent years. These consist of many highly local demands without a cohesive planning based on overall national requirements, hence likely to result in undesirable and even disastrous impact on the river system. Moreover, embankments, road construction, drainage channel, etc. have all changed the normal flow pattern affecting fish reproduction. The direct loss of fish harvest has been estimated at 37 kg/ha.

4.2.34 Reduced water flow, both on surface and groundwater, allowed saline water to intrude inland. Presently, over 10000 square miles of agricultural land, i.e., 2.8 million hectares are affected by salinity. Saline intrusion in the north-western region which is mostly dominated by the Ganges system has been shown in the previous chapter.

Salinity in the Meghana estuary is not a problem at the moment but it is feared that the salinity limit may advance further inland if fresh water supply is reduced.

4.2.35 Another major source of water pollution is the disposal of wastes in the water bodies in untreated form. The large volume of effluent generated daily by polluting industries in urban areas such as Dhaka, Chittagong, etc., contain both degradable and persistent organic and inorganic wastes and toxic metallic compounds and chemicals. Most of the country's rivers are affected by this type of pollution. Pollution by toxic chemicals and industrial wastes further aggravate during floods.

4.2.36 Oil is another major pollution of the marine system. Nearly 1,000 ships, including 50 oil tankers ply the water of Chittagong harbor every year, not to mention countless small crafts. All these ships are permitted to discharge ballast water and bilge washings, a policy which makes Bangladesh an exception to world maritime practices. The ports do not provide any facilities to dump those wastes. The country also does not possess adequate petrolling system. As a result, toxic wastes from developed countries could be dumped in the Bay of Bengal without notice. Another dimension of the problem is that since Bangladesh has not ratified most of the Conventions and Protocols dealing with pollution she cannot take any action even if any accident or spillage of oil occurs within her territorial limit.

4.2.37 *Land use and Agriculture*

4.2.38 Unsustainable land use practice and unscientific cultivation methods are having their impacts on the environment negatively, through soil erosion and reducing soil fertility. Various flood control, drainage and irrigation projects are affecting other sectors like fisheries. During dry season, surface water flow reduces and numerous deep tubewells are sunk in an attempt to ensure year round irrigation but this has contributed to the lowering of ground water level.

4.2.39 In many areas, where ground water have lowered greatly, agriculture has to depend on rain water during monsoon. As a result, the land is left exposed for the other half of the year. The top soil of this dry land is blown away by wind together with the nutrition of the soil. When rain water flows on such exposed land, it not only washes away the top soil but also helps the minute soil particles to enter inside the land and

create an inaccessible layer sealing off all the gaps. Since the rain water cannot enter that inaccessible layer, all the rain water flows over it very quickly taking away all the top soil. In this way, vast areas of the Barind region are facing soil erosion at an incredibly fast rate. Weather in that area has also become extreme as in desert, i.e., dry and hot during daytime and cold at night. Dust storms have also been reported.

4.2.40 Slash and burn agriculture is being practiced in the Chittagong Hill Tracts. However, the long time required between cultivation to allow the forest to regenerate is no longer possible because of growing population pressure and need for land. The exposed slopes are subject to increased soil erosion.

4.2.41 Fragmentation of land is another contributing factor to soil erosion as well as declining soil fertility. Side by side with fragmentation, increasing landlessness is inducing people to destroy forests, wild habitats and to get hold of the marginal land.

4.2.42 Forest

4.2.43 Forest is very important in maintaining the balance of nature. Forest provides valuable wild-life habitat, controls erosion and is the primary source of fuel wood for domestic energy. It also provides protection from storm surge and cyclons on the coast. To maintain the balance of the nature there should be at least 15% to 20% area of forest land of the total land area of a country. But in Bangladesh as already mentioned actual forest cover is approximately 1 million hectares i.e. 6% of the total land area. With a population of some 120 million people. Bangladesh has less than 0.02 ha. of forest land per person, one of the lowest such ratios in the world. It is primarily the result of dramatic increase in population and their need for land and fuel.

4.2.44 Hill forests are very important for the protection of watershed areas. The Kaptai hydropower project has dammed the river Karnaphuli to create Kaptai lake. The forest conserves the hydrologic cycle maintaining water flow for the dam and preventing soil erosion from silting in the reservoir. But the creation of dam opened the area of the settlers and forced the villagers to move up the hillsides. Over the years, forest areas have been shrinking and degrading due to shifting cultivation, encroachments, land alleviation, fire

and logging. As a result, Kaptai lake is silting up. It is believed that one of the reasons for the recent cyclone and the storm surge to cause so much damage is the large scale deforestation in the Cox's Bazar and Hill Tracts areas.

4.2.45 The Sundarbans in Bangladesh together with the adjacent Indian Sundarbans form the largest mangrove ecosystem in the world. The importance of an intact Sundarbans ecosystem is considerable as it protects human settlements in adjacent areas from the ravages of cyclones. The Sundarbans ecosystem is also important in protecting adjacent inland groundwater from salinization. This is vital to agricultural production and drinking water supplies in these areas. Moreover it is a huge reservoir of oxygen, consumes pollutants of the air, acts as a moderator of climate and protect the coastal area from erosion. It is a wonderful assemblage of flora and fauna, home to the world's largest population of Royal Bengal Tiger and the globally endangered estuarine crocodile.

4.2.46 Decreased freshwater inflow and increased salinity as well as water pollution on the one hand, and over-exploitation of the forest resources on the other, have produced such serious consequences that this delicate ecosystem is threatened to destruction. Unless appropriate measures are taken this may totally imbalance the ecological equilibrium of the country of rare and endangered species and their habitats.

4.2.47 All these factors are denying the development of the country on the one hand and making the country exposed to all sorts of natural calamities on the other which destabilize the infrastructure of the country. Hence the country is subject to greater insecurity stemming from within the boundary of the country itself. Successive governments have met immediate needs often overlooking long standing consequences. Every sector is linked with several other sectors which requires a comprehensive development planning and this has to a great extent been lacking in Bangladesh. It frustrates the development objectives and further damages the environment.

