The background of the cover is a photograph of a sunset over a body of water. The sky is a mix of orange, yellow, and purple. In the distance, a line of silhouetted figures is walking across a low ridge or shore. The water in the foreground reflects the colors of the sunset, creating a shimmering effect. The overall mood is serene and evocative of a rural or coastal setting in Bangladesh.

BANGLADESH
STATE OF ENVIRONMENT
REPORT 2001

Edited by
Quamrul Islam Chowdhury

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A publication of
Forum of Environmental Journalists of Bangladesh (FEJB)

Bangladesh

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Preface

The State of Environment (SoE) Report 2001 is the fourth in a series of annual publications focusing on Bangladesh's environmental trends. It is published by the Forum of Environmental Journalists of Bangladesh (FEJB) under the Sustainable Environment Management Programme (SEMP) with support from the UNDP and the Ministry of Environment and Forest (MoEF).

Since the first SoE Report 1998 was published, this annual FEJB exercise has been acclaimed by environment watchers, conservationists, development practitioners, policymakers as well as the general public at home and abroad. This annual effort by the FEJB can be seen as a modest attempt to review the dynamics of the country's environmental conditions as well as the status of the national response--including those of the government, NGOs and private initiatives--to our changing environmental situation.

The SoE aims at providing a general evaluation of the state of the country's environment and newly emerging priorities for ensuring sustainable development. The purpose is to bring the nation's major environmental issues to the government, the people in general apart from the international donor community as well as the country's development partners. Another objective of this publication is to entice more and more NGOs and the private sector into devoting some of their energies and resources for the nation's conservation cause.

Let us be modest and humble in pointing out that this publication is not a product of intensive research work; rather it should be taken as an anthology of reports, articles and write-ups from the FEJB members as well as experts and other writers. Since developments in the environment sector do not occur by the day-- rather these are slow --the readers might not

find drastic changes in some of the chapters covering different aspects of the nation's environment scenario. We have tried to update most of the chapter addressing our burning conservation issues and also incorporated some new issues and topics that had not been covered in the previous SoEs.

The SoE 2001 attempts to address most of the nation's burning environmental issues--from our declining forests and biodiversity to the increasing population, industrialisation and rapid urbanisation that are threatening to disrupt the country's fragile ecological balance.

It has also tried to touch upon some of the measures taken by the government and other agencies to protect the country's environment and ensure a sustainable development for the future. Creating public awareness and sensitising the media and the policymakers are also the objectives being sought by the FEJB in publishing this latest SoE 2001.

Quamrul Islam Chowdhury
Chairman
FEJB
March 2002

Chapter 1



Exhausted environment



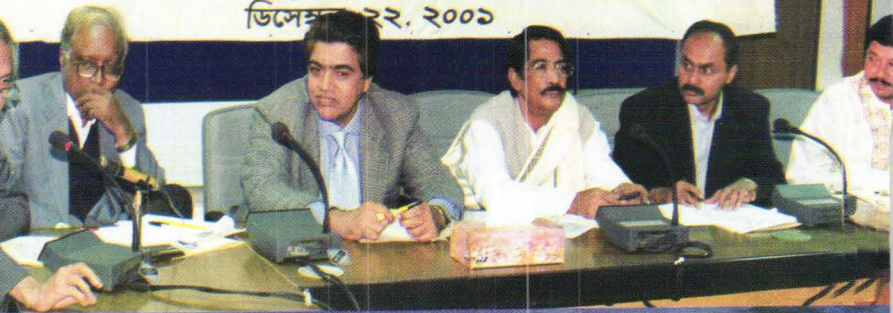
Photo: Abu Taher Khokon, FEJB

Bangladesh
State of Environment Report 2001



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Exhausted environment

Quamrul Islam Chowdhury

Despite a rising awareness about the needs for protecting the environment, environmental degradation already cut a swathe through Bangladesh quite fast during the last three decades (1971-2001). The country's ecology has been damaged, the forests have been depleted, the wetlands destroyed, different species of flora and fauna have vanished, wildlife has almost disappeared, bio-diversity has been greatly reduced and the air quality deteriorated. And even if drastic measures are taken to halt the deteriorating trend, it is difficult to visualise an optimistic scenario for the country over the next 30 years (2001-2030).

Of late though, since June 2001 to be precise, some positive steps started to be taken to arrest such deterioration in the environment sector. In mid-June 2001, a caretaker government that took charge for a three-month stint addressed some of the burning environmental issues. Despite their short tenure, they took up the issue of the river Buriganga, applying their authority to evict encroachers from large tracts of land along the moribund river that was once the lifeline of capital Dhaka. The caretakers also tried to address the problem of inland marine pollution as well as the wanton encroachments on the lakes within Dhaka city, viz. Gulshan and Dhanmandi lakes. Some steps were also taken to stop an attempt by some private and political quarters to grab parts of the Usmany Uddyan -- a green patch of land with trees -- in the heart of Dhaka city to build a hotel. The caretakers further tried to discipline the city's chaotic traffic and curb air pollution.

But as soon as a new government was elected in October, 2001, it took up the green agenda. The new Cabinet of Prime Minister Khaleda Zia took a momentous decision of banning Polythene shopping bags from the country. It also decided to ban old and dilapidated vehicles belching out deadly black smoke from the city streets. A 100-day programme announced

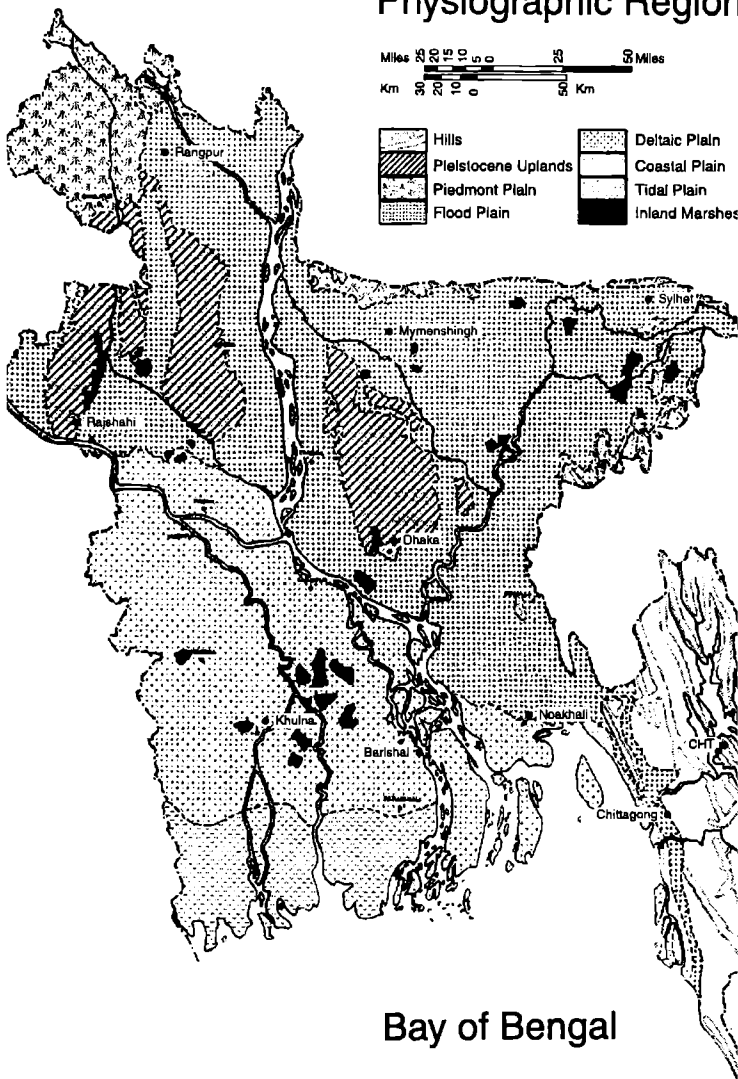
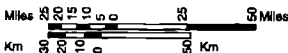
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Bangladesh Physiographic Region



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by the prime minister also included emergency arsenic mitigation schemes. Besides, the Ministry of Environment and Forest went about addressing such problems like hill cutting, theft of trees in the reserve forest and unauthorised mushrooming of brickfields in and around the country's major cities. But although the decision has been taken to set up environmental courts, those were yet to be put in place.

As a matter of fact, for the years ahead, the country is braced for a series of serious environmental problems like climate change, sea level rise, depleting groundwater table, the persisting menace of arsenic contamination of groundwater, deteriorating water and air quality, alarming level of soil degradation, etc. These are just to mention a few of the environmental problems looming large over this over-populated and impoverished nation. It is high time that we take up environmental issues in right earnest and put them high on the national agenda for action to halt environmental degradation. That is an imperative for ensuring a sustainable future for our nation.

Bangladesh is a land-hungry country with a large population. Tucked away in the northeastern part of the South Asian subcontinent, it abuts on India on its western, northern and eastern sides and borders upon Myanmar (Burma) on the southeastern tip. Its seaboard is in the south on the Bay of Bengal.

At the current annual growth rate of 2.17 per cent (*Bangladesh Bureau of Statistics, 1997*), the estimated population in 1998 was about 126.5 million. The total area of the country is 147,570 square kilometres, 6.7 per cent of which is rivers and inland water-bodies. The population density, therefore, is about 900 persons per square kilometres -- one of the highest in the world.

Even with a steady decline in fertility, due largely to accelerated efforts in population control, the country's population is expected to reach 170 million -- with the density increasing to 1200 people per square kilometre -- by the year 2010. The official target, however, is to attain a replacement fertility rate by 2010, and in such case, the population is expected to reach a steady state at 250 million towards the end of the next century (World Bank, 1998). The predominant concern for the

country's environmental sustainability is to achieve this target and ensure a reasonable livelihood for over twice the size of the present population.

Bangladesh is also a disaster-prone country, the geographical setting and various other anthropogenic activities make the country vulnerable to natural disasters. Almost every year one or more severe natural disasters upset people's lives in some part of the country. Flood is a recurring phenomenon in the country, which brings untold sufferings to millions of people, and results in human deaths, loss of livestock, spread of diseases and hunger, damaged standing crops, destroyed physical and economic infrastructures, damaged fish and shrimp ponds and hatcheries, etc.

Cyclone and storm surges occur frequently and cause significant destruction in the coastal areas of the country. Nor'westers and tornadoes also frequently hit different places of Bangladesh. Tropical cyclones and tornadoes have serious and adverse impacts on the economy, as well as on the whole environment, they uproot trees, telephone, telegraph and electricity lines, destroy bridges, culverts and houses, kill people and domestic animals.

Although this country with a monsoon climate usually has enough rain, but often droughts make a negative impact on the agriculture and economy of Bangladesh. The northwestern part of the country is vulnerable to drought. Disastrous land erosion events mainly take place along the banks of the major river systems of the country. i.e., the Brahmaputra-Jamuna, the Ganges-Padma, the Lower Meghna, and other rivers.

Now, whether it is the socio-economic life of northwestern Bangladesh or the coastline, whether it is agricultural bases or power of cyclones, whether it is global warming or terror of tornadoes, Bangladesh is environmentally vulnerable and the nation should take a defensive action plan to avoid a catastrophe.

Vulnerable to any degree of sea-level rise, the major parts of Bangladesh are deltaic in origin. The terrain is largely flat and the relief is low. Nearly 50 per cent of the country has an elevation of less than 10 metres above sea level. Only in the

southeastern parts of the country does the altitude exceed 300 metres.

Large areas within the country have been uplifted geologically in recent times while some areas are still subsiding. It is postulated that these movements may be due to the presence of a major fault (*Alam et al, 1990*) that connects Calcutta (*West Bengal, India*) and Mymensingh in north-central Bangladesh.

The Tropic of Cancer passes through the centre of Bangladesh and the climate can be described as tropical monsoon type -- warm and humid in the summer, dry and cool in the winter. Three meteorological seasons are identified, which also coincide with the three main cropping seasons.

The meteorological seasons are summer (March-May), monsoon (June-October), and winter (November-February). Maximum temperature in the summer exceeds 38.C, and is characterised by thunderstorms (locally known as nor'westers) as well as high evaporation rates. The monsoon or the rainy season experiences more than 80 per cent of the total annual rainfall.

The winter season receives less than five percent of the total rainfall, and is characterised by low temperature (often reaching below 10 degrees C in the north), low humidity and high solar radiation. Temperature in Bangladesh varies between 10 degrees C and 40 degrees C. It peaks during April and the minimum is recorded in January. The critical aspects of rainfall in relation to the use of land for agriculture are the uncertainty of the onset and departure of the monsoon as well as the total amount of rain in a year.

Land Ecosystem: Bangladesh has three broad types of landscapes: floodplains, terraces and hills. Floodplains are composed of recent alluvial deposits and occupy 80 per cent of the total area of the country. The terraces (slightly uplifted fault blocks), occupying about eight per cent of the area, include the Madhupur tracts in the centre and the Barind tracts in the north-east.

The hills occupy the remaining 12 per cent of the area in the southeastern Chittagong Hill Tracts (CHT) and northeastern Sylhet districts. The three broad types of landscapes can be divided into 20 physiographic units (FAO, 1998), each with its

own characteristics of land capability and land use.

Although a small country, Bangladesh has a wide range of soils. About 500 soil series have been identified, but these can be grouped into three categories, conforming to the three major landscape types of the floodplains, terraces and the hills. Soil erosion is a serious problem in Bangladesh.

Heavy rainfall, steep slopes of hills and terraces and year-round tillage contribute to continuous erosion of the topsoil. Lack of comprehensive soil conservation practices and increasing pressure of population on land are major constraints in combating the land degradation process.

Agricultural land is the most basic resource in Bangladesh -- the main component for crop production. The current land/person ratio is very unfavourable, and there is little or no scope of expanding the land resource base. In 1997, the per capita land availability was 0.11 hectares, declining from 0.16 hectares in 1981. Agriculture is the main user of land resource -- employing directly or indirectly three-fourth of the country's population and contributing about 30 per cent to the GDP (*BBS, 1997*).

Bangladesh has about 9.56 million hectares of cultivated land, which is about two-thirds of the total area. Of the net area, 17.5 per cent is single crop, 54.7 per cent double crop and 20.4 per cent triple crop, while the remaining 7.4 per cent is cultivable waste and is currently fallow (*World Bank, 1998*).

The current average cropping intensity is 179 per cent -- an increase from 150 per cent about a decade ago (*GOB, 1996*). However, each year the net cropped area continues to shrink due to the loss of cultivable land to alternative uses like urbanisation, housing, industries and other infrastructure development.

The agricultural sector is dominated by rice farming, which covers about 75 per cent of the cropped area. Other grains include wheat (a dry season crop), and maize grown in all seasons. Jute, a natural fibre, is a major cash crop although the share of raw jute and jute goods in the total exports of the country has been declining in recent years. Tea is one of the most dynamic export-oriented cash crops. Other cash crops of significance are tobacco, cotton and sugarcane.

In Bangladesh, the three cropping seasons approximately coincide with the three meteorological seasons. The cropping seasons are Kharif 1 (pre-monsoon), Kharif II (monsoon) and Rabi (dry or winter). Three rice varieties are grown in these different seasons -- Aus, Aman and Boro respectively. Aman is the leading rice crop, accounting for 56 per cent of the cropped area, followed by Boro (27 per cent) and Aus (17 per cent), according to BBS, 1996.

The most significant recent development in agriculture has been the introduction and diffusion of high yielding varieties (HYV) of rice. The first HYV was introduced more than two decades ago from the International Rice Research Institute (IRRI) in the Philippines. Since the early 1970s, the HYVs released to the farmers are bred at the Bangladesh Rice Research Institute (BRRI) at Gazipur, about 25 kms north of capital Dhaka. At present, HYVs of rice occupy nearly 50 per cent of the rice growing area. HYV Boro is entirely irrigated, while HYV Aus and Aman -- though largely rain-fed -- often require supplementary irrigation.