4.3 Section-III

4.3.1 National Environment Management

4.3.2 The Government of Bangladesh being a signatory of major protocols, and conferences held under the aegis of United Nations Environmental Programme (UNEP), starting from UN Conference on "*Human Environment*" held at Stockholm in 1972 to "*Earth Summit*" at Rio-de Janeiro in 1992. Following the commitment made in those protocols and conferences Government of Bangladesh has taken a few initiatives for sound environmental management conservation of natural as well as ecological resources. Formation of Ministry of Environment and Forest (MOEF) in 1988, Department of Environment (DOE) in 1989 and Formulating National Environmental Policy in 1992 and Environment Conservation Act in 1995 as well as National Environmental management Action Plan (NEMAP) are the most important initiatives taken by the Government. This section attempts to highlight these initiatives in brief.

4.3.3 National Environmental Policy-1992

4.3.4 Appreciating the need for economic development on the basis of sustainability and also the consideration that economic development policies should integrate the objectives of poverty alleviation, sound environmental management and conservation of natural as well as ecological resources, Government of Bangladesh formulated the National Environmental Policy in 1992. The objectives of the policy are:-

- Maintaining natural ecological balance and ensuring sustainable development of the country through the development and conservation of the environment;
- Saving the from natural disasters;
- Identify and control of all types of activities that pollute and degrade the environment;
- Ensuring environmental friendly development in all sectors;
- Ensuring sustainable and environmentally sound management of the natural resources; and
- To be actively associated, as far as possible, with all institutional initiatives related to environment.

4.3.5 Environment Conservation Act - 1995

4.3.6 Subsequently Government of Bangladesh formulated Environment Conservation Act in 1995 as an improvement of environmental pollution control ordinance 1977. This

Act empowers the government's implementing agency like Department of Environment to prevent control and abate environmental pollution. The main objectives of Environment Conservation Act '95 are:-

- (i) Conservation and improvement of environment and
- (ii) Control and mitigation of environment pollution .

The salient features of the Act are: -

- Declaration of ecologically critical areas and restriction on the operation and process which can be carried out or can not be initiated in the ecologically critical areas.
- Regulation in respect of vehicles emitting smoke harmful for the environment.
- Environmental clearance
- Regulation of the industries and other development activities discharge permit
- Determination of standards for quality of air ,water, noise and soil for different areas for different purposes.
- Determination of standard limit for discharging and emitting waste.
- Formulation and declaration of environmental guidelines.

4.3.7 This law empowered the Director General of DOE to initiate among others steps to prevent probable accidents which may cause degradation and pollution of environment adopt safety measures and determine remedial measures against such accidents advice regarding the environment friendly handling storage, transportation, movement of hazardous substances, conduct drinking water quality surveillance programme. The emission of smoke from motor vehicles detrimental to environment is regulated and monitored under this law. The law provides that no industrial unit/project shall be established /adopted without obtaining environmental clearance from DOE, for holding public hearing to settle any imminent degradation of environment.

4.3.8 The Environmental Conservation Act '95 requires, inter alia, all types of socio-economic development activities which include various industrial enterprises and undertaking of projects should take environmental aspects into due consideration and obtain prior environmental clearance.

4.3.9 The Environmental Conservation Rules-1997

4.3.10 In order to operationalize the Environmental Conservation Act properly in the field as well as in the concerned agencies, Ministry of Environment and Forest introduced the Environmental Conservation Rules in 1997. Categorized various industries and

projects into four categories on the basis of their expected pollution loads and proposed location. These are (1) Green (2) Orange-A (3) Orange-B and (4) Red. Industries or projects belonging to categories Orange-B need to conduct Initial Environmental Examination(IEE). Industries or projects belonging to categories Red need to conduct Initial Environmental Examination (IEE) and followed by Environmental Impact Assessment (EIA).

4.3.11 The Rules include standards for air, water, noise and odor, vehicular emission, domestic and industrial wastewater discharges, etc. specific Standards are given for industrial effluents and gaseous emissions. Other environmental legislation include Factories Act, 1965. The Factory Rules, 1979, Shops and Establishments Act, 1965, Radiation Protection Act, 1993.

4.3.12 Environmental Court

5.2.13 For affecting the compliance of environmental practices the Government of Bangladesh has decided to setup separate courts for trial of offences relating to environmental violation. The formulation of court is under process. It is worth mentioning that in 1998 the Government of Bangladesh by an executive order has prohibited hunting of wildlife for 5 years.

4.3.14 National Environment Management Action Plan (NEMAP, 1991-95)

4.3.15 The National Environment Management Action Plan (NEMAP) is plan of the Government of Bangladesh prepared by the Ministry of Environment and Forest (MOEF) in consultation with people from all walk of life. It is a pro-active and pelvic consultative process where people have one opportunity to define the environmental issues of concern, priorities and suggest solutions. More specifically, NEMAP constitutes a synthesis of the perception of the government and the people of Bangladesh regarding environmental issues and what need to be done to address them. **NEMAP** has got the following objectives:-

- a) To identify the key environmental issues of concern to Bangladesh.
- b) To suggest measures required to halt or reduce the rate of environmental degradation and improve it as well as conserve the habitats and biodiversity.

- c) To contribute towards promoting sustainable development and quality of life.
- d) To implement the plan not only by the government of Bangladesh but also by the NGOs, communities and individual citizen as well.

4.3.16 In order to make the NEMAP document representative of all classes of public opinion, the whole exercise was not only done on different phases but also several techniques were used in the process. The first phase was carried out in 1992 by national consultants who identified certain areas of concern. While the second phase was undertaken in 1993 by national and international consultants who prepared on list of projects in consultation with different ministries and government agencies to prioritize the sectoral issues. The third phase was carried out in 1994 through a series of discussion and workshops in which people from all walk of life participated to ascertain their own environmental concern and prioritize them so that there could be reflected in the action plan.

4.3.17 NEMAP an Innovative model

4.3.18 The NEMAP process is the first of its kind where an effort of public participation has been undertaken prior to any major planning. It is an innovative approach in three ways (i) for going to people to get their opinion prior to developing the plan (ii) for the cooperation between government, NGOs and private sector for developing a truly national plan and (iii) for the use national resource persons in all stages of development without any expatriate consultants.

4.3.19 This NEMAP is a pioneer action plan document in the history of environmental management and has become the flagship success story in participatory consultation not only in Bangladesh but also in the world. It has succeeded in overcoming party political barriers. Present Government has acknowledged NEMAP as the key environmental policy framework of Bangladesh.

4.3.20 Although the action plan might be far from perfect and has presumably overlooked certain important issues and areas, nevertheless it has become a model for Government and NGO collaboration among the national and international development partners.

4.3.21 Rationale for Innovative Model

4.3.22 In order to promote, protect and improve natural resources and to link all developmental activities with environmental for improving in quality of life the NEMAP has strongly recommend the following issues of concerns to :-

- (i) Ensure active participation of all class of people in environmental management.
- (ii) Preserve, protect and develop the natural resource base.
- (iii) Achieve sustainable development process and can not be considered in solution from it.

4.3.23 Planning To Action

4.3.24 The National Environment Management Action Plan (NEMAP) has been released by the MOEF after review by all the main participants. It is now about to move from the planning phase to the implementation or action phase. In making this transition from planning to action a number of considerations need to be taken into account which are described below.

4.3.25 Comprehensive Plan

4.3.26 As it has already mentioned earlier that the main characteristics of NEMAP which separates it from most other traditional planning exercises was its participatory nature. Thus, in a very real sense the NEMAP has a claim to represent the 'Nation' as a whole rather than just the Ministry of Environment and Forest or even the government of Bangladesh alone. Therefore, the actions that are recommended under the plan were meant for all the actors in the nation including the MOEF, other government ministries, NGOs, educational establishments, private sector, lawyers, students, citizen groups and even individual citizens to choose and implement as they see fit.

4.3.27 The NEMAP document is therefore to be seen not as a prescription of a single set of actions to be implemented by one or two government agencies (which is the traditional model of action plans), but more like a "Menu" of a large number of actions from which different organizations (and indeed even individuals) including MOEF and other government ministries, can choose the ones which match their particular interest or priority.

4.3.28 *Priority Setting*

4.3.29 This raises the issue of "*priority setting*" which seems to cause concern in some quarters. It has been said that the NEMAP failed to set priorities and has simply listed a large number of different actions. Such criticism is in fact a misreading of the intent of the NEMAP process and the current document. It should be borne in mind that NEMAP is above all "*process*" rather than a single "*product*" that is cast in stone for all time and that must be adhered to by everyone. It is much more of an evolving process taking place in phases in which the phase just ended has brought out a large number of environmental concerns and issues as prioritized by the people through a consultative process. It is up to the different actors, both government as well as non-government, to set their own priorities as to which particular action or actions they would pursue. Thus for example a University or training institute interested in doing something would obviously prioritize the training related components, media related organizations would prioritize awareness raising actions, etc.

4.3.30 (a) *By Government*

4.3.31 For the government to choose its priorities it needs to carry out some further analysis along two lines, namely to look at (i) the economic cost of the different actions and (ii) the institutional arrangements for carrying them out. This has been done by the team of expatriate and national consultants and the draft is ready. This economic analysis is important to enable the government to assess the economic costs versus the benefits of any proposed actions. The innovative element in the economic analysis currently being done is an attempt to cost the environmental degradation by not taking action now compared to the cost of taking action.

4.3.32 The institutional analysis relates to the role of the Ministry of Environment and Forest and its two subsidiary departments namely the Department of Environment and Forest Department respectively. Moreover, the role of other sectoral ministries and government agencies have environmental impacts such as industries, energy and mineral resources, water resources, agriculture, fisheries and livestock, land, etc

4.3.33 (b) By Donors

4.3.34 The NEMAP document in its current incarnation is a nationally developed plan of action which has been agreed amongst the national stakeholders, both government and non-government. Since most development activities in Bangladesh are usually supported financially by bilateral or multilateral donors (or "development partners" to use the politically correct term) it is only natural that the donors would express interest in supporting certain actions emanating from NEMAP. Here again it is for the donors to carry out their own analysis and prioritization process and decide which actions they would wish to support. Some donors have already expressed interest in supporting particular aspects such as strengthening of the DOE, support of NEMAP secretariat in MOEF, strengthening environmental capabilities in other line agencies, assisting NGO environmental activities or environmental awareness programmes etc. In the coming months it is expected that the different agencies, both government and non-government, will develop their own priority actions and share those at a workshop with government, NGOs, other professional groups and donors. This workshop would then acts a kicking-off event for the action phase to be undertaken by the different actors.

4.3.35 (c) By MOEF

4.3.36 The role of the NEMAP secretariat in the MOEF would then be to act as a clearing-house of information on NEMAP related activities being undertaken by the different government as well as non-government actors. They would collect information and act as a repository of such information as well as disseminate the information (perhaps through a regular newsletter) to let people know what is happening.

4.3.37 At some point in time over the next few years (perhaps after three years or so) another round of consultations and data collection could be carried out in order to ascertain : (i) whether or not there had actually been any change in the environmental situation of the country, (ii) whether people perceive any such change (for better or worse) and (iii) whether the involvement of people in the NEMAP process could be actually sustained through its action phase.

4.3.38 NEMAP is pioneering initiative in developing an action plan based on issues and

concerns identified largely by the people as well as the agencies of GOB and NGOs. It efforts to constitute a synthesis of the perception of the government and the people of Bangladesh regarding environmental issues and what needs to be done to address them.

4.3.39 In the ultimate analysis it should be recalled that the objective of the whole NEMAP process is to improve the actual environmental situation of the country, in order to halt any on-going environmental degradation and where possible improve the environment. Make people feel that improving and protecting the environment is their responsibility and provide scope for people to genuinely participate in the process of environmental improvement. The test of the exercise- will be if visible progress can be discerned in meeting these objectives within the next possible time.

4.3.40 As environmental concerns encompass all sectors of life and economy it has therefore been recognised that, multi-disciplinary approaches are needed for the formulation of policies and implementation of programmes related to environmental issues. NEMAP has been prepared to be the basis for programmes and interventions aimed at promoting better resource management, making people aware of environmental problems and reversing the present trend towards environmental degradation. NEMAP is expected to identify key environmental problems. Since these may change over a period of time. NEMAP is expected to evolve in response to these changes. Finally, the initiation of NEMAP can be seen as a step, reaffirming Bangladesh's commitment to Agenda 21.