Poverty with rapid population growth, absence of a proper land use policy, and other driving forces compel people in Bangladesh to over-exploit natural resources like land, which forms a major focus for human economic activities. The functional capabilities of the soil have deteriorated due to unbalanced use of agrochemical, unplanned land use, encroachment on forest areas for agriculture and settlements, ineffective implementation of existing laws and guidelines, and improper disposal of hazardous industrial effluents.

Moreover, urban sprawling and infrastructure development have reduced the availability of land. Natural events such as cyclones and floods cause land loss, and also decrease the functional capabilities of soil. Soil degradation in the coastal area results from unplanned land use, and due to intrusion of saline water. The extent of land degradation varies according to region, season, and year due to the diverse nature of the driving forces and causes.

Degradation of soil quality in the floodplains is mainly attributed to improper use of fertilisers and pesticides to boost agricultural production. Gradual salutation in the floodplains also contributes towards degradation of land. Dispersed

industrial growth, and uncontrolled discharge of untreated effluents in the nearby floodplain deteriorate the quality of land and soil.

Land degradation in the coastal areas of Bangladesh is mainly due to cyclones and storm surges inundating the land. Shrimp cultivation occurs round the year in these areas, which is ultimately increasing the salinity and degrading soil as well. Intrusion of saline water in the dry season is attributed to the low flow in the river system.

Erosion of topsoil in the hill districts has increased, and 17 per cent of the soil resources have deteriorated between 1964 and 1985. It was found that in the mixed forest-covered land, the topsoil erosion rate is 2.7 to 7.2 tons per hectare per annum. On the other hand, in the deforested hill slopes erosion goes up to 120 tons per hectare per annum. A study in Khagrachhari, Rangamati, and Bandarban areas on topsoil erosion showed that it ranges from 100 to 120 tons per hectare annually.

The concentration of organic materials present indicated the quality of soil and this has deteriorated significantly in the Barind Tract, Madhupur Tract, Himalayan Foothill areas, the floodplains to Tista, Karatoya, and Bangali, and in the hilly Northeast region. Moderate deterioration of organic materials has been observed in the medium highlands of the rivers Tista, the Jamuna, and in the Ganges floodplain.

Bangladesh is experiencing a decline or stagnation in the yield of many crops. At present, there is meagre HYV rice cultivation in the coastal areas. The environment is also unsuitable for cultivation of any other grain during dry period, except wheat where the temperature permits, and early sowing is possible. This is because both dry period Boro and wheat are cultivated in the winter season when salinity also reaches to its maximum, and renders most of the coastal land unsuitable for their production.

Water Ecosystem: Bangladesh is a country richly endowed with water resources. The water ecosystem comprises the tributaries and distributaries of the three major river systems: the Ganges-Padma, the Brahmaputra-Jamuna and the Meghna, and numerous perennial and seasonal wetlands like haors, baors and beels.

All the three major river systems originate outside the country. The combined total catchment area of these major river systems is about 1.74 million sq. kms, of which only seven per cent lies within Bangladesh. Another important feature to be considered for water resource planning is that 57 rivers of varying sizes enter the country from outside the national frontiers. The total length of the river courses is 24,000 kms and covers about seven per cent of the country's territory.

Flooding and river bank erosion -- two very related phenomena -- are common in Bangladesh. Rivers erode parts of their banks during floods and post-flood periods due to current and wave action. Land loss due to river erosion is the highest in the Brahmaputra-Jamuna basin, where the erosion rate is estimated to be between 139 hectares and 358 hectares per year (*Elahi and Rogge, 1990*).

Recent satellite images of the Ganges-Brahmaputra and the Meghna rivers, studied under the Flood Action Plan [FAP], indicated that 106,300 hectares were lost through erosion, while only 19,3000 hectares were accreted over the period 1982-1992 (*World Bank 1998*). Riverbank erosion made thousands of families homeless and landless, forcing many of them to move to the urban centres where they live as squatters in the rising number of slums.

A significant trait of Bangladesh's water ecosystem is the seasonality of water availability, i.e., excessive water during the monsoon causing floods, and water shortages in the dry season often causing a drought-like situation. The annual surface water flow whose major source is rainfall -- both inside and outside the country -- is impressively large.

The availability of this water is not uniform throughout the year. For the country as a whole, the dry season flow of water is less than one-fifth of the wet season flow. Owing to the fact that about 93 per cent of the surface water comes from outside the country, there remains an element of uncertainty about the quantum of water that would be available from trans-boundary rivers. The sharing of the Ganges water was agreed upon through a treaty with India in 1996, but sharing agreements for all other international rivers are still awaited.

Groundwater is another important component of the water

ecosystem. The quaternary alluvium of Bangladesh constitutes a huge aquifer with reasonably good transmission and storage properties. Heavy rainfall and annual inundation help the groundwater to rise almost to the ground level in the wet season.

The first assessment of groundwater was made in 1984, and later on the Master Plan Organisation (MPO) made three estimates in 1991: potential, usable and available recharge. In 1996, the National Minor Irrigation Development Project [NMIDP] -- using a different approach -- projected how much groundwater could be withdrawn, under conditions of receding water, from tube-well extractions.

Despite such varying estimates of groundwater reserves, it is generally agreed that Bangladesh will largely depend on this reserve for expansion of irrigated areas and to meet domestic needs.

Bangladesh is yet to formulate a pragmatic National Water Plan with a conjunctive water use planning (*Quamrul, 1998*). So far on the supply side, policymakers have over emphasised the use of groundwater more than the surface water. On the demand-side irrigation has received higher priority than the supply of safe drinking water. The fallout is mass scale arsenic contamination.

A scenario of water availability can be obtained only through an understanding of conjunctive water use planning. The National Water Plan [NWP-II] in 1991 had projected a water demand in the critical dry month of March, by the year 2018, of about 24,370 million cubic metres, while the supply from both surface and groundwater sources will be about 23,490 million cubic metres -- showing a shortfall of 880 million cubic metres.

This shortfall will be caused by increased irrigation. The NWP estimated that by the year 2020, 6.90 million hectares of land would be brought under irrigation out of a total 7.56 million hectares of irrigable land (*World Bank, 1998*).

The environment, economic growth and development of Bangladesh are all highly influenced by water - its regional and seasonal availability, and the quality of surface and groundwater. Spatial and seasonal availability of surface and groundwater is highly responsive to the monsoon climate and physiography of the country.

Availability also depends on upstream withdrawal for consumptive and non-consumptive uses. In terms of quality, the surface water of the country is unprotected from untreated industrial effluents and municipal wastewater, runoff pollution from chemical fertilisers and pesticides and oil, and lube spillage in the coastal area from the operation of sea and river ports and ship breakage.

Water quality also depends on effluent types and discharge quantity from different type of industries, the type of agrochemicals used in agriculture and seasonal water flow, and dilution by the river system.

The arsenic concentration in the groundwater is a major problem in Bangladesh now. High levels of arsenic cause serious human health problems if imbibed for a long time (from 5 to 15 years); including skin ailments, damage to internal organs, skin and lung cancers, and eventual death.

The recent major studies carried out on arsenic reveal that among 30,000 tubewells studied, 2,000 of them exceeded the national standard of 0.05 mg/1 for drinking purposes (the WHO guideline is 0.01 mg/1). The problem is acute in tubewells abstracting groundwater from 10 m to 100 depths in the Southeast, South Central (the northern part only), and Southwest regions, and occurs to a lesser extent in the eastern part of the Northeast region, and the very southern fringe of the North Central and Northwest (along the river Ganges).

The most seriously affected districts are in and around Chandpur. It has been estimated that more than 20 million people drink water exceeding the national standard for arsenic levels.

Notwithstanding the large number of rules and regulations to protect water from industrial effluents and other pollution, and the policies for enabling the environment through dry season augmentation of water concerns for the future still prevail.

These are regarding proper implementation of national policies, due to the lack of institutional capability and awareness to properly address the policy objectives and goals. The emerging issue of climate change and its adverse impacts on water resources needs proper consideration for planning.

Earlier analysis of climate change scenarios showed that water scarcity in the dry season would be aggravated and low water flow in the river system would allow saline water intrusion to progress further inland. Climate change induced adverse impacts on agriculture will put further stress on the country in attaining food sufficiency in the future.

Wetlands: The wetlands of Bangladesh (haors, baors and beels as well parts of the floodplains that remain inundated for parts of the year) cover about 16,000 sq. kms or 11 per cent of the country's area. However, the wetland area has often been estimated to account for nearly 50 per cent of the territorial land including estuaries and mangrove swamps along the coastal belt.

Wetlands in Bangladesh have great ecological and economic significance. They are a hotbed of biodiversity and contain flora and fauna of local, national and regional significance. Besides being a habitat of aquatic plants and animals, the wetlands help in the storage of floodwater, provide a rich source of inland fisheries, and facilitate water transport.

In recent years, as a direct consequence of population increase and agricultural expansion causing water regime modification, many wetlands have shrunk or disappeared. Such degradation has brought about a biodiversity loss, reduction in fish habitat, and an increase in the flood-proneness of certain floodplains (*Quamrul, 1997*).

Fisheries: The loss of fish habitat is a matter of serious concern because fish is one of the prime dividends of the water ecosystem. More than 70 per cent of animal protein in an average Bangladeshi's diet is obtained from fish, and this sector provides income for about 12 to 13 million people (*GOB, 1998*).

Indeed, Bangladesh is the world leader in open-water fish production per unit area. Open-water capture fishery sustains itself on the extensive network of inter-linked aquatic habitats, which provide the areas for fish spawning and migration. Closed-water culture fishery includes harvest from ponds, baors (ox-bow lakes) and coastal shrimp farms.

Shrimp farming is becoming the principal activity in coastal brackish aquaculture. It is currently practised in temporal conjunction with a rice crop or salt production or as a mono-

cultural activity. Marine fishery accounts for about 27 per cent of the total fish harvest of the country.

Bangladesh possesses good terrestrial and aquatic environment that provide habitat for a large number of plants and animals. The delta is rich in fish and aquatic resources and other biodiversity. Rivers and other inland water bodies provide habitats for 266 indigenous fish species (belonging to 55 families) and 150 species of birds. The inland water bodies are also the habitat of 56 species of prawns. More than 20 species of freshwater molluses have been identified.

The marine water bodies are also remarkable in biodiversity, harbouring 442 species of fish and at least 36 species of marine shrimps. About 336 species of molluses, representing 151 genera have been identified from the Bay of Bengal. In addition, several species of crabs and 31 species of turtles and tortoises, of which 24 live in freshwater are found in Bangladesh.

However, shrimp cultivation has become a major concern from the past decade. It has caused serious environmental damage that has harmed fish and other aquatic biodiversity significantly. The physical loss and modification of aquatic habitats for fish, prawn, turtle and other aquatic organisms are said to be the major factors involved in overall fish varieties depletion.

Such shrinkage has been the result of thousands of physical structures and drainage systems that have been constructed in Bangladesh in an effort to control floods, cyclones and other natural calamities. These structures have disrupted the natural flow of waters in closed rivers, diverted rivers and have dried up water bodies.

Coastal ecosystem: A vast network of rivers, an enormous discharge of river-borne sediments, a large number of estuarine islands, strong tidal actions and vulnerability to tropical cyclones characterise the coastal environment of Bangladesh. The coast is about 710 kms long, measured along the shores of the Bay of Bengal between India (on the west) and Myanmar (on the southeastern tip). The coastal districts cover some 23 per cent of the country's territory and account for 27 per cent of the total population.

The coastline of Bangladesh can be divided into three main zones -- the western, central and eastern (Quamrul, 1997). Each zone contains distinct coastal landforms, and geomorphic and biological characteristics. The western zone extends from the international border with India to Tetulia river (east of Barisal) and the central zone extends from the Tetulia river point to the Feni river estuary (including the Meghna estuary). The eastern zone starts from the Feni river and continues up to the southern tip of the mainland beyond Cox's Bazar -- extending up to the Naaf estuary.

The western and central zones are part of the Ganges-Brahmaputra-Meghna delta system, whereas the eastern zone is non-deltaic. In the west, mangrove forests, i.e. the Sundarbans, dominate the coastal fringe. The central zone witnesses sediment-rich freshwater flows and their interaction with tides. In the eastern zone, wave action dominates the open-ocean front, though mangroves exist within sheltered estuaries.

The natural shape of the coastlines of Bangladesh is controlled by the forces of erosion and deposition, involving rivers, tides and waves. Straight coastlines of beaches and dunes are formed in the southeast where waves are strong. In zones where tidal action predominates, as in the western zone, tidal creeks of complex patterns are common, while the deposition of riverine sediments produce islands and estuaries in the central zone.

Population density in the coastal districts is slightly higher than the national average, and the rate of increase is also similar to the national trend. In addition to the permanent coastal population, there is a significant number of new and seasonal migrants to the coastal areas, especially to the newly emerging chars (shoals).

Seasonal migrants also include migrant fishermen who fish in the Bay. The two seaports of Bangladesh along this coast are Mongla (near Khulna) in the southwest and Chittagong - which handles the bulk of import and export commodities -- in the southeast. These two port cities are the major urban centres in the coastal region.

Fisheries in the coastal zone range from fully inland fresh water fisheries, through shrimp and other mixed freshwater and

saltwater fisheries to fully marine fisheries in the Bay of Bengal. Brackish water fisheries on the coast (where saltwater and freshwater mix) have increased in recent years with the intensification of shrimp farming -- one of the fastest growing export industries in Bangladesh.

Shrimp farming has inevitably created a conflict in land use with rice farming in the coastal zone. Since it is an export commodity and brings substantial foreign exchange, poor farmers in shrimp growing areas are losing the battle and are increasingly being forced to move and become landless.

Mangrove forests in the coastal area are an important natural resource. The largest of these forests is the Sundarbans. The Chakaria Sundarbans, along the southeastern Chittagong coast, are shrinking due to encroachment by shrimp farms. The Department of Forest has a scheme of planting mangrove trees along the shores for cyclone and embankment protection, and on newly accreted land for their stabilisation. The mangrove forests supply fuel wood for domestic and industrial use, timber for industry, and a range of other non-wood products.

There is a seasonally moveable salinity interface in the coastal area and estuaries, with the threshold limit for agriculture (2dS/m) moving inland in May in the southern part of Bhola and other southern islands. There are also salinity issues in the Southwest region, attributed to reduced dry season flows into the area from the Ganges system.

During the 1990s dry season, salinity levels in the Khulna area rose, for which one of the likely causes was also postulated to be the decrease in dry season surface flow from the Ganges. Surface water scarcity is observed in the Sundarbans, Chittagong, Noakhali, and Dhaka regions, where the ecological and environmental demands for surface water are higher than the supply.

Natural resources: The primary non-renewable resources in Bangladesh belong to the energy sector, and the country is generally poor in non-fuel minerals. Bangladesh heavily depends on traditional energy sources like bio-mass, especially in rural areas. National endowments of commercial energy, too, are modest.

Non-renewable commercial energy resources include coal, oil

and gas. Good quality bituminous coal -- discovered about 40 years ago -- is deposited at a depth of over 1000 meters at Jamalganj in western Bogra district. The reserve is estimated to be more than 1000 million tons. Geological exploration in northwestern Bangladesh also indicated probability of discovering coal reserves in that area.

Bangladesh has no significant oil deposit. But the country is endowed with an untold reserve of natural gas, which is currently its only non-renewable energy resource. It is the main source of commercial energy, accounting for 70 per cent of the country's commercial energy supply.

About 90 per cent of the country's power generation is based on natural gas and the entire urea fertiliser requirement of the agriculture sector is met by using gas as raw material. The proven gas reserve is estimated at about 23.21 trillion cubic feet [TCF], of which 13.73 TCF is considered to be recoverable.