4.3.41 *Sustainable Environment Management Programme (SEMP)*

4.3.42 Sustainable Environment Management Programme envisages interventions in different sectors of the country's economy in order to bring about an improvement in the country's deteriorating environmental situation and to improve simultaneously the financial base of the poor, particularly the rural poor. The 5 year (1998-2002) Technical Assistant Programme to the tune of about US\$26.45 million, is being executed by MOEF with UNDP funding indeed, a multidimensional follow up of NEMAP programme, which aims at sustainable environment management, sustainable human development and a break through in the poverty situation affecting poor sections of the society.

4.3.43 The major programmes of SEMP are : (1) Policy and Institutions; (2) Participatory ecosystem management; (3) Community based environmental sanitation; (4) Advocacy and awareness; and (5) Training and education. The different component of these programmes will be implemented by Government Departments and NGOs.

4.3.44 *The National Environment Committee*

4.3.45 Following the Environment Policy 1992, the government established a broad-based National Environment Committee (NEC) chaired by the Hon'ble Prime Minister along with a corresponding Executive Committee chaired by the Hon'ble Minister for Ministry of Environment and Forest. The National Environment Committee consists of 59 members from Ministries, Departments, Chambers, Journalists, Professionals and NGOs. According to its terms of reference, the National Environment Committee has the following responsibilities: -

- to review the progress of activities towards implementing the Policy;
- to consider implementation of the decisions taken at the United Nations Conference on Environment and Development (UNCED) IN 1992 and those taken by other international bodies; and
- to identify interministerial problems in respect of the National Environment Policy and recommended remedial options.

4.3.46 *Decision of National Environment committee for Control of Industrial Pollution*

4.3.47 National Environment Committee in its Meeting on 04/05/97 presided over by the Hon'ble Prime Minister has taken the following decisions relating to banking sectors:

- i) Banks/other financial institutions that follow usual rules while sanctioning loans to the proposed industries will ensure environment pollution control measures of the existing industries while sanctioning them working capital.
- ii) In case of BMRE activities of the existing industries, banks/financial institutions may take same steps that of the proposed industries towards conservation of environment.

- iii) Banks/financial institutions shall have to be confirmed about the inclusion of waste treatment plant machinery of the industries (under bank loan) in the import list.

4.3.48 Bangladesh Bank (Central Bank), in turn, has asked all the nationalized and commercial banks to abide by the above-mentioned decision while sanctioning loan and working capital against the industries. There are other sectoral plans and policies with emphasis on environment and its conservation. They are: Flood Action Plan, Bangladesh Water and Flood management Strategy, National Energy Policy, National Science and Technology Policy, Industrial Policy, Forestry Master Plan.

4.3.49 Key Environmental Institutions

4.3.50 Realizing the ever-increasing importance of environmental issues, a separate Ministry was created in 1989 and is entrusted to look after the matters relating to national environmental policy and regulatory issues. This ministry is a permanent member of the Executive committee of the National Economic council, which is the major decision-making body for economic policy issues and for approving all public investment projects. The MOEF oversees the activities of the following agencies.

- Department of Environment (DOE).
- Forest Department (FD).
- Bangladesh Forest Industries Development corporation (BFIDC).
- Bangladesh Forest Research Institute (BFRI)
- Institute of forestry.
- National Herbarium.

The DOE was set up in 1989 under the MOEF, and is the executing agency for planning and implementing of all environmental issues, including but not limited to the following activities.

- Reviewing environmental impact assessments and issuing of environmental clearance where appropriate.
- Implementing environmental monitoring programs and enforcement measures.
- Developing and housing environmental data-bases.

- Coordinating international events in close cooperation with MOEF (e.g., representing Bangladesh in international seminars, workshops etc.).

Other Ministries dealing with environmental issues are Ministry of Energy and Mineral Resources, Ministry of Industries, Ministry of Science and Technology, Ministry of Agriculture.

4.3.51 Goals and Objectives of fifth Five Year Plan (1997-2002).

4.3.52 In order to promote, nurture, protect and expand nature and natural resources and to link all developmental activities with environment for improving the quality of life, the Fifth Five Year Plan aims at the following objectives:

- a. promoting sustainable environment management in pursuit of quality livelihood and to alleviate poverty;
- b. promoting participatory, community-based environmental resource management and environmental protection (considering the poor's access, equity as well as gender issues);
- c. ensuring active participation of the poor, especially women, in environment protection activities;
- d. promoting environment-friendly activities in development interventions;
- e. preserving, protecting and developing the natural resource base;
- f. strengthening the capabilities of public and private sectors to address environmental concerns;
- g. controlling and preventing environmental pollution and degradation related to soil, water and air;
- h. creating public awareness for participation in environment promotion activities; and
- i. conserving non-renewable resources and sustaining auto and eco-generation of renewable resources.

CHAPTER –V

5.0 *Recommendations and Conclusion*

5.1. *Recommendations*

5.1.2 Responding to the environmental challenges facing Bangladesh requires policy formulation not only within the national boundary of the country but also at the regional and global levels. Ecological concerns cannot be compartmentalized within sectors like energy, agriculture, trade or within broader areas of concern like environment, economy, security etc. These are all interlocking concerns and one cannot be dealt with in isolation from the others.

5.1.3 The inherent objective behind all environment programmes and policies should also be sustainable development i.e., “to meet the need of the present without compromising the ability of future generations to meet their own needs”.¹²¹ Moreover, such development requires meeting the basic needs of all and extending to all the opportunity to fulfil their aspirations for a better life. That will require not only a new era of economic growth, but an assurance that everyone gets his share of the resources required to sustain that growth which is possible by the political system that would secure effective citizen participation in decision making, equal participation of all in international decision making, sacrifice by the rich nations to adopt life style with planets ecological means and so on.

5.1.4 *Global Measures*

5.1.5 Since Bangladesh is going to be one of the first victims of global warming and sea-level rise, policies regarding the methods of slowing global warming is very much relevant to her.

5.1.6 The straight way to eliminate the greenhouse problem completely would be to return the world to its pre-industrial state. Since this is impossible, researchers are concentrating their efforts on slowing down the process of warming which will buy time for adapting to the changed climate. There are two aspects of such efforts : (1) to slow down the warming; and (2) to adapt to the changed climate.

5.1.7 *Slow Down the Warming*

This may be done in the following ways :

- a. Reduction of Carbon-dioxide emission through using less coal by :
 - Finding more efficient ways to use clearer burning fossil fuel;
 - Manufacturing of more fuel efficient vehicles;
 - Shifting the mix of energy supply option away from such carbon intensive sources as coal and
 - Taking a new look at non-fossil alternatives, e.g., solar, hydropower, nuclear, etc.
- b. Reduction of emission of other green house gases like methane, nitrous oxide and CFCs.

5.1.8 Greenhouse impacts should be an explicit part of all future decision making process in the energy sector. Triangular development of energy, viz., energy conservation, efficient technologies and renewable energy efficient shall help reduce the emission of the greenhouse gases to a much lesser extent even though major economic growth are achieved.

- c. Another method of slowing global warming is reduction of deforestation and mobilization for reforestation. Forests absorb greenhouse gases and contribute to climate stabilization. Policy formulation in this area shall require the following steps:¹²⁵
 - Creation of general awareness as to the importance of forest and mobilize the people to reforestation;
 - Evaluation of the development priorities of the government as well as the local government and to adopt a more responsible role towards forest preservation and reforestation;
 - Taking initiative for high yielding food production and alternate energy source so that pressure to expand agricultural land or fuel wood demand is reduced;
 - providing assistance to the developing countries in achieving alternative energy, high yielding food production and so on;
 - Bringing a change in the trade policies of the developed countries which will discourage import of tropical woods; and
 - Adoption of policies like 'debt for nature swap'¹²⁶ by the donor agencies, financial institutions which will mobilize reforestation as

well as preservation of forests.

- d. Another approach towards slowing the global warming will require a multilateral treaty with standards binding under international law that would require each country to take prescribed actions to reduce and halve greenhouse warming.

5.1.9 Adapting to Climatic Change

5.1.10 Undoubtedly, energy conservation, energy efficiency, reforestation and legal provision or multilateral treaties can slow the rate of climate change. Nonetheless, since climate change appears to be inevitable, it is important to explore the opportunities for adapting to unavoidable changes. Such adaptation cannot be universal but regional since warming will affect the various region differently.

- a. One of the most likely impacts of global warming will be changes in the timing and distribution of regional precipitation, which in combination with changes in regional temperatures will cause reductions or increase in surface run-off, evapo-transpiration (the evaporation of water from plants by way of the holes of leaf surfaces) and soil moisture.¹²⁸ To prepare for such changes, policy makers must modify water management practices and improve the efficiency of water use. Climate impact studies suggest that where demand for water is likely to increase in the future, less water will be available for agriculture and municipal uses. In the circumstances, increasing water storage capability and reducing seepage and evaporation losses may be critically important.
- b. Another promising but equally difficult opportunity is to improve agricultural and forest management. Policies to spur the early development of heat and drought resistant seed varieties of major cultivator could reduce the risk of future losses from climate change. The challenge of course is to develop varieties that can withstand a broader range of environmental conditions without sacrificing current yield.¹³⁰

- c. Until such advanced varieties can be achieved, alternative cropping patterns should be explored.
- d. Another approach involves altering irrigation practices to improve the efficiency of water delivery systems. By increasing local storage capacity and shifting from flood or field type irrigation techniques to drip irrigation system (which deliver water to individual plants) farmers can minimize seepage and evaporation losses.¹³¹
- e. Since the sea level rise will not be uniform everywhere, its monitoring will be important in concentrating efforts to minimize local damages. Additional detailed data collected with remote sensing techniques from existing satellites could be crucially important for identifying areas vulnerable to sea level rise. Once the location of new flood plains have been established it is important to guide local planning and zoning decisions.¹³²
- f. Cyclone preparedness system needs to be strengthened which would involve not only installation of satellites for correct weather forecasting but also to establish shelters in the areas more vulnerable to cyclones and storm surges.

5.1.11 Regional Measures

5.1.12 The contention over Ganges issue and other rivers as well as the impact of deforestation on Bangladesh have reached a delicate state. India's endeavor to take some calculated steps with a view to serving her own need is posing severe threat to Bangladesh including disturbance in the balance of shared nature. Bangladesh is geographically in a disadvantageous position which forced her to bear almost the sole burden of that disturbance in such a helpless way that her survival is at stake. The dispute on the Ganges as well as all other common rivers between the two countries are to be viewed in the context of implications for the socio-economic and environmental equilibrium. The political aspect of the problem has made it more and more complicated.

The political primary needs to be stressed while there is no denying that if political goodwill prevails on both sides a mutually acceptable solution can be achieved.

5.1.13 Complex tasks of conserving ecological balance, like afforestation, flood control, proper use of common rivers, etc., cannot be resolved in isolation from each other nor by any individual state alone. It should be realized by India that since the rivers of the region are part of the same ecological belt, developmental activities done in one part of that belt are bound to cause repercussions in another. Every programme needs to be undertaken keeping in mind this ecological unity. Moreover, it is by now widely recognized that there is immense potentiality for development through cooperation in such areas as the unutilized energy reservoir of Nepal from which the entire region can be developed.

5.1.14 A jointly coordinated policy should be formulated for collaboration of the environment related organizations of the countries of the region and there should be exchange of materials and information among them. A regional coordination body within or outside the South Asian Association for Regional Cooperation (SAARC) may be established for continued monitoring of the situation resulting from the environmental changes that are taking place. The objectives of such coordination policy should include things of regional priority. It may be useful to jointly exercise the relative priority of flushing of Hooghly river, for example, as against the acute problem faced by Bangladesh due to diversion of water.

5.1.15 Steps should be taken to afforest the Himalayas and for this purpose the upland countries should be provided with alternative energy source. There is enough potential for improving hydroelectric power in Nepal and upper reaches of India, which can be the best source of alternate energy. This will not only slow deforestation but also balance the environment of the entire region. This is again a regional problem and all concerned states need to formulate a joint comprehensive long term project for which external financial assistance may be obtained from appropriate sources.