Hydrocarbon exploration in Bangladesh started as early as 1910. The first gas field was discovered in Sylhet in 1955, and so far 20 gas fields have been discovered in the eastern and southeastern parts of the country, including the offshore field at Sangu, off the coast of Chittagong.

The government has recently opened up the oil and gas sector to private investment, inviting international oil companies for exploration and development activities under production sharing contracts.

The country has been divided into 23 hydrocarbon blocks, of which eight have already been awarded to foreign companies for exploration of oil and gas. The remaining blocks are now in the process of being offered to the foreign oil companies under the second round bidding.

Biodiversity: Biological resources and diversity form the basis of both the ecology and economy of Bangladesh. The country's agriculture, fisheries and livestock, along with a number of other sectors are heavily dependent, directly or indirectly on biological resources.

The Sundarbans support a very rich and diverse fish fauna of 400 species, over 270 species of birds and over 300 species of plants. It is an important staging and wintering area for

migratory shore birds, gulls and terns. The Sundarbans comprise the largest remaining tract of habitat for the rare Royal Bengal Tiger (*Panthera tigris*). St. Martin's Island is an important breeding area for marine turtles and a wintering area for migratory shore birds.

There is a great potential in Bangladesh for biodiversity based sustainable development. In spite of the threatened wild fauna and flora, there are nearly 10,000 species of plants, animals and microbial organisms - a good percentage of which are found in superabundance. A wise and sustainable yield and harvest methodology and management plan need to be formulated and applied at the field level. So that these biological resources are not over-exploited, and the economy of the country prospers.

Renewable resources: Forestry is one of the major sectors of renewable resources in Bangladesh, which contributes to the economic and ecological stability. Yet this is also a major vulnerable sector, facing continual depletion. Actual forest cover is approximately one million hectares, or only about six per cent of the total land area. Under the management of the Department of Forest, there are three main types of forests in three separate zones.

These are (a) tropical evergreen or semi-evergreen hill forests in southeastern Chittagong, Chittagong Hill Tracts and north-eastern Sylhet district, (b) deciduous forests in central Bangladesh, and (c) tidal mangrove forests in south-western Khulna district and the southern coastal belt. The hill forests account for 47 per cent of the forest area and supply around 40 per cent of the commercial timber production. The important timber species of these forests are garjan, jarul, gamari, koroi and shegun (teak). Parts of the forests have also been converted into rubber plantations.

The deciduous forest of central Bangladesh had originally extended beyond the Madhupur Tract into the northern districts. Sal is the predominant species here. This forest area has suffered massive degradation in the past three decades through illegal cutting and human encroachment. Unscrupulous timber merchants and poachers have not only cut down the mature trees, but have also dug out the stumps -- leaving the area barren without any regeneration potential.

The mangrove forest of the Sundarbans, in the greater Khulna district, is the world's largest single tract of mangrove -- parts of which spill over across the border into the Indian state of West Bengal. The total area of the Sundarbans is about 555,000 hectares, including waterways. Classified as a "reserved" forest, it provides timber, pulpwood and fuel wood. The main tree species of the Sundarbans are sundari, gewa, goran and keora. The most commercially important species, the sundari, has been adversely affected by increasing salinity levels.

The Sundarbans forest supports numerous and diverse animals, including the famous Royal Bengal tigers, birds, amphibians and reptiles of commercial and conservation importance. The fauna includes 120 commercially important fish species, 270 species of birds (including 95 types of water fowl), 50 species of reptiles, and 42 species of mammals like tigers, rhesus monkeys, spotted deer and wild boars. But unfortunately, the Sundarbans are in a state of decline due to a combination of causes, some of which are man-made including, unsustainable forestry management.

In addition to the above-mentioned forest areas under government control, there are private forests in villages around homesteads -- all over the country. Although these homestead forests comprise only 11 per cent of the total forest area of the country, they are characterised by high productivity and efficient management.

The government in 1993 prepared a Forestry Master Plan followed by the formulation of a new forestry policy in 1994. The Plan aspires to attain tree cover of 20 per cent of the total land area, and undertake reforestation of all degraded and denuded forest areas over a period of 20 years. In the reforestation programme, the private sector is being encouraged to participate in planting, nurturing and harvesting tasks through the social forestry model.

Poverty and population boom: The rising number of the poor and the population boom have been the two major challenges facing Bangladesh. Poverty does not just mean a lack of income. It also means a permanent state of vulnerability and

lack of access to resources. The poor in both rural and urban areas see sustainable livelihoods as depending upon secure employment and access to productive resources.

In general, they are more concerned with the exploitation of the environment in order to meet basic needs than with its protection and regeneration. Poverty and environment in Bangladesh are thus, caught in a vicious cycle - the growing number of the poor are forced by the few powerful rich to over utilise the environmental resources and put strain on their carrying capacity, while the environmental degradation (from overuse) further limits access to resources for the poor. The few rich are getting richer. The income inequality is also widening (*Quamrul, 1998*).

Bangladesh is often cited as a country with one the highest population densities in terms of numbers, disregarding the productive capacity of its human resources. People can resolve the resource constraints if their local wisdom and knowledge is supported to enhance production and quality of life.

Unfortunately, due to the use of unsustainable technologies in agriculture, the country's natural resources (land and water) are already under intense pressure. The narrow biological and genetic base of agriculture has become a threat for the agrarian systems. Bangladesh has demonstrated that increase in agricultural productivity is possible without exacerbation problems of soil fertility, water quality and ecological cost.

In this context, so far as Bangladesh is concerned perhaps on other areas deserve as much attention as the issue of sustainable agricultural and rural development strategies as enshrined in Chapter 14 of Agenda 21.

Poverty still remains a major environmental concern for Bangladesh. The links between poverty and environment demand formulation and implementation of alternative and innovative anti-poverty safety net programmes and, at the same time, promote sustainable development through increasing the productivity of natural resources involving the people in planning, decision-making and management (*Quamrul, 1996*).

But a major constraint in anti-poverty drive in Bangladesh is the high rate of population growth. Population pressures have

added to the stresses on natural resources and contributed to their over-exploitation. Some impressive achievements have been made during the past 20 years in reducing fertility.

Bangladesh has made commendable progress in the area of health & family planning. Effective family planning policies have helped in bringing down the population growth rate from 2.6% in the 1960s to 2.1% in the 1990s. Immunisation coverage in Bangladesh is the highest in South Asia.

It has been treated as a model country with respect to disaster management experience. Communities living in the vulnerable zones of Bangladesh have enormous coping capacities. Community resilience through indigenous coping capacities and improved warning systems are appreciated. Efforts must be made to expand activities that require full community participation for enhanced disaster prevention and mitigation.

In Bangladesh, concentration of poverty incidence is more prominent along the riverbank and vulnerable coastal zone. People living in the flood prone areas are susceptible to widespread starvation during the severe flood years.

However, Bangladesh offers a marvellous example to the world for the dynamism of its civil society organisations and development NGOs. Yet while civil society organisations have become worthy interlocutors for the poor and the disenfranchised, it is also apparent that the long term sustainability of poverty reduction depends, to an important degree, on real local self-articulation.

And this is where Bangladesh is redefining the agenda for development policy. Currently 10.2 million people in Bangladesh have access to microfinance services under government supported programmes, including the Grameen Bank, and more than 500 NGOs. Efforts to commercialise micro-credit system, however, are likely to push the NGOs further away from comprehensive social development programmes, which will have adverse impact on the poor.

Bangladesh has unique characteristics in the sense that the rural livelihood is based on biodiversity-based production systems where the majority can survive if the existing life support systems are maintained and enhanced.

In achieving sustainable development maintenance and regeneration of common property resources (CPRs) are important, as is the issue of increasing access of the poor to CPRs.

In the final analysis, poverty, population growth and environment have strong linkages in Bangladesh. The continued stress on natural resource potentials caused by increasing population will retard the poverty alleviation efforts. Thus, it is critical to get a further and more rapid reduction in population growth to achieve sustainable development.

Bangladesh steps into the third millennium with a vision for sustainable human development based upon a coalition of people across and within nations to achieve a just society in an atmosphere of peace, security, and harmony. This requires equity (within and between nations), prosperity (which must be inclusive of all strata in society sharing the fruits), and efficient and equitable management of the natural and biological resource base and the life-support systems globally, regionally, nationally and locally.

X

Chapter 2



Out goes ploybag, in comes jute bag



Photo: Abu Taher Khokon, FEJB

Bangladesh
State of Environment Report 2001



Out goes polybag In comes jute bag

Kazi Shahnaz with Rezaul Karim

For Dhaka city dwellers, it could as well be a cultural shock when they go shopping from the New Year's Day. For, they will no longer get those environment-hostile polythene bags, often so handy, to pack their groceries and instead may have to pick up the habit of using jute bags that they left some 20 years ago.

As the ban on polythene bags takes effect from the first day of the New Year, different organisations are ready with environment-friendly jute, cotton and paper bags as alternatives for polybags.

The decision has brought an unprecedented opportunity to many entrepreneurs who have long been producing bio-degradable paper bags for different city shopping malls.

Before the environment ministry decided to ban use of polythene bags, it was assured by various government bodies of adequate supply of products replacing polythene bags, ministry sources said. "We were assured by the Bangladesh Jute Mills Corporation (BJMC) and the Bangladesh Textile Mills Corporation (BTMC) of suitable alternatives to polythene bags," a highly placed source said.

The BJMC mills have been working round the clock to produce jute bags of different shapes and sizes so that people can use them for shopping, AKM Manzurul Haque, secretary of the Corporation said. These bags would sell at between Tk 2 and Tk 5 apiece. "We have directed our mills to produce jute bags and we hope these would reach the city markets before January 1 at affordable prices," he said.

The BJMC will deliver the jute bags by trucks to city markets including Karwan Bazar, Kachukhet Fokirerpool, Mahakhali, Gulshan, Thathari Bazar, Jatrabari and Amin Bazar. Moreover, the bags will be available at BJMC sales centres, he said. The

corporation earlier had conducted a market survey to assess the demand for various types of bags and set its production target accordingly, he said.

In a major pro-environment move, the cabinet with Prime Minister Khaleda Zia in the chair on December 23, 2001 approved the decision to ban use and marketing of polythene bags in Dhaka city from January 1, 2002.

The ban is being implemented under the Environment Conservation Law, 1995. Earlier, two separate moves to stop use of polythene bags -- one by the BNP regime in 1994 and the other by the Awami League government -- failed due to internal and external pressure.

While approving the decision, the cabinet observed that excessive use of thin polythene bags was seriously polluting the soil and water and adversely affecting the environment and the bio-diversity.

Cabinet sources said plans are underway to phase out the use, marketing and production of polythene bags (20 micron thick) across the country.

Although there has been tremendous pressure on the environment ministry not to go for such an action, the decision received an overwhelming endorsement by the cabinet members.

A cabinet minister said some of his colleagues and party lawmakers were averse to the idea of a ban, but none in the Cabinet stood for the harmful polythene bags.

The summary paper placed in the cabinet meeting said although the use of polythene bags started in 1982, its production and use have increased manifold since then.

Everyday about one crore polythene bags are used and 90 lakh of them are dumped haphazardly in the capital alone. About 20 per cent of the bags are recycled while the rest 80 per cent are being dumped into rivers, canals, drains, sewerage system, water bodies and in open spaces.

A study of the environment ministry said the total number of polybags produced in the country is around 129 million per day. Since polythene bags are not biodegradable, they remain intact

in the ground forever and destroy soil fertility.

The summary paper further said the rampant use of polythene bag has led to the clogging of the Buriganga river, lakes in the Dhaka city, the sewerage system and other water bodies. The dredging of Buriganga has been seriously hampered due to polythene bags accumulated at the riverbed.

Besides, the existing recycling process emits poisonous smoke and causes serious public health hazards. Polythene bags are injurious to human health and is a major factor responsible for cancer and other skin diseases.

The summary paper dispelled the apprehension of job loss due to the ban, saying that more employment opportunity will open up when jute, fabric and paper bags would be produced to replace polybags. Besides, the factories currently producing polybags can be remodeled for manufacturing of packaging products.

Sources said the cabinet discussed ways of encouraging manufacturing of jute, cloth and paper bags both in private and public sectors. The closed jute mills can be utilised for producing jute bags.

According to the environment ministry, there are about 800 polythene factories all over the country. Of them, 315 to 320 factories are engaged in manufacturing thin shopping bags and on an average eight to 12 workers are employed in each factory. Between 2520 and 3840 workers are engaged in these factories.

The summary paper said manufacturing of polythene bags is highly profitable because of low production cost. The production cost of each polybags is about Tk 0.05 to Tk 0.07 while the manufacturer sells these to the whole sellers at Tk 0.30 to Tk 0.35. It said the preliminary investment in a polythene bag factory is only about Tk 2 lakh.

The BTMC would also produce different types of cloth bags before the ban takes effect, an environment ministry official said. He said manufacturers of paper packets and bags are expected to produce different types of products to feed the market.

"The ban of polythene would also open different avenues for investment in pro-environment business," another official said.

The European Union (EU) earlier proposed to finance a project to produce bio-degradable jute products and was ready to provide Tk 23 crore for it.

Meanwhile, the ministry recently advertised for hiring manpower for the project, the source said.

The government has decided to ban marketing and use of polythene bags in the capital city from January 1 next year, considering their adverse impact on the environment.

"Marketing and use of polythene-made shopping bags will be banned initially in Dhaka city and then across the country in phases. In the second phase, the ban will be imposed in other major cities," said Forest and Environment Minister Shahjahan Siraj.

Talking with members of the Forum of Environmental Journalists of Bangladesh (FEJB) at his Secretariat office on November 3, 2001, the minister said officials concerned are now examining whether there is any legal aspect of the proposed ban.

FEJB Chairman Quamrul Islam Chowdhury who led the delegation spoke about activities of the organisation.

The minister said the government is very much concerned over degradation of environment in the country and will take necessary steps immediately to eliminate air pollution, noise pollution and lead pollution. It will effectively deal with issues like proper disposal of industrial wastes, indiscriminate setting up of brick fields and saving the Buriganga and other rivers from illegal encroachments, he added.

Shahjahan Siraj said the government has decided to begin the process by banning use and marketing of polythene bags. If necessary, laws would be amended for protecting people from environmental hazards.

He mentioned that the Ministry of Forest and Environment has already discussed with the ministries of Jute and Textile and NGOs to find out alternatives of polythene shopping bags. The environment secretary has been asked to look into the matter on an urgent basis.

The minister pointed out that there could be temporary problems due to the ban. "We are also thinking of importing of bags made of paper and cloth on a temporary basis till domestic jute and textile industries can ensure adequate supply of bags."

Regarding unemployment of people now working in polythene factories, he said steps will be taken to absorb them in jute and textile sectors.

About there-wheeler auto-rickshaws, he said the prime minister has already instructed that immediate steps should be taken to eliminate emission of black smoke by these vehicles. An inter-ministerial meeting will be held soon to take a final decision. "I think elimination of auto-rickshaws black smoke is not a big task and we will be able to do it soon."

The steps initiated by the caretaker government to save the Buriganga from illegal encroachments will continue, he said. Steps will also be taken to free the river from pollution.

Shahjahan Siraj said that the environment ministry is not being able to discharge its responsibilities freely as more than three other ministries are involved in its activities.

He however said all obstacles to enforcement of environment related laws would be removed soon.

Unlike the previous government, the BNP government will not do politics, capitalising on issues concerning rickshaws, auto-rickshaws and such other vehicles, he said.

Responding to an FEJB suggestion, the minister said the National Environmental Council headed by the prime minister would be reactivated immediately and if necessary, recast. Representation of FEJB in all committees relating to environment would be ensured.

Environment Secretary Mahfuzul Islam said, "We have to proceed considering alternative employment of the workers of polythene factories."

The others who spoke were FEJB Vice-chairman Anwar Hossain Manju, General Secretary Abdul Jalil Bhuiyan, Sharif Shahabuddin and Giasuddin Ahmed. Director General of the Department of Environment Hedayetul Islam Chowdhury and high officials of the ministry were present.

Alternatives are there

Kazi Shahnaz

Arrangements have been made to provide immediate alternatives to polythene shopping bags as the government has slapped a ban on their use and marketing effective from January 1, 2002.

Environment Secretary Sabihuddin Ahmed said this at a press conference in the city on December 24, 2001.

Refereeing to the directives of Prime Minister Khaleda Zia for effecting the ban on the use of polythene shopping bags across the country by next two months, the environment secretary said prior to the ban, the government wanted to allow a 'breathing space' to the users and manufacturers to adapt to the new situation voluntarily.

When asked about the immediate alternative to polythene bags, he said the government has already asked BJMC and BTMC to innovate environment-friendly shopping bags at cheaper rate. Jute mills in public sectors have given the assurance of providing 1.2 million (12 lakh) bags within a short time, he said.

Marghub Murshed said the government wants to encourage the use of indigenous 'thonga' (packets made of paper sheets) in the country instead of polythene bags. He said, if necessary, financial support would be given to the 'thonga' makers who employ a good number of poor people.

Meanwhile, the government sought allout cooperation of the print and electronic media in its extensive campaign against the use of polythene shopping bags across the country, particularly in Dhaka city. "Certainly, we will go for the ban on the use of polybags in Dhaka city from the first January. But, prior to that, we need an extensive last-minute campaign to encourage people to join the move voluntarily," Environment and Forest Secretary Sabihuddin Ahmed told a press conference in the city.

Information Secretary Syed Margub Murshed, Principal

Information Officer Suzauddin Ahmed and Chairman of the Forum of Environmental Journalists of Bangladesh (FEJB) Quamrul Islam Chowdhury were also present and replied to questions from journalists in the conference held at the information ministry.

The cabinet agreed on December 23 in principle to control and discourage marketing and use of thin polythene shopping bags as well as imposition of ban on it in capital Dhaka, from January 1, 2002.

Beside, the government has plans to impose ban in phases on the use of thin polythene bags that have already posed serious threat to land fertility, environment, public health and sewerage system of different towns and cities.

In another development, Environment and Forest Minister Shahjahan Siraj urged the citizens not to use thin polythene bags inside the capital city from January 1, 2002 to protect Dhaka from a colossal ecological disaster.

The minister's passionate appeal came at an inter-ministerial meeting on a ban on use and marketing of polythene shopping bags. Mayor of the Dhaka City Corporation Mohammad Hanif, State Minister for Forest and Environment Zafrul Islam Chowdhury, State Minister for Textiles Mizanur Rahman Sinha and Deputy Minister for LGRD and Cooperatives Advocate M Ruhul Qudus Dulu, among others, were present in the inter-ministerial meeting while mayor of Dhaka and ward commissioners participated in it.

Shahjahan Siraj directed all government, semi-government, autonomous and private offices not to use polythene shopping bags. He also asked the entrepreneurs and executives of jute-based industries and paper bag makers to make their products available in the markets as early as possible.

The environment minister assured them that alternative employment opportunities would be created for all

entrepreneurs and workers who would be adversely affected after imposition of restriction on the use of polythene shopping bags.

The inter-ministerial meeting stressed the need for launching a massive campaign in radio, television and national dailies for highlighting the magnitude of the polythene problem and the significance of the issue.

Why should we shun polythene bags?

1. Foodstuff when kept in polythene bags cause chemical reaction that may result in food poisoning and prove detrimental to health.
2. Polythene when burnt in open air creates poisonous gas that may cause cancer in the lungs.
3. Polythene does not dissolve or organically mix with soil. Hence it reduces the fertility of the soil.
4. If there are polythene in different strata of the earth, it is dangerous for constructing buildings on that land.
5. Polythene shopping bags cause water-logging in cities.
6. Polythene creates problem for trees to receive nutrients from the soil.
7. Polythene can cause different kinds of skin diseases.

Means of getting rid of polythene

1. We can get rid of polythene by using bags made of jute, cotton textiles and paper.
2. By introducing greater use of packaging materials made of bamboo and clay.
3. One should not only shun using the polythene bags but also encourage others to shun their use.
4. By creating a social resistance against use of polythene bags across the country.

Helping hands needed

Anisur Rahman

The Ministry of Environment on November 9, 2001 sought the support of the civil society and NGOs along with the common people in enforcing the ban on the use of polythene bags in Dhaka City from January.

"We urge the civil society, NGOs and others concerned to extend their hands along with the common people to help enforce the ban in line with the recent government decision," Secretary of the Ministry of Environment and Forest Sabihuddin Ahmed said here at a review meeting.

The call came as officials and representatives of the donors, NGOs and other agencies concerned attended a meeting to review the progress of the US\$ 26 million Sustainable Environment Management Programme (SEMP) at the LGED auditorium in Dhaka.

A total of 21 government, NGO and professional bodies are implementing the SEMP, the largest United Nations Development Programme (UNDP) sponsored environmental programme across the world having 26 components.

The secretary noted that most of the implementing agencies achieved substantial progress in their respective components but few are lagging behind the desired level.

Yannick Glemarec, Deputy Resident Representative of UNDP said a lot of activities were being carried out under the UNDP sponsorship in Bangladesh. He urged the implementing agencies to share their information and successes for better outcome of the massive programme.

Chiefs of the implementing agencies described the progress of their programmes in their respective components.

The five-year SEMP to continue till 2003, was initiated as a follow up of the landmark 1995 National Environmental Management Action Plan (NEMAP) which recommended specific programmes and intervention for the protection and management of environment in all sectors.

UNDP Assistant Resident Representative Shireen Kamal Sayeed, Environment Ministry's Dr Mahfuzul Haque, Sunil Kanti Bose and Kamar Monir, World Bank's Dr Paul Martin, SEMP's Dr Mizan Khan, BIDS Director General Dr Asaduzzaman, FEJB Chairman Quamrul Islam Chowdhury and BUP's Dr K B Sajjadur Rashid were present.

Polybag ban to create jute sector jobs

Kamaluddin Sabuj

Minister for Environment and Forest Shajahan Siraj has said the ban on the use of polythene bags would held create job opportunities in the jute and other sectors apart from protecting environment.

"Only 4,000 employees may lose their jobs due to the ban, but we are committed to rehabilitating them," he said at a mass rally at the Paltan Maidan on December 27, 2001. Ministry of Environment and Forests and Directorate of Environment organised the rally to raise awareness about the impact of polybags on the environment.

The decision to ban use of polythene bags was taken after a series of discussions with all sections of the society, he said, adding that this highly harmful substance was polluting environment in Dhaka and other parts of the country.

Describing polythene as an enemy, the minister said the Buriganga has lost its navigability and its water has become poisonous due to polythene bags, which are being deposited in millions on its bed day by day. And the city's sewerage system, are being choked with polybags.

Reiterating the government's commitment to improving the city's environment, he said city dwellers would also get rid of the poisonous effect of black some by February next. "We will do it all over the country in phases", he added.

Participants in the rally carrying placards and festoons paraded main avenues and chanted slogans against polythene. Department of Mass Communication arranged a musical programme with the participation of leading artists and music bands as part of the campaign against polythene.



The all-devouring rivers



Photo: Shafiuddin Ahmed Buti, FEJB



The all-devouring rivers

Dr. Rezawan Siddiqui

During monsoon every year, heavy rains trigger floods in the northeast Indian State of Assam. The floodwater from Assam rushes downwards to the Bay of Bengal through Bangladesh territory, bursting the banks of the river Brahmaputra and its tributaries which are the main purveyors of the monsoon floodwater. The floods thus inundate vast tracts of sandy char lands or shoals (river islands) of the mighty Brahmaputra. Much of the rages of the monsoon floodwater from the Assam hills are experienced by Gaibandha and Jamalpur districts through which the Brahmaputra meanders downstream towards the Bay. Some years, the flood takes a catastrophic turn with deep water sub-merging vast areas across the Brahmaputra basin. At some points, the river itself becomes violent with strong currents, triggering massive erosion that devours large tracts of land along the Brahmaputra.

The water of the Brahmaputra in the Indian side is clear. But after entering into Bangladesh territory, it becomes muddy. That is because the river's water gets mixed with eroded soil and land along the banks as it flows downward. Erosion along the Brahmaputra is massive on the Bangladesh part. And the river erosion problem is so grave that thousands of people become homeless overnight each year. There might be a market place at some point of the river bank in the morning and overnight--the next day--there would be no sign of that busy village market. The plight of the victims of river erosion is miserable as they turn pauper overnight. Thousands of villagers along the Brahmaputra thus have to fight for their existence against the atrocities of the river Brahmaputra.

A group of journalists recently made a trip to the most affected area of Brahmaputra basin in the Gaibandha district on the river's west and Jamalpur in the east to see for themselves the

on the ground situation. This writer was in that group. We started our journey by an engine boat from the Pallakandi Ghat under Dewanganj upazila of Jamalpur district on 28th June, 2000. Once there was market, a hospital, an orphanage and some residential houses at Pallakandi. But as we set out, we saw a single structure of tea shop there. But on our return to the place the next day, we found that tea shop was no more there as the Brahmaputra water already submerged the spot. In 1988, there were 873 families at Pallakandi village. Except a few, all families were uprooted from their ancestral home, which disappeared over the years by the endless process of erosion. The homeless villagers of Pallakandi took shelter on a high metalled road with all their belongings.

During the trip, the group also experienced river erosion in its full fury as the nearby Nayagram village under Bahadurabad Union Council. The villagers there were trying hard to save their homesteads as well as other belongings in the face of slowly advancing Brahmaputra that was about to devour Nayagram anytime soon. The village of about 40 families was bracing itself to be taken away by the angry Brahmaputra.

We also crossed a long stretch of land hit by erosion at Madarer Char village. Only 3 to 4 houses could be seen. There were remains of kitchen gardens and homestead forestry hoisting their tops over water. People are shifting their pets and different household materials to another char nearby. Water engulfed the courtyard of a homestead at Madvar Char village. The local administrator had advised them to shift to safer places or at the Upazila headquarters leaving their homes. But many did not follow such instructions; rather they were preparing themselves to protect their home from the erosion underway.

These people are used to fight against natural calamities like river erosion. They live with them and even fight to the last to survive in their ancestors' village. And for that reason, they do not want to leave their homes and hearth even in the face of heavy floodings. Often they even take shelter on the rooftop of their submerged houses.

The United Nations Development Programme (UNDP) has undertaken a project called 'Sustainable Livelihood in Riverine

Charland' for the benefit of these struggling people of Gaibandha and Jamalpur area who have been the worst victims of river erosion. But only one non-government organization (NGO), Ganachetana, was seen working for implementation of the UNDP project.

We visited a model cluster village under Merurchan Union on the eastern part of the Brahmaputra. The village, Bhati Kalkihara, was developed on char and surrounded by the river. It accommodated 62 families who became homeless due to erosion. The land of Bhati Kalkihara village was raised high so that it always remains out of the reach of the floodwater. The dwellers of the village cultivated vegetables and green grass in and around their settlement.

Anguri (25), an ill-nourished wife of a day-labourer, lives in a room with their three sons and a daughter. She rears a goat, which gives birth to 2-3 kids twice a year. With the onset of the floodings, she had sold out two goats of 6-month-old and got Tk. 1200. We found there were two goat kids kept inside the room. She rears some chickens but no ducks. As the family remain idle during the monsoon, they would have to depend on that small amount of money they got by selling the goats and the pet poultry birds for their survival.

A river ravaged

Shehab Ahmed with Kazi Shahnaz

The Buriganga, the river on which Dhaka, Bangladesh's capital, grew up over hundreds of years, has been stealthily shrinking and slowly dying -- thanks to acute environmental pollution and a section of influential quarters engaged in encroaching upon and grabbing the river bit by bit.

Despite a government vow to stop the encroachments into the river, which was once the main artery of communication of this ancient city, this old tributary of the Ganges has virtually been reduced to a narrow canal of polluted water. Moves to evict the illegal encroachers and restore the normal flow of the river have so far failed to make any headway.

Experts fear that the Buriganga is likely to be physically and biologically dead with heavy water pollution in the near future. The authorities concerned must do something to save this lifeline of our capital city; or else the river will die soon, causing a great environmental disaster.

A survey conducted in 1998 by the Department of Environment (DoE) showed that the river flowing by the capital's western flank had been boxed in by at least 244 establishments, most of which are makeshift homes, small factories, dockyards, boat-making workshops, etc. The survey revealed that approximately 50 acres of Buriganga land have been encroached upon by those occupants. Out of 50 acres of land, 38.7 acres of land are under Kotwali circle, 7.01 acres of land under Tejgaon circle and 4.3 acres of land under Keraniganj thana. During the dry season, the activities of the encroachers are too visible all the way down the flood protection embankment from the city's Mohamamdpur area to Lalbagh in the old town, and up to the Bangladesh-China Friendship Bridge in further south.

All kinds of encroachers, often backed by the local bigwigs, were reportedly busy consolidating their gains through

reclaiming land -- the most precious thing in and around the capital -- from the riverbed. A visit to the riverfront will show how structures built on stilts have sprung up along the banks of the dying river. To consolidate their holdings, they resort to largescale and indiscriminate dumping of wastes and garbages for landfill. At some places like Kamrangirchar, Kamalbagh and Islampur, some local people have even raised concrete pillars with boundary walls to make their presence permanent. Huge slums and shanties also sprang up on both banks of the river.

Further down near the Sadarghat riverport terminal, the encroachers are mostly commercial establishments. They have put up their shops on both sides of the river, selling all kinds of things. There are quite a large number of unauthorised dockyards and boat building factories which extend to the mid-stream.

When the DoE came up with its startling revelation after the survey, identifying the occupants, there had been very strong protests from the encroachers, some of whom even gave statements to newspapers claiming that they had been defamed and that they were the rightful owners of their establishments. As public opinion grew against the encroachment upon the river, the government immediately decided to act by launching a "save the Buriganga campaign".

Water of the river turned septic under the huge burden of effluents flowing into it, mostly coming from the sewerage system and carrying chromium-rich leftovers from the tanneries at the city's Hazaribagh area. The river, with black and stinking water, is constantly receiving industrial and other toxics and poisonous wastes of Dhaka city and oil and grease spills from riverine vessels. Its water is no longer clean and transparent. Today, the living organisms in the river from Mirpur to Bangladesh-China Friendship Bridge point are all dead, according to a DoE survey. The dissolved oxygen in water near the Hazaribagh point, according to the survey, reached a low of 2 mg/litre during January-May period.

A national committee headed by the Minister for Environment and Forest has been formed to prepare an action plan to evict the encroachers and salvage the river. According to informed sources, the Divisional Commissioner of Dhaka had been given the responsibility to evict the illegal encroachers. RAJUK -- the

government agency responsible for the development of the capital -- had been given the task of beautification of the river banks. BIWTA -- the inland water transport authority of the government -- was entrusted to restore the normal flow of the river.

Experts suggested remedial measures including demolition of illegal settlements along both the banks of the river, not allowing any new settlements, dredging the river to deepen it and enhancing the navigability of the Buriganga. They also laid stress on the construction of a road -- with provision for sidewalks for the pedestrians -- for beautifying the river banks and keeping its water clean.

Siltation chokes Karnaphuli

Abdullah Al Mahmud

Stretching around two-kilometre area, the river Karnaphuli from Karnaphuli Shah Amanat Bridge to Sadarghat BIWTC terminal faces severe siltation that narrowed the river at Bodnor channel alarmingly.