5.1.16 Regional cooperation is the most practical approach for development of common natural resources of this region and resolution of most of the related problems including water sharing. However, Bangladesh should also recognize the fact that India, which has the upper hand, is yet to fully adopt this regional approach. Hence it may be counterproductive to bank too much on a regional solution. Parallel with Bangladesh's efforts for a regional solution, Bangladesh also needs to strengthen its relation with India with a view to reaching a bilateral agreement for long term sharing of the common water resources.

5.1.17 *National Measures*

5.1.18 Until recently, the need to cope with periodic disaster, preoccupation with increasing food production and reducing poverty in the face of continued population growth have overshadowed efforts to conserve and manage the natural resources within national boundary of Bangladesh. Environment policies in government plans and priorities are conspicuous by their absence and when they exist, they are inadequate, outdated or unenforceable. If the issue of environmental degradation is not addressed immediately, it could significantly undermine Bangladesh's long term economic development and be the reason of greater insecurity.

5.1.19 Various efforts are needed not only to check the further decline in land productivity, fisheries, water quality, forest resources and so on but also to improve the quality, biological diversity and efficiency of the natural resources. It should require not only effective regulation, monitoring and enforcement mechanism but also large scale advance studies and research aimed at restoring, maintaining and improving the quality as well as biological diversity of natural resources. Moreover, following issues are to be addressed properly for environmental management and sustainable development in Bangladesh context.

5.1.20 *Agricultural Resource Base:* Agricultural resources in Bangladesh are already under severe pressure and environmental strain. It is essential to reverse this trend and rebuild, and where possible, augment the productive capability of scarce and essential

agricultural resource base. To produce enough food for an increasing population, it is necessary to maximize the benefits that can be derived from existing technologies and to maintain the sustainability of the food production system beyond 2010. It is essential that Bangladesh should make all out efforts to bring about a major breakthrough in agricultural technology.

5.1.21 Biodiversity : To bring about a future breakthrough in agricultural technology, it is necessary to preserve variety of life or biodiversity. The preservation of biodiversity is both a matter of insurance and investment - necessary to sustain and improve agriculture, forestry and fisheries production systems to keep open future options, as a buffer against harmful environmental changes and as a raw material for scientific and industrial innovations. Moreover, we must conserve biodiversity as a matter of survival. The variety of life helps to make the earth fit for life. It plays an important role in all major life-support services, from maintaining the chemical balance of the earth and stabilizing climate to protecting the watershed and renewing soil. Maintaining a nation's biodiversity is integral to maintaining its wealth. The importance of species and ecosystems will be considered in the formulation of development policies. Institutions assigned responsibility for conserving biodiversity will have the necessary financial and organizational resources. The species and ecosystems on which our survival depends should be clearly identified and appropriate technology applied to make our survival worthy of human beings.

5.1.22 Biomass : In Bangladesh, especially in the rural areas, where 80 percent of people live biomass plays an important and complex role. The problem is not merely the supply of wood or of fuel or of food. These products are linked by competition among land uses and by different product end uses that may compete or complement one another. Thus shortage of any form of biomass will affect the quantity and composition of different end uses. At the moment, there is an acute crisis of biomass fuel in Bangladesh, which constitutes 73 percent of total energy consumed. The per capita supply of biomass fuel is declining. There is an increased used of crop residue and dung as fuel which is diverting valuable nutrient and organic matter away from the soil.

5.1.23 Impact of chemicals: Modernization in agriculture has led to the extensive use of fertilizers and pesticides. Although production of food grains and other crops has increased significantly by use of fertilizers and pesticides, productivity of land has decreased due to indiscriminate use of chemicals. Farmers spraying pesticides and using fertilizers, in many cases, are suffering from heart and skin diseases. Cows goats and other domestic animals eating fertilizer and pesticides affected grasses are suffering from diseases. Fish population in the rivers and other water bodies have drastically decreased due to water pollution by chemicals including fertilizers and pesticides.

5.1.24 Industrial pollution : The growth of industries in the country has generally been unplanned without keeping the issue of environmental protection in careful consideration. There are many industries in the residential area causing pollution of air and water through smoke emitting chimney and dumping of untreated effluent. Industrial wastes have polluted the water of the Buriganga, the Shitalakhya, the Karnafuli and the Rupsha rivers. Effluents from tanneries are extremely harmful to human beings since they contain high concentration of chromium compounds. About 250 tanneries in Hazaribagh area within the Dhaka city are causing serious environmental pollution and health hazard making the area virtually unsuitable for human habitation.

5.1.25 Deforestation: Bangladesh has a forest area of around 6-8 percent of the total land which is far short of the desired level. According to a study, 50 percent of destruction of forest took place in the last 20 years.

5.1.26 Wetland and fisheries: Bangladesh has a high proportion of wetland area, which has, of late, been declining. Rivers, canals, beels, lakes and baors are the open wetlands while baors, dighis, ponds and ditches constitute the closed ones. They are significant sources of sweet water fish. The decline in fish production has been attributed to a general deterioration of the wetlands, characterized by a silting up of bed levels, water logging and water pollution.

5.1.27 Mangrove ecosystem : The Sundarbans, located in the south-western part of Bangladesh is the largest single patch of mangrove forest in the world. It is a dynamic,

fragile and complex ecosystem in delicate balance with land and water. It serves as a good location of offshore fisheries and onshore shrimp cultivation, a natural coastal protection, a highly valuable forest resource and a recreational resort. There has been a degradation of environment in the Sundarbans due to rapid deforestation, top-drying, saline water intrusion, killing of wild lives, inadequate re-forestation and efficient conservation programmes.

5.1.28 Coastal and marine water : Disposal of chemical fertilizers, insecticides and industrial effluent into the water is leading to severe pollution of the coastal and marine environment. Rare species living in these areas will gradually disappear if they are not preserved.

5.1.29 Salinity : Diversion of the Ganges water has drastically reduced the down stream flow of its distribution. Consequently saline sea water is entering into the mainland rivers. It has adverse effect on agriculture and shrimp cultivation and also on availability of sweet water.