If it continues, the existence of main jetties of Chittagong port might be threatened in addition to the hindrance to free-movement of water transports.

Side by side with illegal encroachments, unplanned construction of different installations, even by the government and lack of coordination to address the menace is worsening the situation.

At the same time, random disposal of harmful wastes and tons of garbage that ultimately find their way to the river through the city drains not only aggravated the siltation but also polluted the Karnaphuli.

Such practices now poses a threat to the existence of the Karnaphuli- the economic lifeline of the port city of Chittagong and the country as well on which the country's premier sea port is based.

According to a Bangladesh University of Engineering and Technology (BUET) study on the siltation at the portion of the river, construction of the Shah Amanat Bridge (locally known as Karnaphuli Bridge) was identified as the main reason behind it. The four-member team conducted the study as per the agreement signed between Chittagong Port Authority (CPA) and the BUET on June 11 last year. The team submitted its draft report to the CPA for its opinion on April 8 this year.

Prof Dr. Khorshed Alam led the team. Other members of the team are Prof MF Bari, Prof MM Hossain and Prof Mir Zahan from the Department of Water Resources of BUET.

The team identified three main reasons for the massive siltation

of the river at that point. Of them, deposition of earth through replacement by scouring from river bed at the left bank due to the construction of the Shah Amanat Bridge was attributed to around 78 per cent siltation at the right bank of the river.

Two other main reasons were: Tons of wastes and garbage of the city carried into the river through drains and other canals with strong currents and erosion of the river bank to the upstream of Shah Amanat Bridge and scouring of the river bed soil due to lack of river training.

The report put forth a set of recommendations to be implemented in two phases for remedies. The first phase includes capital dredging, periodic maintenance, dredging and revetment works of the existing erosion prone banks. Construction of jetties, wharves or training wall along the left bank of Shah Amanat Bridge, training wall at the tail end of the right channel of Bakalia char and along the alignment of old Kolagaon revetment and widening of Bakalia right channel and closing of the left one are to be done in the second phase.

As the first option for capital dredging, the report suggested dredging of 21 lakh cubic metre within an area of 1800 metre in the aforesaid stretch. The area has been marked up to 200 metre into the river from the banks where the draft is less than four metre.

Sources concerned in the CPA said, though the report did not give any hints about the possible "indicative price" for the recommended capital dredging and river training works, the dredging of 2.1 Million (21 Lakh) cubic metre might cost some Tk 46 crore (Tk. 220 for each cubic metre of dredging).

"The area suggested for dredging in the port is now a complete shoal and immediate dredging is vital," a senior CPA official of the Hydrographic Department said.

"Otherwise, it would severely affect the main jetties of the port," the official added preferring anonymity. Moreover, the siltation of the river at the said stretch rendered the once lively BIWTC Terminal of Sadarghat "useless" as no vessel of coastal route now anchor there, the sources said.

The passengers have to board the vessels using boats and the goods also need to be carried by the same means that raises the

transportation costs of essential commodities, they added. The Roads and Highway (R&H) has proposed for third bridge (after Kalurghat and Shah Amanat bridges) over the river.

The ECNEC recently approved the proposal. The BUET report said if the R&H authorities responsible for such installations take initiative for the third bridge then it must remove all the pillars of the Shah Amanat Bridge. Prior to that the R&H must consider all the possible impacts the proposed bridge might have on the navigational channel of the river, the report added.

And accordingly, sources said, the CPA might think of requesting R&H for conducting a survey in this regard and might seek cooperation of the ministry concerned if necessary. Around 50 kilometres area of the river bank at different points has already been taken over by illegal occupants. Many places of Chaktai, Yeakubangor Ghat, Bridgeghat, Jalilgonj, Bangla Bazar, Sadarghat and Mazirght, have been encroached upon, giving way to construction of illegal structures.

The encroachers occupy the river bank erecting bamboo fencing and then fill the river to sell the gained land at Tk. 4 lakh per Katha. In some cases, they obtain license or take lease of foreshore land from the estate department of the concerned CPA and extend their grab inside the river increasing the area of the land.

Foreshore land license holders go for installations and construct illegal structures very often violating the conditions set in the licenses.

Dozens of slipways and gangways of different industries have been constructed extending them illegally sometimes as far as 400 feet inside the river from the both banks choking the river near the Bondor channel.

These structures help siltation of the river hindering its flow. As these remain submerged during the high tide, they pose threat to the safe movement of the water transports as well.

There are over 30 firms and industries along the banks at the Bondor channel, hindering the river flow. On the otherhand, thousands of tons of garbage and solid wastes 50,000 of the city find their way to the Karnaphuli through drains of the city. There are also around 50 thousand sanitary latrines and another

24,000 open latrines in the city to produce around 400 tons of solid wastes to go to the river.

Besides, of the 720 industrial units along the river at Chittagong and Chandrghona, 217 units have been indentified as polluters of the river releasing harmful chemical wastes.

Meanwhile, speakers at a discussion meeting on "The present and future of the Karnaphuli" recently stressed on comprehensive planning mechanism to save the river Karnaphuli. Coordination among all the authorities concerned including the CPA, R&H, Chittagong City Corporation (CCC) and Chittagong Development Authority (CDA) was underscored.

The participants stressed for integrated and well-coordinated measures to help maintenance, timely dredging and training of the river and for the development and taking care of the canals of the city's drainage system that carries mud and wastes to the river causing siltation.

They also felt the necessity of strict application of the laws to check the encroachment of the river and disposal of chemical and other wastes from different factories along the river and the city canals polluting the water seriously. To check pollution, the speakers put accent on the necessity of eviction drivers and other measures to be properly implemented through integrated and sincere efforts by the authorities concerned.

They severely criticised the CPA for not taking proper measures to control the encroachment and pollution in the Karnaphuli. They also blamed the CPA for leasing out lands on the river bank helping growth of factories that dispose of harmful chemicals to pollute the river.

The Gorai groans in pain

Rosy Ferdous

It was mid-monsoon when reports of river erosion started pouring in from every nook and corners of Bangladesh. The erosion situation along all rivers in Bangladesh, including the mighty Padma and Jamuna, also became critical. But here is the sordid tale of Gorai, a major tributary of the Ganges flowing across the district of Kushtia in western Bangladesh.

For much of the country's southwestern parts, the river was the main source of sweet water supply. But exceptionally, it is not hit by massive monsoon erosion suffered by other rivers--maybe because of Gorai's quiet nature. The Farakka Barrage, constructed on the Ganges by neighbouring India across the border reduced the Gorai to a virtual stream. And it is probably because of the Farakka Barrage that keeps the Gorai free from erosion even at the peak of monsoon. Today, the river is slowly dying, causing serious threats to public life and the environment.

As a result, saline water infiltrated in the southwestern Bangladesh affecting agriculture, forestry, fisheries, hydro-power generation, health services and domestic work of people over an area of 25,900 square kilometres. The region was totally dependent on the natural flow of the Ganges water. For instance, salinity of water at Khulna, 146 kilometers off the coastline, had gone up almost 72 times after the construction of the Farakka Barrage, which was commissioned in 1975.

For instances, the condition was so grave on 30 March 1993 near the Hardinge Bridge point that the flow of Ganges water came down to 9208 cusec. Subsequently, the flow of Gorai was becoming slow due to dearth of adequate water resulting in siltations on the river bed at various points. The disruption of connection between the Gorai and the Ganges for a period of four to six months each year became a regular phenomenon.

Some steps were taken to keep the river's flow normal. And to check such infiltration of saline water massive excavation programmes on the Gorai were undertaken in 1977, 1983, 1984 and 1992.

A three-year project was also taken up in the fiscal 1996-97, but the initiative could not yield any positive result. Meanwhile, a model was developed to review the recommendations of a survey conducted under the Flood Action Programme (FAP-4) to increase the water flow of the Gorai. But in 1997, following the advice of the World Bank, the government postponed the implementation work of the ongoing project.

As the same time, another project was formulated to keep the flow of the Gorai normal throughout the year by a joint mission of the World Bank and the Dutch government. They recommended mechanical dredging at the beginning on a priority basis. The government approved this project in 1998 with its own contribution of Tk. 1030 million. Donors committed Tk. 1207.5 million for this project, of which Tk. 810 million was to come from the Dutch government and the rest was pledged as soft loans by the World Bank and the government of Belgium.

A group of six members of the Forum of Environmental Journalists of Bangladesh (FEJB) recently went to Kushtia to see how the river that had so much of project support is flowing today. The field trip was organised in June, 2000. The FEJB team was accompanied by the officials of Gorai River Construction Company (GRC). The team started its journey by an engine-boat from Bebaria village under Mirpur upazila on June 10 and traveled up to Gopinathpara village toward the north under Sadar upazila of Kushtia district. The Gorai then appeared a lean, thin and weak stream.

The distance between the Gorai and the Bay of Bengal is almost 325 kilometres. The GRC officials informed the FEJB team that they had started the dredging in 1998, despite obstruction from local people. The villagers along the river believed that erosion would start with the mechanical dredging, causing the loss of their homestead and land. But after the dredging of 20-kilometre area of the river route from Shaldalia

to Barulia, the Gorai was having 10 per cent water from the Padma and no case of erosion was reported. When the boat carrying the journalists was approaching Kushtia town, they saw a huge German-made dredging unit at the Renwick ghat and a town protection groyen. There are three such groyens constructed a long time ago, perhaps during the Pakistan period or during the late British rule.

In course of the trip, it was found that at many places earth were being collected from river bed and piled on the river bank. The officials accompanying the team as well as the local people informed that often some influential people deployed labourers for cutting the earth used to low lands in and around Kshtia town. Often, those influential people have arrangements with the district administration which keeps a blind eye to such illegal activities like collecting earth from the river bed. And when the government is trying to revive the normal flow of the Gorai for restoring the overall environment with foreign assistance, lease holders and often the heads of the local government bodies are involved in such eco-system damaging activities, which created erosion along the river bank and siltation on the river bed at many points.

Daring the spot investigation by the FEJB team, local people gave many important information. Sajeda Khatun, a housewife who lives in a nearby village, said, "We can now have bath in the river water even in the summer. Earlier it was impossible to do so in the knee-deep water. Braving the monsoon, water flow does not rise remarkably as it did earlier when overflowing water used to inundate nearly every village and field."

These is a controversy at the local level over the success and failures of the Gorai river reexcavation activities. Some people held that it was simply a misuse of money. Some experts said nature does not permit the change of normal course of a river. So it should not be done even in the face of popular public demand.

Remedies for river erosion

Dr. Mahfuzul Huq

River erosion is a complicated and long time problem in Bangladesh. The banks of the rivers erode regularly grasping more land. It is creating an adverse impact on man and environment. Thousands of people are losing everything and there is no initiative to rehabilitate them. There is a qualitative difference between river erosion and other natural disasters. Flood, cyclones and tidal surges become headline of newspapers and draw people's attention at home and abroad. But river erosion is a continuous and silent process which remain out of the policymakers' attention.

Bangladesh is a riverine country. There are 250 small and big rivers in Bangladesh. The length of all these rivers together is 24,000 km. The rivers of Bangladesh are part of three major international river systems, their branches and tributaries. These three major rivers are the Ganges (popularly known as the Padma in Bangladesh), the Brahmaputra and the Meghna. Eight per cent of these rivers and their branches flow through Bangladesh and the rest 92 per cent are in the other countries.

The landmass of Bangladesh is basically a delta which has been formed by silt carried by the rivers. The formation is continuous process and it is ongoing. As a result, little pressure of river water causes land erosion on the river banks. Around 1200 km of river banks have been identified as erosion prone. A report reveals that since 1954 till 1988, 2000 km of land had been devoured by the rivers.

River erosion in Bangladesh is not less dangerous than other sudden and disastrous natural calamities. River erosion causes damage slowly and gradually. It has long term effects. It requires several decades to make up the massive loss caused by river erosion. But there is little initiative in taking development projects for changing the lot of the people who are victims of

river erosion. People are also not much aware regarding the problems of river erosion.

The legal regime of river erosion is also very weak. River erosion creates new land as riverine island. But the laws regarding land alluvian are so complicated and full of lacunas that people who lose their land by river erosion cannot get their land in newly formed riverine island. These lands are occupied forcefully by rural rich or powerful people. If any poor family becomes landless due to river erosion, they usually do not get back their land any more.

A survey conducted by Bangladesh Development Partnership Center during 1992 to 1994 reveals that some 26,95,048 people lost their land and 5, 50, 207 acres of land were lost due to river erosion in 51 districts out of 64 districts in Bangladesh. Fifty per cent of the people who lose their land by river erosion cannot construct new home for lack of money. So they become homeless and landless. There are about 35 lac homeless floating people in Bangladesh and this number is increasing by 2 lac 50 thousand on average every year. They live a floating life on roads, embankments, railroads or khas lands. They migrate to the towns and cities and create additional pressure on urban slums.

Previously river erosion was treated as a natural calamity by the government of Bangladesh. In 1993, it was included in the government's disaster list during the formation process of the government's disaster management bureau.

Land law of river erosion

Under State Acquisition and Tenancy (Amendment) Act of 1994, previous laws were amended to bring changes in two important areas. Firstly, if a land lost by river erosion emerges again within thirty years (previously it was 20 years under State Acquisition and Tenancy Act 1950), the original owner will get back the ownership of the land. Secondly the possession of the emerged land will be taken over initially by the district commissioner for one year, its survey will be done and border will be demarcated by 45 days, and its possession will be handed over to the original owner within one year. But if the owner has had any other land, that land together with the re-emerged land cannot be more than 60 bighas.

But a memorandum was circulated by the Ministry of Land regarding the execution of the law after it obtained the President's assent. The memorandum said that the lands which were alluvial or diluvial immediately before the promulgation of this law would not fall under the jurisdiction of the law. That means the land which was eroded by river the day before the law was promulgated would not be returned to its original owner after whatever period of time it would emerge. That land will become khas land. Again, since it takes 25 to 40 years for a land eroded by river to re-emerge, the land which will emerge within next 25/30 years will be treated as eroded before passing of this law and therefore, will not fall under the domain of this law. So this law will not have any effect in next 25/30 years.

Again if this law becomes effective after 30 years, many issues will remain unresolved then. There may be uncertainty about the accuracy of survey that may be conducted for land identification and demarcation. Because, in returning land to its original owner, preparing correct map and designing and doing demarcation as per the design is very important. Difficulties in land demarcation might deprive victim of river erosion by giving them no land at all. If original owners of land can be deprived for any reason, it will become khas land and the influential people will take that land by settlement.

In the past, there were not so many problems regarding land erosion in Bangladesh. Because, there was no individual ownership of land, rather there was social ownership of land. Social leaders used to distribute land among the family members of a society for possession and use. If any land was eroded by river, it was treated as lose of land of the society at large. The society used to arrange land for a person who had lost his land by river erosion. As a result, river erosion did not affect economically any person or his family. Villagers used to pay land tax to Bhuiyans who in turn would pay tax to the Nawab of Bengal or the Emperor of Delhi. The British initially introduced 10-year settlement of land in this sub-continent. In 1793, permanent settlement was introduced which caused emergence of the Zamindari system. Thus concept of individual ownership of land was created which started causing land disputes.

The basic law on river erosion in this country was the Bengal Alluvial and Diluvian Act, 1825. This law was promulgated by the British rulers and by this regulation, various rules regarding settlement of land eroded by river were introduced. Despite some changes, the law was in force before the State Acquisition and Tenancy Act, 1950 was promulgated. Under the State Acquisition and Tenancy Act, 1950 if a diluvian land re-emerges within 20 years, it will be vested back to its original owner under certain conditions.