5.1.30 Sanitation : In order to benefit from the increased coverage of water supply, the vicious cycle of bacterial contamination has to be broken by introducing some form of safe disposal of domestic waste including human excreta.

5.1.31 Urbanization : Serious problems of environmental degradation resulting from urbanization needs to be evaluated in terms of (i) land use alterations. (ii) inadequate shelter, water/sanitation, and other facilities in slums and other urban poor areas, (iii) degradation of community ambient environment, and (iv) little control of industrial waste emissions, which often greatly compounds the problem of environmental pollution due to inadequate management of human and domestic wastes. Provision of water, sanitation and other environmental infrastructure should adequately serve the entire urban area.

5.1.32 Inter-sectoral linkage : Rapid economic development will put ever increasing pressure on natural resources such as land, water, energy, etc. and tend to increase the discharge of pollutants to the environment in varying degrees. It is, therefore, essential to choose the future pattern of development in such a way that environmental degradation is

minimized through judicious use of resources on an inter-temporal basis to achieve sustainable development. Such developmental efforts must focus on creation of an "efficiency and quality culture" in our planning process. Alongwith the increase in capital and labour efficiency, the contribution of the 'residual' factors to growth has to be maximized through such measures as, development and application of appropriate and modern technology, intersectoral linkages, internal and external economies in production, etc.

5.1.33 Another important aspect that must be taken into consideration is that economic development and improved natural resources management are inextricably linked and success in one area cannot be achieved without success in another. Therefore, these two goals must be addressed in an integrated fashion. A concern for environmental conservation and improved natural resource management must be an integral part of development strategies.

5.1.34 Another challenge facing development planning in Bangladesh like many other countries is the institutional constraints. Inter-sectoral coordination of development planning is hampered by a multitude of specific agencies and frequently overlapping jurisdictions or conflicting mandates.

5.1.35 Legal framework in many instances needs to be further updated and better adapted to cope with current problems and projected demands. Most of the environmental laws of Bangladesh were promulgated before independence and are only recently being revised and updated or have yet to be updated. Urban planning laws of the 1950s and 1960s were passed when the population was half the present size. The Factories Act of 1965 was enacted before industrial pollution or hazardous substance became a serious concern. The Forestry Act of 1927 was adopted when enforcement against deforestation was manageable. Although the Motor Vehicle Ordinance 1939 was updated in 1983 and the Pesticide Ordinance of 1971 was updated in 1980, the provisions are largely unenforceable.

5.1.36 A particularly critical issue is the strengthening of environmental monitoring

capabilities and environmental impact assessment (EIA) procedures. The newly established Environment Department under the Ministry of Environment and Forest is likely to play an important role in EIA. Its institutional capacity and procedures need to be strengthened. Within the Ministry of Planning, the Environment cell can also be a forum for assessing economic trade-offs and environmental threats originating from sectoral development programmes. Another problem of EIA is the compartmentalized developmental activities. Various Ministries need to take joint initiatives in examining the anticipated impact of proposed project of the environment and on the development objectives of other sectors which may be adversely impacted.

5.1.37 Another problem facing successful environment management is that there is want of cooperation between public agencies and the private sector including both private enterprises and independent voluntary non-governmental organizations (NGOs). Not only the government will be benefited by the experiences and information gathered by the NGOs, they will also be benefited through access to information about past or ongoing development activities of the government.

5.1.38 But the most important factor that is posing the greater challenge to environment management is the lack of public awareness. Success of all programmes ultimately depends upon those who use the resource on a daily basis.

5.1.39 In order to address the critical needs and important issues related to the environment and natural resources, short, medium and long term approach is needed. But these are preconditioned by a firm and sustained commitment to a steady reduction in population growth rates and to population stabilization.

5.1.40 In the short term a number of initiative should be taken by the Government of Bangladesh, in concert with donors and other interested agencies, to reduce further environmental degradation and to develop the technical skills, information base and institutional capacity needed to move forward with a sustainable developmental agenda.

5.1.41 Medium and long term objective should be to continue to build up efforts aimed at institution strengthening and programme support for critical areas of natural resource

management and environment conservation. This shall include not only extended support for research and advance studies in resource management, EIA etc., but also to implement the various reports made on environment, viz, the National Water Plan, Coastal Zone Management Plan or Action Plan for Flood Control, etc. There should be a coordination cell to make every department aware of the past, present and future development activities. This cell can again be the centre for assessment of trade-offs and resolution of inter-sectoral conflicts.

5.1.42 Although in the past environment management did not get that much attention from the government, a number of recent developments and natural resource issue are steadily growing. By declaring the year 1990 as the Environment Year and the 1990s as the Environment Decade, the Government of Bangladesh has reaffirmed its commitment to focus increasing attention to this growing problem.

5.1.43 Ministry of Planning can play a key role in environment management since it is charged not only with the preparation of Five Year Plans but it also controls the allocation of funds to individual Ministries. Moreover, it has the authority to supervise and coordinate cross-sectoral and inter-ministerial activities, affecting the use of natural resources and environment. With a view to utilizing this opportunity and evaluating the environmental impacts of proposed development projects, a new "Environment Cell" is being established within the Planning Commission. The Local Government Institutions formed under the Local Government Ordinance of 1982 can also play important role. The Upazila Council or Parishad can carry out various delegated powers, including building regulations, and implementation of projects related to infrastructural development and environment management. Municipal Corporation which has the authority of land use planning (except for the national laws and regulations affecting forest, land tenures and coastal resources) can be a potential source for environment development. These local bodies can also play effective role in creating greater public awareness.

5.1.44 The private industrial enterprises will have to assume a growing responsibility to utilize resource sustainability and mitigate environmental damage resulting from industrial process whereby they will have an important role to play in improving natural

resource management. Press and media is a very significant source to reach the message to the people, hence generate public awareness.

5.1.45 If the existing policy research and coordinating institutions can be properly utilized by the government it could form the basis of sound environment related research as well as development planning. Public awareness, as already mentioned, is very important for the successful implementation of the environmental programmes. In recent period, at the initiative of public and non-governmental organisations, people's awareness of the problem is growing. If this trend can be sustained and if the government can utilize and coordinate the work of all the related institutions, the country may be able to cross the borderline from vulnerability to sustainability.