By the Presidential Order No. 135 of 1972, all alluvial land became the government's khas land. But in this order, there was a weak provision of giving preference, under certain circumstances, to the original owners of such khas land during their distribution. The Presidential Order of 1972 was amended by Presidential Order of 1975 and Ordinance No. 61 which indirectly reinstated the State Acquisition and Tenancy Act, 1950. In 1984, a land reform ordinance was promulgated by which per family land ceiling was decreased to 60 bighas keeping other provisions same. In 1987 by another circular of the Ministry of Land, landless people particularly people who have lost their land by river erosion was given preference in distribution of khas land. It was also mentioned that section 87 of State Acquisition and Tenancy Act, 1950 was to be applicable only in case of agricultural land and non-agricultural land would not come under the domain of this provision. On the other hand, under the Non-agricultural Tenancy Act, 1949, government cannot acquire those land which were non-agricultural as khas land. Since this law was not amended, it is still in force and the government is acquiring all kind of lands which were eroded by river.

Recommendations

Land law reform

- A law is to be promulgated with the provision that a diluvial land cannot be made khas land up to government prescribed ceiling after whatever time it becomes aluvial.
- A law is to be promulgated with the provision that if a land under personal ownership is grasped by river and re-emerges after whatever time, if its ownership is changed by any transfer deed, its ownership will remain same up to the government prescribed ceiling and its previous/original

- owner or his legitimate heir will get the ownership.
- No aluvial/diluvial land can be given in one year settlement. Aluvial land, up to its ceiling, is to be allocated to its legitimate owner and the additional land will be owned by the government as khas land. This khas land can be transferred, by transfer instrument, to people who are victim of river erosion or other landless people.
 - Except aluvial land, in allocation other government khas land, people victim of river erosion will have to be given preference, because as per the indicator of landlessness, landless people who are victim of river erosion are the poorest of the poor.

Loan facilities for victims of river erosion

- All agricultural and other small loans of victim of river erosion are to be waived. All certificate cases against victims of river erosion are to be withdrawn and filing such cases against victim of river erosion will have to be prohibited.
- Be an owner of land or not, people who are victim of river erosion will have to be provided with micro-credit from banks without any collatrel for ensuring their self-employment. Besides, people who were previously owner of land will have to be provided with long term bank loan against the ownership instrument of their diluted land.
- A special scheme is to be introduced for providing long term house building loan on easy terms as emergency measure for victim of river erosion.

Rehabilitation of victims of river erosion

- Emergency relief is to be provided to families who have become destitute overnight due to river erosion. For people who have become new victim of river erosion, temporary employment for three months is to be created for them on urgent basis.
- Rural development Board and other government poverty alleviation agencies and social development organisations will have to take projects on priority basis for rehabilitation of victim of river erosion.
- NGOs are to come forward with specific projects for long term socio-economic rehabilitation of victims of river erosion. NGOs can play important role in providing instant relief and long term rehabilitation.

- Measures have to be taken to keep the Schools, which have been washed away by river erosion, running in alternative places so that children of victim families are not deprived of education.

Reducing intensity of river erosion, water resources management and environmental conservation

- Construction works of all roads, embankments, groens, polders and other structures all over the country including river erosion areas are to be temporarily stopped to assess their environment friendliness.
- For national interest, river transportation should be given equal importance with land transportation by taking effective steps in internal, bilateral and international forums for maintaining navigability of the rivers including protecting river transportation system.
- Projects should not be taken only for utilising aid money. Water resources management of the country should be overhauled by considering natural resources management, environmental conservation and preventing river erosion.

Land laws related with river erosion are to be streamlined. An effective and result oriented action plan is to be taken keeping the plights of the victims of river erosion in consideration. If victims of river erosion cannot be rehabilitated in their own area, the number of floating people in the cities will increase day by day which will also increase the number and size of slums in the urban area. This is a silent disaster which require social movement to prevent. Countrymen are to be made aware about the plights of the people who are victim of river erosion. Timely and people oriented reforms and amendments are to be made in the complicated and backdated land laws related with river erosion. They have to be provided with assurance to live a humane life. River erosion make people poor and poverty causes damages to environment. So immediate steps are to be taken for finding solutions of the problem of river erosion for ensuring a sustainable environment for the people of Bangladesh.



Drinking death



Photo: Bulbul Ahmed, FEJB

Bangladesh
State of Environment Report 2001



Drinking death

Bangladeshis at risk of arsenic poisoning

Quamrul Islam Chowdhury

Pinjira has lost her battle with arsenic. Sofura is missing. Zahangir is knocked down. Kamal Hossain's dream has been shattered. The sordid tales of thousands of innocent victims of mass poisoning of arsenic contamination have been hitting the headlines of national and international media for last couple of years. The problem of arsenic pollution in Bangladesh's ground water has turned into a crisis of unprecedented proportion. Millions of people in rural Bangladesh have been exposed to the risk of arsenic poisoning.

At the end of the year 2001, the claws of arsenic have also threatened the living of thousands of people of 28 municipalities. The number of patients seriously affected by arsenic from drinking water has now risen to thousands. In early 1996, arsenic contamination of groundwater was reported first in Bagerhat, Satkhira and Kushtia, three south-western Bangladesh districts bordering upon the Indian state of West Bengal. Some 61 out of 64 districts across the country (FEJB, 1998) face the menace of arsenic poisoning.

The new government of Prime Minister Begum Khaleda Zia has already declared arsenic problem as one of its 100-day agenda for action. LGRD Minister Abdul Mannan Bhuiyan said a preliminary survey to identify arsenic-affected patients was conducted in different rural districts of Bangladesh. He said instructions had been given to the Department of Public Health and Engineering to supply arsenic-free water to the affected areas. Besides, he said, instructions had been given to test the tube-well water locally in every district. He suggested that grassroots level people should be involved in arsenic mitigation programmes.

Earlier, the Ministry of Health during the AL regime was served

with the bad news that groundwater in adjacent rural areas around the capital city of Dhaka was contaminated by arsenic. Health and Family Welfare Minister of the then AL government, Sheikh Fazlul Karim Selim, said that his ministry had diagnosed 8,500 arsenic patients in the country. Incumbent LGRD Minister Abdul Mannan Bhuiyan and Health Minister Dr. Khondker Mosharraf Hossain informed that the number of arsenic patients crossed the 10,000-mark.

In end of 2001, Bangladeshi officials admitted that some 80 million people - more than 65 per cent of the country's population - live in the arsenic-contaminated areas. Thousands of crowded villages with their golden paddy fields and steamy banana groves are threatened by poisoned water. Due to the sheer magnitude of the catastrophe, a resource-poor nation like Bangladesh is now struggling, not quite successfully, to cope with the problem caused by arsenic-contaminated tube-wells in the rural areas. Of late, there have been some efforts to mitigate the woes of the arsenic-hit villagers through distribution of water filtration devices. The authorities have also been reportedly seeking an easy solution to tackle this latest environmental hazard.

The authorities are ill equipped both financially and technically to deal with the massive problem. They have been at a loss how to deal with its fallout. The government launched a campaign to create awareness among the public about the hazards of drinking arsenic-contaminated water and issued warnings through radio and television. A National Arsenic Committee was formed to address the problem. But efforts to tackle the situation have to be far more widespread and intense. Most of rural Bangladesh has been caught up in an arsenic panic. Members of the Forum of Environmental Journalists of Bangladesh (FEJB) were the first to break the bad news. Now FEJB is trying to sensitise the officials and policy makers about the magnitude of the disaster. They have also been trying their level best to make the people, particularly the rural community, aware of the hazard and also of the ways to mitigate public suffering caused by the arsenic-contaminated groundwater.

Arsenic is a white, semi-metallic powder found in nature. Some of its compounds -arsenite and arsenate - are highly toxic and

can cause skin cancer, kidney and liver failure, respiratory problems, and in extreme cases, death. Other symptoms include dark brown spots on the body, thickening of the skin of the palms and feet, and warts on hands and legs. Colourless, tasteless and naturally occurring in the sub-soils, arsenic has been seeping into the region's groundwater for years. Some experts say that arsenic beneath Bangladesh's fertile river delta was probably deposited long ago after being washed down from the ores in the Himalayas. For long, the arsenic compounds called arsenic sulphides were submerged in groundwater and remained inert. But with the advent of intensive irrigation in the 1960s, the aquifers started to drop, exposing the poisons to oxygen for the first time. Once oxidised, arsenic sulphides become water-soluble. They percolate from the sub-soils into the water tables during every monsoon flood like drops of tea seeping from a tea bag.

Late Amjad Hussain Khan, a Bangladeshi water expert, reportedly observed in 1997 that the arsenic contamination had originated in the Indian state of West Bengal bordering Bangladesh - particularly on the eastern side of the Ganges-Bhagirathi rivers. The deadly poison then slowly seeped into Bangladesh's groundwater. He said that the western border districts, specially the southern-western region of Bangladesh, were particularly vulnerable to arsenic contamination. The reason is that the sediments on both sides of the border have the same depositional history and geological environment- the region being commonly known as the Ganges delta. Khan said that the aquifer of the contaminated zones in West Bengal and that of the areas within Bangladesh were hydrologically connected. He further observed that the groundwater of the region along the south-western border belt of Bangladesh is highly vulnerable to arsenic contamination.

The first reports of arsenic contamination of water appeared in 1978 in West Bengal. The initial theories blamed arsenic pollution blamed on the use of insecticides and pesticides, metal strainers in industrial effluents, etc. But, subsequent studies proved such theories to be wrong. The School of Environmental Studies [SOES], Jadavpur University, near Kolkata, the capital of West Bengal, started investigation in 1988 when reports of sporadic cases of arsenic poisoning

began to appear in West Bengal. The study said that for centuries a 450-kilometre stretch of arsenic has been deposited in rich silt clay some 70 to 200 feet below the surface in an area covering about 35,000 square kilometres. The problem did not surface until the 1970s when the farmers in West Bengal began tapping huge amounts of groundwater to irrigate their summer crops, thus triggering chemical changes in the soil composition.

Scientists now advise that if a catastrophe is to be averted, pumping of groundwater must be reduced and farmers should increasingly try to tap surface water for irrigation. As the water table falls, pyrites - a mineral which holds arsenic - begins to oxidise and exude the poison, contaminating thousands of shallow tube-wells.

Bangladesh is now threatened by mass poisoning that endangers the lives of millions of people not only in rural areas but also in some urban areas like municipalities.

In June 2000, the Dhaka-based National Institute of Preventive and Social Medicine (NIPSOM) tested some 1000 samples of tube-well water in 17 rural districts. And it found arsenic in at least 180 such samples. Arsenic toxicity in the water of the affected districts is 25 to 35 times higher the safety level set by the World Health Organisation (WHO). The permissible level of arsenic in water is 0.05 ppm, according to experts. The Bangladesh Atomic Energy Commission found the level of arsenic between 1.5 and 2 ppm in tube-well water in the districts bordering West Bengal. The situation was so bad that an even more dangerous level of arsenic toxicity was found in the water of a tube-well in the village home of the then incumbent Health Minister, the late Salauddin Yusuf, in Khulna, which is not far from the border with India. During 2001, the number of arsenic poisoned tube-wells was on the rise, creating a panic across Bangladesh.

The Dhaka Community Hospital [DCH] has been conducting research on the arsenic situation. Their investigation revealed that the number of arsenic-affected people also kept rising. Public health has been in jeopardy in areas where arsenic poisoning is extensive. The DCH conducted its research on arsenic poisoning among residents in four villages under the Ishwardi Police Station in Pabna district, eight villages and

localities in Kushtia district and in one village in Meherpur district. Specimens of skin, nails, hair and urine of 53 suspected arsenic victims were collected and tested. Arsenic was found in the urine of 94.34 per cent, in the nails of 8.12 per cent and in the skin of 100 per cent of the suspected victims. Besides, in separate tests, arsenic was found in the urine of 90 per cent of suspected arsenic victims. Ten persons were chosen for urine, 21 for nails and 11 for skin tests.

Tests of water samples collected from the arsenic-infected areas of the country contained more than the normal percentage of arsenic. Twenty-eight per cent of the affected people had more than 100 to 1500 per cent more arsenic than the normal level in their urine, 47 per cent had 8 to 20 per cent more than the normal level in their nails and 98 per cent had 100 to 15,000 per cent more than the normal level of arsenic in their skin! Twenty per cent of the water samples contained amounts of arsenic, which were more than 100 to 900 per cent more than the allowable quantity. The DCH tested 920 patients suffering from skin diseases, of whom 150 were suspected to have been suffering from arsenic poisoning. Samples of urine, nails, hair and skin were collected from 95 of some 105 patients. Water samples from 41 tube-wells were also collected from the arsenic-affected areas. These samples were examined at the Bangladesh Council for Scientific and Industrial Research [BCSIR].

Thousands of people of 28 municipalities of the country are drinking arsenic contaminated water from pipeline water supply system, a recent study has revealed.

Earlier, it was believed that the wells including the deep tube-wells in the municipalities posed not threat to public health since they were safe. The tests carried out by the Dhaka Community Hospital (DCH) in cooperation with The Daily Star were done between January and September 2001.

The municipalities include the hill district of Rangamati where, until now, experts ruled out possibilities of finding arsenic even at low concentration. Laboratory tests of water samples collected from the municipalities revealed that all of them including those from privately owned wells contained at least

0.03 milligram per litre arsenic or three times the acceptable level (0.01 mg/L) for human consumption. For Bangladesh, the highest level of arsenic in drinking water is 0.05mg/L.

Atomic absorption and spectro-photometry, two of the world's best and most reliable methods, were used to test the samples. Two separate tests were carried out for each of the 324 water samples. One set was tested at the laboratory of the DCH while the other was sent to Jadavpur University in Kolkata, India for a second opinion.

According to the World Health Organisation (WHO), long-term consumption of arsenic can cause various skin diseases. Experts studying some arsenic patients have concluded that long-term exposure to arsenic through drinking can lead to cancer in the bladder, intestine and even lungs.

So far, official surveys in only 500 villages have found over 10,000 arsenic patients suffering from various forms of ailments including cancer related to arsenic poisoning.

The DCH study found the highest concentration of 0.199 mg/L arsenic in a deep tube-well in Gopalganj town that supplies water to more than 12,000 inhabitants.

The second highest concentration was found in another Gopalganj town deep tube-well supplying water to more than 10,000 people. This one has an arsenic concentration of 0.177 mg/L.

In Chuadanga town, a 170-foot deep tube-well, which is shared by some 20 families, has a concentration of 0.42 mg/L of arsenic. The users have been drinking from the well for the last six years.

In Kishoreganj and Laxipur district towns, similar concentrations of arsenic were detected. In Kishoreganj, a privately owned well had presence of arsenic at 0.183 mg/L while in Laxmipur 0.267 and 0.140 mg/L arsenic was found.

Similarly, high concentration of arsenic was detected in Magura, Manikganj, Narail and Kushtia district towns. A total of eight

teams collected water samples and other data. People at risk from drinking arsenic at high concentration were informed in writing. The Department of Public Health and Engineering (DPHE) was also informed about the status of arsenic concentration.

However, according to sources, none of the deep tube-wells with high concentration of arsenic have so far been shut down. The urban areas from where water samples were collected are Barisal, Brahmanbaria, Chapainawabganj, Chittagong, Chuadanga, Cox's Bazar, Dhaka, Dinajpur, Habiganj, Jessore, Jhenidah, Khulna, Kishoreganj, Kushtia, Laxmipur, Magura, Manikganj, Moulvibazar, Munshiganj, Narail, Natore, Pabna, Rajshahi, Rangamati, Rangpur and Sylhet.

When contacted, Chief Engineer of the DPHE Abu Muslim said, "We have tested water in almost all the 100 municipalities and found eight of them to have contaminated water."

"Alternative measures like iron-arsenic removal plants (IARP) have been installed to remove arsenic and in some places we have also shut down pumps. As soon as we learnt about contamination, we ordered for alternative measures," Muslim added.

The eight districts where the DPHE has taken alternative measures to remove arsenic are Rajshahi, Chapainawabganj, Chuadanga, Satkhira, Meherpur, Faridpur, Noakhali and Gopalganj.

Meantime, Gopalganj Pourashava (municipality) Chairman Mohammad Ali Khan expressed surprise when told about the concentration levels of arsenic in his town. "I am really surprised. We must take immediate measures to inform the people about the risks," Khan reacted.

Until recently, government and non-government agencies have tested water in rural areas. So far, 61 of 64 districts are found affected by arsenic. According to the latest data, 85 million people in the affected areas are at risk of drinking arsenic contaminated water.

As the mysterious sores first appeared on the work-toughened

palms of Anil Chandra Das, a rice farmer in the southwestern Nowapara area, he kept grizzling in pain but just ignored it. But the lesions did not go away. Instead, the small purplish scabs on his palms began cracking and bleeding. Then the headaches started, accompanied by chest congestion and stomach cramps. And finally, in March, 1997 the man - whose neighbours remember him for his breezy story-telling - died.

"He just lay in bed all day and we looked into his eyes. Then one day he didn't open his eyes any more. And we all began to cry," said Ila Rani Das, 16, Anil's daughter. Fighting her tears, Ila recalled how her eldest brother, Shamyal, 20, died in August, the same year, of the same grim symptoms. She held out her palms, the purple sores were also there. She is not alone; there are thousands of others like her in the length and breadth of the country, silently suffering from the ailments caused by the deadly arsenic.

Arsenic's social fallout has been enormous. Amina Begum, 35, a victim who developed dark brown spots on her skin, was socially shunned by her neighbours. Girls with such spots are unable to find husbands, married women showing signs of arsenic poisoning are often sent back to their parents by their in-laws, and young men suffering from arsenic-related ailments are simply refused jobs in rural areas. Abdus Samad lost both his home and social status due to arsenic.

"My parents told me one day to leave home when I fell sick," recalled Samad, a sad wiry young man of Noapara, whose hands and feet were still covered with sores even months after undergoing treatment and drinking safe, arsenic-free water. Banished by his family, Samad and his wife built a tin-roofed hut on the remote edge of his parental homestead. "Everybody thinks it might be contagious - like leprosy," Samad said bitterly. "I have to wash my plates with boiled water after every meal I take - uselessly, for nothing!" he grumbled.

Rasheda K.Chowdhury, chairperson of the Environment and Development Alliance, said the life of the entire rural community had been affected by the arsenic catastrophe. She emphasised the need for intensifying the government and non-government measures to tackle the hazard of arsenic poisoning

that experts say has no equal in medical history.

Since arsenic poisoning often takes months or years to become lethal or debilitating, it can be easily misdiagnosed. If diagnosed early, patients can be relieved of mild symptoms by switching to pure, arsenic-free water. Continued exposure to contaminated water can be fatal. Kits that can filter the water to make it arsenic-free cost about US \$ 18 - almost a month's income for many in Bangladesh. The means to pipe in clean water could cost millions and take years to build the network.

The then health minister, Sheikh Selim, said the government had identified arsenic pollution as a national problem and was determined to solve it. He emphasised the need for joint action in this regard by different ministries concerned, including his own, and said that an extensive programme had been undertaken by his ministry at the field level in the arsenic-affected areas. But implementation at the affected village level was yet to be geared up.

Stressing the need for undertaking preventive measures against arsenic toxicity, Dr. A.Z.M. Iftikhar Hossain, deputy programme manager of the Arsenic Mitigation Project, said his department had already developed a filter to purify arsenic-contaminated water. There is no definite cure for arsenic poisoning, but uncontaminated water and nutritious food over a period of time nurture sufferers back to health. Unfortunately, there are few alternative water supplies in the affected districts and most of the people in the rural areas cannot afford nutritious food.

Dr. Mujibul Huq, head of Dermatology Department, Dhaka Medical College Hospital, said that arsenic-affected patients can be cured by proper medication and access to pure drinking water. But it is important to take advice from the experts at the early stage. Medicine was scarce and steps were taken to make them available, he added.

Experts underscored the need for adopting a national strategy for mitigating the arsenic problem. United efforts by the government, non-government organisations (NGOs) and donors are needed to face the challenge of arsenic

contamination to which some 80 million people are exposed.

"At least 80 million people of the country are affected by arsenic, a silent killer, and one in ten has the possibility of developing cancer from the poisoning," said Dr. Kazi Kamruzzaman, chairman of the Dhaka Community Hospital (DCH). He regretted that policy-makers are yet to include arsenic in the syllabus for medical education in the country. He was critical of the government for not including the problem in its 3.3 billion dollar Health and Population Sector Programme (HPSP) and the donors for their non-specific programmes to tackle it.

"While the UK government is providing subsidy to farmers for mad cow disease, we are receiving foreign loan for tackling the arsenic problem." The government does not feel any urgency to mitigate the problem, he said. To grab the local market, foreign companies are active in the field to test their products on our people without prior laboratory tests, he pointed out. Noted economist Prof. Muzaffar Ahmed criticised the "single-ended mindset" of donors and said the amount spent for elimination of AIDS from the country is higher than that spent for tackling the arsenic problem.

Babar N. Kabir of the World Bank said donors should not be solely blamed for the failure. "Please do not blame only the donors. They make programmes after approval from the External Resources Division (ERD)." Kabir apprehended that arsenic might have a very adverse impact on the food chain in Bangladesh. "If proved, it will be a threat to our food security"

Dr. Imamul Huq of the Soil Science Department of Dhaka University, quoting from his study report said there is a "mentionable amount of arsenic in rice crops and leafy vegetables in Bangladesh".

Bangladesh Medical Association (BMA) President Dr. Rashid-e-Mahbub said the methods developed by donor agencies to free drinking water from arsenic were not effective. "These are ineffective toys", he observed. Members of FEJB called for creating public awareness about the problem and stressed the need for community participation to remove it.

They also called upon all concerned to take immediate steps to discover and provide alternative sources of drinking water to save the people from the deadly poisoning. They felt the need for treatment and rehabilitation of arsenic patients on a priority basis. The FEJB members observed that out of 110 million deep tube-wells in the country, more than 50,000 were contaminated with excessive amounts of arsenic.

Noted water expert Dr. Ainun Nishat said the government should frame a clear-cut policy for sinking new tube-wells. People cannot be barred from taking drinking water from red-marked tube-wells as they become confused after seeing sinking of new tube-wells near the old (red-marked) ones, Dr. Nishat said.

With 61 out of 64 districts affected and 264 upazilas being the most affected, it is believed that at least 26 million people are at risk of contracting arsenicosis. Because, the people themselves with the help of private sector installed most of the tube-wells and so there are no records of how many wells exist. The estimate is between 6-10 million. If the current national pace of testing output cannot be improved, it will take 6-8 years just to test all of the existing tube-wells, observed an expert.

There is no pattern to arsenic contamination of groundwater. One well in a village may be safe while another well 100 yards away may be contaminated over the currently nationally prescribed safe level of 50ppb. And the one after that may again be safe! Therefore, the only way to know if a tube-well is providing safe water or not is to test every tube-well. The contamination of tube-wells may change over time and so, people will at some point need to have access to local testing facilities so that they can regularly check the level of contamination in their wells. This facility presently does not exist.

There is still no clear medical understanding as to why some members of a family contract arsenicosis while others do not, even though they drink the same water. At what time and in what circumstances will people contract arsenicosis? What is the risk factor related to the onset of gangrene and cancer? There are no clear answers to these issues till date.

There is a growing possibility that arsenic may be entering the food chain through contaminated irrigation water. This may have an effect not only on the food being eaten (which may eventually have adverse impact on the economy of the farming community), but also on the ability of the soil to produce crops in a country which has reached self sustainability in food production.

While arsenicosis is not a contagious disease, it often appears to be - to the affected rural communities. There are instances where affected children, having the raindrop pattern, kurtosis and melanomas symptoms on their skin, are being asked to leave school. Parents are deserting their families. Marriage prospects for the affected youth may be severely hampered.

In the advanced stages, people may suffer amputation as a result of gangrene or cancer, severely affecting the chances of earning or sustaining a livelihood. If at some point, soil is found to be contaminated and food production becomes unmarketable, it would have far reaching implications in the socio-economic sector and national development.

At present, figures suggest 12,000 recorded cases of arsenicosis in the country. Some experts say that at this moment, there could be two million people in the pre-arsenicosis stage. What has been detected at this time could well be only the tip of an iceberg. There is really no time to lose.

This problem calls for a two-pronged approach; an emergency testing and awareness creation in the first place, followed by a second stage of a community based and sustainable set of activities.

The Department of Public Health Engineering (DPHE), and NGOs are working to develop and implement a four-part community-based and integrated arsenic mitigation programme.

It is widely believed that action should be carried out on an emergency basis to undertake countrywide testing. The aim will be to identify not only those sources which are contaminated

but also the one which are safe. This process will involve the implementation of the national communication campaign to fully inform all people with regard to the risks and how to deal with the problem in the first instance. The urgent need to test all tube-wells has to be addressed as quickly as possible, deliberately planned to be completed with all speed. Involving local and district government and more than this - expecting, encouraging and supporting this tier of government to lead and work for faster progress. Communication materials must be used continually and nationally - both mass media and interpersonal.

The issue of sustainability must be addressed. Testing facilities must eventually be made available to the people on a continual and cost-effective basis through public and private sector partnerships. The government has an overarching responsibility to put in place regular and systematic groundwater quality monitoring for a wide range of parameters to ensure that knowledge base is increased and that the population is kept fully informed.

People affected by arsenic contamination must be informed and assisted to make decisions on safe water options, installed in a way so that each is sustained and maintained by the people themselves. While there is still more to know about the arsenic problem in terms of health and technology, there is enough knowledge, enough field test kits and enough safe water options already known to mount a major national mitigation programme, which must be implemented at all speed.

During 1999-2000, DPHE / UNICEF, working closely with NGO partners (BRAC, DCH, Grameen and Rotary/ISDCM) developed and implemented an action research project in five upazilas (Sonargaon, Jhikorgachha, Kachua, Bera and Mainkganj). A four-part integrated approach was developed for this project. Over 100,000 tube-wells were tested, more than 13,000 safe water supplies were provided under research and development and over 700 arsenicosis patients were identified and helped. Thousands of vitamin tablets and ointments for palliative assistance were also provided. Follow-up work to provide safe water supply and other activities continues in this project area. DPHE /UNICEF have since been allocated an

additional 40 upazilas, for which testing is about to commence in 15. Work in the remaining 25 will begin early in the new year. Field test kits are improving. Arsenicosis patients can be looked for either by house-to-house search or through health camps. The next and perhaps greatest challenge yet is to help people to obtain safe water supply in a sustainable way in the long term, because arsenic contamination is not going to go away in the foreseeable future.

While there may be more new technologies that have not yet been learned of, there are already enough reliable options available to move quickly to assist people in their quest for safe water supply.

Rainwater harvesting is a household option that costs approximately Taka 5,000 for 3,000 litres. It is not new; it has been used for thousands of years. The issue is whether or how well people are able to conserve the stored water during the dry season. The cost can also discourage a family, but new designs are bringing the cost down and people can be taught to conserve the reservoir.

Pond sand filtration is a community option, costing approximately Taka 42,000. Again not a new technology, it has been used to clean up surface water for many years, especially in the saline affected areas of the country. The issue is that the community has to agree to carry out regular maintenance. Otherwise, it quickly falls into disrepair.

Another community option is the protected dug well costing approximately Taka 12,000. These wells tap water from above the arsenic contaminated zone and are a good option where the water table is high enough. Dug wells are also popular with the people. They need to be protected with a cap and water preferably should be extracted through a hand pump to maintain sanitation.

These technologies represent the main traditional systems, which can be used as options for the provision of safe water. Some research is also being done in using river water supplied to several villages through local reticulated systems. In addition to these traditional and well-known systems,

UNICEF /DPHE are trying out other filtration systems, which employ a column filter filled with a media which adsorbs arsenic. Some of these systems can deliver or treat up to 500,000 litres of contaminated water on one filter pack, lasting up to 500 days before the filter media needs to be replaced. These are also effective at removing iron from the raw water and therefore, are even more popular with the community.

The capital cost for this type of filter may at first seem prohibitive. However, simple mathematics show that the cost per treated litre is, in fact, very small - approximately only Taka 0.4 per litre as calculated against the initial capital cost. The cost per litre for the second filter is much, much less when calculated against only the cost of the replacement filter.

A community of 50 households saving Taka 30 each per month will easily have enough money to replace the filter media when needed, at today's cost. Communities might need assistance to find the capital cost, but the current National Water Supply Policy says that communities will pay 10-20 per cent of the capital cost for government schemes, with special arrangements being made for the poor. Thus, with some creativity and support from NGOs for savings and credit schemes, it will be quite possible for these continuous arsenic removal plants to become an entirely feasible option.

There are already several models available using imported adsorbent media filtration technology. With competition, local manufacturing of the media at some point (depending on eventual demand) and perhaps with the customs duty removed or reduced for this currently imported media (100% duty at the moment), this technology will become cheaper still.

The communities will be a part of the decision making process. DPHE /UNICEF have begun to look seriously at this technology and will continue to develop the systems within which the technology will be used. Included in this will be developing ways in which the saturated media can be disposed of safely from an environmental perspective.

In addition, the government is working with its partners to assist in developing a locally produced adsorbent media, which will be ideal for household filtration. So far, this locally

produced media seems to hold good prospects and will be a cheaper option for household use.

The aim is to reach a stage where affected communities can be informed about a range of options which might be feasible for each given situation; where the community will then decide which is the option they want to choose.

The media has a role in ensuring that the communities' messages already developed are transmitted to the people often and in all forms. Messages include advice for people that once they know which wells are affected and which are not, the community can drink from only the safe wells as an immediate option. Messages must be given to ensure that people affected with arsenicosis do not suffer stigmatisation within the community or at school or in workplace. Families must be encouraged to stay together and seek help from local health authorities. Local government must be encouraged to be more proactive in planning and implementing a mitigation programme. In all of this, the media has an important role to play as a public service.

The cast of characters in this emerging health disaster includes armies of quack doctors who prey on the arsenic victims, knowing or not knowing that arsenic has no real cure other than switching to drinking pure water.

Many people in the past had warned the proponents of the Green Revolution about the dangers of over-extraction of groundwater for irrigation. But the policy-makers in the 1960s did not heed to such warnings. By drilling hundreds of thousands of tube-wells - both for irrigation and safe drinking water in the villages - the authorities and planners unwittingly exposed millions of the rural Bangladeshis to the naturally occurring poisons in the groundwater. Now there is no time to waste for the planners and decision-makers. They must act and act decisively to save millions of people from slow mass poisoning by deadly arsenic.

Now, the question that may arise is how to go about in tackling the problem. Here are some ways:

Emergency measures:

- Raising public awareness should be the starting point for any approach to deal with the arsenic problem
- Groundwater treatment technologies that are cheap, efficient and easy to use should be applied at a large scale as an interim or midterm solution
- Immediate measures must be taken to protect the health of those living in areas where water is contaminated by arsenic
- Improving nutrition and fighting under-nourishment has to be a central element of the fight against the arsenic crisis
- Participation of the civil society has to be a key element of designing, planning and implementing remedial strategies
- Intra-governmental coordination is a must for effective implementation
- Information dissemination and transparency play a key role in effectiveness of remedial strategies while building the confidence of stakeholders, particularly general public

Long-term policy alternatives

- An overall health policy to deal with currently-identified patients as well as those potentially at risk
- Food security and improving nutritional quality of the food should be a high priority
- Alternative livelihoods should be provided for those who are directly impacted by arsenic contamination as well as their immediate families
- Water resource management on a regional or national scale is essential to fully exploit the abundant water resources available in Bangladesh
- Scientific research has to be emphasised to reduce uncertainty, with due consideration to local conditions
- Drinking water standard has to be re-evaluated based on scientific research, and
- Coordination, management and dissemination of information should be undertaken through well-defined mechanisms.