5.1.46 The change to living sustainable and caring for the Bangladesh will be a major task for most people. For a start we will need to understand and accept the consequences of the community life and to become more conscious of the effects of our activities on societies and future generations. We will need to cultivate and promote an ethic for sustainable living and it must be a guiding principle for all the country's people. But living sustainable will never be possible when hundreds of millions live without the basic essentials of life. To make it possible for us all to think of the welfare of later generations and species, we need a new kind of development that rapidly improves the quality of life for the disadvantaged.

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Air Quality Standards

Annex-A

Density in micrograms per cu m

Sl.No	Area	Suspended Particle Matter (SPM)	Sulphur dioxide	Carbon monoxide	Nitrogen oxides
(a)	Industrial and mixed	500	120	5000	100
(b)	Commercial	400	100	5000	100
(c)	Residential and Rural	200	80	2000	80
(d)	Sensitive	100	30	1000	30

Source: Department of Environment

Note:

- 1) National status monuments. Health center/Hospital. Archeology site, Education Institution and area declared by government (if applicable) are included in Sensitive Area.
- 2) Industrial units not located in designated industrial area shall not discharge or emit any pollutant which may help to exceed the air quality standards in areas neighboring those in (c) & (d) Rows above.
- 3) Suspended Particle Matter (SPM) means airborne particles of diameter of 10 microns or less.

Water Quality Standards

Annex-B

A. Inland Surface Water Quality Standard

Sl.No	Best Practice based classification	pH	BOD mg/1	Dissolved Oxygen (DO. mg/1)	Total Coliform
a)	Potable Water Source supply after bacteria freeing only	6.5-8.5	2 or less	6 or above	50 or less
b)	Water used for recreation purpose	6.5-8.5	3 or less	5 or above	200 less
c)	Potable Water Source supply after conventional processing	6.5-8.5	3 or less	6 or above	5000 or less
d)	Water used for pisciculture	6.5-8.5	6 or less	5 or above	5000 or less
e)	Industrial use water including chilling & other processes	6.5-8.5	10 or less	5 or above	
f)	Water used for irrigation	6.5-8.5	10 or less	5 or above	1000 or less

Source: Department of Environment

Note :

- (i) Presence of Ammonia (as nitrogen molecule) in water used for pisciculture-1.2 mg/1.
- (ii) For water used in irrigation Electrical Conductivity - 2250 micromho/cm

Sodium	Less than 26 mg/1*
Boron	Less than 2mg/1*

Noise Quality Standards

Annex-C

Sl.No	Zone Class	Day	Night
a)	Silent Zone	45	35
b)	Residential Zone	50	40
c)	Mixed Zone (mainly areas used as residential, commercial and industrial in combined way)	60	50
d)	Commercial Zone	70	60
e)	Industrial Zone	70	70

Source: Department of Environment

Note:

1. From 6 in morning to 9 at night is considered day time;
2. From 9 at night to 6 in morning is considered night time;
3. Area within radius 100 meters of hospital or education institution or government designated/to be designated/specific institution/establishment are considered Silent Zones. Use of motor vehicle horn or other signals, and loudspeaker are forbidden in Silent zone.

Annex-D

Motor Vehicle Exhaust Quality Standards

Parameter	Unit	Standard Limit
Black Smoke	Hartridge Smoke Unit (HSU)	65
Carbon	grams/km	24
Monoxide	in percent volume	4
Hydrocarbon	grams/km Parts per million (ppm)	2 180
Nitrogen oxides	grams/km ppm	2 600

Source: Department of Environment

Measured at 2/3 of maximum rotation speed.

Major Environmental Legislation of Bangladesh

Annex-E

1. The Environment Pollution Control ordinance, 1977.
2. Territorial waters and Maritime zones Act, 1974.
3. Pesticide ordinance of 1971 and 1983 and pesticide Rules, 1985.
4. Petroleum Act, 1984.
5. Factories Act, 1965 and the Factory Rules 1979.
6. Motor Vehicle ordinance, 1939 (modified upto 1983).
7. Dangerous Drugs Act 1930 and Dangerous Drug Control Order, 1982.
8. Forest Act, 1927.
9. Local Government ordinance, 1982 (Upazilla Parishad and Upazilla Administration Reorganization).
10. Pourashava Ordinance, 1977.
11. Water supply & Sewerage Authority ordinance, 1963 (With amendment of 1989)
12. The Boilers Act, 1923.
13. Agriculture and Sanitary improvement Act, 1920.
14. Water Hyacinth Act, 1936.
15. Tanks Improvement Act, 1939.
16. Embankment and Drainage Act, 1952.
17. Opium Act, 1978.
18. dangerous Drugs Act, 1930 (Amended upon 1988).
19. Chittagong Hill Tracts Regulation, 1900.
20. The Town Improvement Act, 1953.
21. Labour Laws (Amended upon 1987).
22. The Municipal Ordinance 1983).
23. The Explosive Substance Act, 1908 (modified upto May 1983)
24. The Explosives Act, 1884.
25. Poisons Act, 1919.
26. The Factories Rules 1979.
27. Bengal smoke nuisances Act, 1905.
28. Local Government Ordinance (Union Parishads) 1983.
29. Bengal Irrigation Act, 1876.
30. Bangladesh Water and Power Developments Boards Ordinance 1972.
31. Wildlife (preservation) order 1973).
32. East Bengal conservation and Protection of Fisheries Act, 1950 (amended in 1982).
33. The Bangladesh Fisheries Development Corporation ordinance 1973.
34. Marine Fisheries ordinance 1983.
35. Shops and Establishments Act, 1965.
36. Bangladesh Pure Food Ordinance 1953.
37. The Bangladesh Penal Code 1860 (as amended from time to time).
38. Antiquities (Amended) Ordinance 1976.
39. Antiquities Act, 1968.
40. The Tea Plantation Labour Ordinance 1962 and rules of 1977.
41. The Forst (Amended) Ordinance 1989.
42. Merchant Shipping (Amendment) Ordinance 1988.
43. The Inland Shipping (Amendment) Ordinance 1988.
44. The Dhaka Municipal Corporation Ordinance 1983.

Source: Department of Environment