Tackling the arsenic menace

S.M.A Muslim

In Bangladesh, the Department of Public Health Engineering (DPHE) detected arsenic in the water of tube-wells for the first time in 1993 at Baroghoria union under Chapai Nawabganj district. The test of this water was done at the laboratory of Bangladesh Atomic Energy Commission. Although arsenic was found in the water of tube-wells in 1993 a clear picture about the extent of its contamination was not visible reveal before 1997, because of the dirth of adequate arsenic testing equipment. The Department of Public Health Engineering in co-corporation with UNICEF and the British DFID conducted two surveys from 1997 to 2000 and exposed a horrible picture of arsenic contamination in the ground water of Bangladesh.

As many as 55,500 samples of tube-well water covering the whole country were tested under the two surveys. The findings confirmed the presence of arsenic in ground water in 268 upazilas of 61 districts. However, degree of arsenic contamination in tube-well water varies from place to place. Out of the total tube-wells, 28 per cent were having higher level of arsenic than the acceptable limit (0.050 mg/lrl). These were mostly shallow tube-wells. Findings of these surveys confirmed that the water of deep tube-wells was having the lowest degree of arsenic contamination (0.7%). According to the survey, about 35 million people of Bangladesh are now at risk of arsenic poisoning.

Meanwhile, under a programme launched recently, 12,000 arsenicosis patients have been identified so far.

The government has undertaken various programmes to address the arsenic contamination through the DPHE. Different NGOs are also implementing specific programmes supplementing the government's efforts to overcome the crisis. The government has emphasised on the participation of the

people involving the field administration units and the local government bodies at the grass-roots level. The DPHE is implementing these programmes through various projects.

The extent of arsenic contamination in Bangladesh

The Department of Health and the National Institute of Preventive and Social Medicine (NIPSOM) took up an initiative to identify the arsenic hit areas after a countrywide arsenic contamination test of hand-pump tube-well water. Out of 2385 samples of water, 550 (22%) were found contaminated with arsenic having a level of over 0.05 mg/letre.

A massive survey was conducted in 1999-2000 in 61 districts in co-operation with the DFID, under which 3500 samples of tube-well water were sent to the labs of the DPHE and the BGS, England for investigation. The survey revealed that ground water of 249 upazillas of those districts became contaminated with arsenic, but the extent of problem was not identical in all places the most affected areas were the southern and south-eastern regions.

The arsenic mitigation measures

Many tubewells situated near the tubewells water were not free from arsenic. Because of this complex reason, arsenic test of water of all the tubewell of a particular affected area became necessary.

The problem became very acute due to want of test-kits. Because of this limitation the arsenic mitigation programme is being implemented in phases in the affected upzilas. Different alternate technologies for arsenic mitigation are also being applied there. These technologies are indigenous and effective. The DPHE has been applying different methods to mitigate arsenic contamination. They are:

1. Testing of water and marking the arsenic-free tubewells green and the contaminated one red.
2. Increase in awareness on arsenic poisoning.
3. Identifying the arsenic patients.
4. Searching alternate sources of drinking water.
5. Making the alternate sources of water effective.

An action research programme has already been implemented in five arsenic affected areas (Manikganj, Sonargaon, Kachua, Bera and Jhenidah) by UNICEF and the DPHE jointly. Samples of water from 105,179 tubewells of these places were collected and examined under the survey. It shows average 60 per cent of tubewell water contains unacceptable i.e higher level of arsenic concentration. The average maximum presence of arsenic was recorded in Kachua (98%) and the minimum in Manikgonj upazila (29%). A total of 1.2 million people of there upazilas were covered by the survey, 744 arsenicosis patients were detected and 13,733 safe drinking water sources were set up.

At present, measures taken up under the survey programme are beings monitored. Successes achieved by this action research survey programme has inspired the DPHE to launch a similar programme with the financial assistance from UNICEF. The programme is being implemented through eight NGOs in 15 more arsenic-prone upazilas.

A survey programme is also being implemented with the technical and financial support of the government of Japan in three South-western districts of Bangladesh (Jessore, Jenaidah and Chuadanga). A feasibility study is now underway there to explore deep ground water resources for mitigating arsenic problem. Findings of the study released so far suggest that water at the deep ground level of some places of the districts could be consumed directly without any treatment and water of the rest other places in needed to be purified before drink.

The DPHE has undertaken another project in five southern and south-eastern districts (Noakhali, Laxmipur, Feni, Perojpur and Barisal) to mitigate the arsenic problem. On the other hand, another programme named The Water Partnership Project is being implemented in the north-western region (great Rajshahi district).

The Bangladesh Arsenic Mitigation Water Supply Project (BAMWSP). The DPHE has been implementing the project at a cost of 1790 million with a credit of 1353 million from the IDA. The government's contribution in this project is 297 million whereas the beneficiaries world contribute 138 million.

The prime objective of this project is to protect the public from the threat of arsenic contamination. Three special programmes were designed under this project with a view to fulfilling the objective. These are:

- to identify the reasons behind the arsenic contamination and to get a clear idea about the extent of the problem.
- to design plans of action locally for building viable arsenic mitigation arrangement and,
- to strengthen the Union Parishads and other rural organisations for implementing the plans of action.

The project started its sanctioning 6 upazilas under the BAMWSP, 11925 arsenicosis patients and 625,365 arsenic contaminated tubewells were detected in 35 affected upazilas during the fiscal 2000-2001. The project is expanding its activities in 147 upazilas in the next phase.

The number of arsenic contaminated tubewells are increasing gradually with that of affected people. The issue of arsenic-free water supply is getting top priority as the arsenic menace is becoming a great national challenge. To face this challenge, first of all, it is necessary to identify the tubewells having safe-drinking water after proper investigation and steps must be taken to find out the causes of ground water contamination for solving the problem permanently.

Silent sufferers of slow poisoning

Shehab Ahmed

Jyotsna Begum, 34, a mother of three and married to a village butcher at Hathkopa, 24 kilometres southeast of Dhaka, still draws water from her tube well. Its neck is ringed with a fading red paint, a warning that its water is contaminated with arsenic.

But that did not deter her from using the water from the tube well for bathing and washing, including her kitchen utensils.

"We have stopped drinking its water since they painted it red four five years ago," Jyotsna said referring to the job done by the Department of Public Health Engineering workers, officially designating her tube well as affected with arsenic.

The workers tested the water with a simple method - fetched themselves some leaves from the Guava tree, squeezed them a little and put them into a glass of water. When the water turned dark, they gave the verdict that the water was contaminated with arsenic.

She was asked not to drink water continuously from the tube well and instead, use water from tube wells, which were painted with a green circle. That was quite sometime ago. Now Jyotsna and her neighbours, some of whom have tell tale signs of Arsenocosis on their palms and feet, carry out the tests regularly. They have refrained from drinking water from the contaminated tube well.

Counselled and wisened by scores of officials and NGOs who regularly visit the village, often with foreigners, working as consultants for different international organisations, the villagers have stopped drinking the contaminated water, too. For water, they rely on tube wells belonging to some rich neighbours who had re-dug their tube wells deeper into the aquifer.

But it did not help Jyotsna. She has to walk some distance and line up behind people to draw the safe water from her neighbour's pumps, which are painted green. It has become an additional burden on her daily chore although washing with the water from the red circled pump does not pose any threat to her or the children's health. Only continuous drinking of water from unsafe tube well poses the health hazard.

Getting deeper than the usual layer of 80 to 120 feet in this village, formed with rich alluvial deposits from the Meghna and the Old Brahmaputra rivers and their tributaries, remained a safe alternative as the hand pumps burrowed deeper have tested negative.

But there is no guarantee that deeply sunk tube well would not turn out to be contaminated after some time.

Hathkopa villagers who hit international headlines in 1999 thanks to the much-publicised plight of Sofura Khatoon, a poor villager who suffered from Arsenocosis, now feel annoyed even if journalists come and make inquiries about the situation. Despite repeated queries, nobody could say anything about the whereabouts of Sofura. She either left the village or died, said the villagers.

"They have not given us the solution to the problem. What else can I do? If I have to re-sink my tube well I would need a huge amount, in the region of Tk 6,000, something I cannot afford," Jyotsna said.

Her frustration was reflected by her neighbours like Ujjal Hossain, a young tailor, and Alauddin Pradhan, a retiree- both having signs of the disease. Ujjal have not been to a doctor. Alauddin did, but failed to pay the next visit to the doctor after using the medicines. However, both have stopped drinking contaminated water from their pumps.

Tests conducted by different government and international agencies and NGOs indicate that tens of thousands of people in Bangladesh are at risk of contracting Arsenocosis and thousands of tube wells are contaminated.

The tube well was promoted as a safe source of water in the 1970s in Bangladesh, which was afflicted with water-borne diseases. It was cited as a success story for providing the safe drinking water at a cheap rate. But the story changed in the late 1980s when the first arsenic patient was found at a village in Faridpur. Doctors at a hospital in Kolkata, capital of the Indian State of West Bengal, in 1988 diagnosed that the patient suffering from Arsenocosis.

Millions of dollars have been spent to carry out the tests and research to find out the reasons behind the contamination and provide treatment.

But there is yet to be any feasible solution or any concrete evidence on the real cause. Some research by British and Japanese experts revealed that it was due to geological factors. Others said too much extraction of ground water results in contamination of the water.

Other than painting the contaminated tube well red and safe ones green, nothing has been done so far to provide any relief to Jyotsna or her neighbours. Officials say they are evaluating the situation.

Village truth

Rezaul Karim

Supply of arsenic-free tap water through underground pipeline system in rural areas was introduced for the first time in a village in Narayanganj district.

Minister for Local Government, Rural Development and Cooperatives Abdul Mannan Bhuiyan launched the system at a simple function at Pakundia village under Sonargaon upzila.

From now on, about 2300 people of 419 families in the village will get arsenic-free water, pumped by a 400ft deep tubwell (DTW).

The treated water is stored in a 35,000 litre capacity overhead tank and supplied through a 8000 feet pipeline network reaching every household.

A treatment plant has been added to the system to remove iron from the water up to the safe level of 0.03mg/L.

The computer-operated pump can draw about one lakh litres of water per hour.

The project is jointly sponsored by BRAC, the Department of Public Health and Engineering (DPHE) and Unicef while the Rural Development Academy (RDA), Bogra, provided technical assistance.

The RDA designed and developed the low-cost multipurpose DTW which can supply pure water not only to households but also to poultry farmers, livestock rearers and to farmers for irrigation. Installation of a DTW costs Tk 3.25 lakh.

BRAC implemented the Pakudia project at a cost of Tk 18 lakh. For families got water supply in their houses through pipeline

yesterday by making an initial payment of Tk 2500 each to BRAC. More 82 families will get connection soon and the rest will get in phases.

Talking to this corespondent, Md Zakaria, environmental specialist of BRAC, said, " We have been working to mitigate the arsenic problem in Sonargaon for over three years now. Through trial and error we proved today that government-NGO efforts with local partnership can really make things successful."

Kazi Shafiuzamman is among the four who got the water supply yesterday. Standing in front of the tap, hurriedly installed in his bathroom the day before, Safiuzamman said, " I know people in the capital drink water from taps. The dream came true in village today."

His neighbor Md Firoj Alam Khan who has a family of eight expressed the similar excitement." I have no tubewell. So my wife had to walk at least half a kilometer every day to fetch drinking water. Today I have a tap in my house at virtually no cost."

Out of 94 hand-pump tubewells in the village, water of 46 in arsenic contaminated and many of the villagers have reportedly developed primary symptoms of arsenic related ailments including skin lesions on palms and foot.

M.A Matin, project director of Bogra RDA said, " Since 1998, we successfully carried out experiments in areas on both sides the Bangabandhu Bridge and installed 27 such low cost multipurpose DTWs to supply iron-free water to villages. None of those were meant for removing arsenic."

Speaking briefly on the occasion, Abdul Mannan Bhuiyan said, if the project shows success, this can be a model for other arsenic affected villages. But government can not do it alone. Such projects can be taken up with the participation of government, donors, NGOs and local people hesaid.

Praising the role of the local people and RDA, Muyeed Choudhury, Executive Director of BRAC, said "This is the

beginning of a new journey. Such projects can be taken up under joint initiative."

Prof Feroj Ahmed of BUET said an estimated 3000 crore taka will be needed to bring all arsenic affected villages of the country under pipeline water supply system to supply arsenic-free water.

APHP taking wing !

Anisur Rahman

Health and Family Welfare Minister Dr. Khondoker Mosharraf Hossain said that his ministry was set to launch an Arsenic Public Health Project (APHP) as the government undertook arsenic mitigation measure as a leading national issue.

"Due to the new problem of arsenic and its peculiarity, developing a strategic plan for mitigation is not that easy. But we can't sit idle," the minister said while speaking at the closing session of a two-day media-reporting workshop on arsenic under the auspices of Forum of Environmental Journalists of Bangladesh (FEJB) with supports of UNDP and Environment Ministry on November 14, 2001.

He added: "We are facing a problem but we are not hopeless."

FEJB chairman Quamrul Islam Chowdhury presided over the session, joined among others by World Bank representatives Roy K. Boerschke and Zita Lichtenberg, Toufiq Arif of the World Health Organisation, Dr. Mahfuzul Haque of Environment Ministry, Dr. AZM Iftekhar Hossain of Health Ministry, and Syed Fahim Munaim of the Daily Star General Secretary of the FEJB Mofizur Rahman among others spoke on the occasion.

The minister, himself a geologist, said the initiatives and achievement in mitigating arsenic crisis was little although the menace was detected nine years ago. After the UNDP sponsored Emergency Programme for Mitigation of Arsenic Contamination in ground water the past government did not take any effective programme particularly on the health aspect of the problem, he said.

Dr. Mosharraf said the new programme to be launched by the government would be focused on the health aspect of crisis

since the fate of the arsenic victims "remained uncertain in terms of developing drugs."

Referring to his personal experience, he said the people exposed to the problem were yet to be aware of the consequences of the arsenic in real terms despite their knowledge about the presence of the toxic material in red marked tubewells.

"This is also because we could not provide them any alternative to tubewells, on which they became dependent over the years," Dr. Mosharraf said.

World Health Organisation (WHO) expert Toufiq Arif said awareness building was a major task in mitigating the crisis, which, he said, became more complex in the absence of suitable alternatives to ground water.

He underlined the need for carrying out both preventive and curative measures under an effective coordination between health and LGRD ministries.

Dr Mahfuz said the most alarming trend was that arsenic in ground water could spread and one "green tubewell" might turn "red" anytime. He urged media to help choose suitable alternatives available in the market along with disseminating information on its treatment.

Dr. Iftekhar said the mitigation measures undertaken so far were not adequate as the problem was a new and unprecedented in nature while most donor-sponsored supports were directed on their lines.

Ms. Lichtenberg urged the media to play a greater role as watchdogs and regularly keep people posted on the developments about the arsenic problem.

Bangkok declaration on arsenic

Kazi Shahnaz

The Bangkok declaration of UNESCAP-UNICEF-WHO Expert Group Meeting on Geology and Health: Solving the Arsenic Crisis in the Asia-Pacific Region held from May 2-4, 2001 at ESCAP HQ in Thailand pointed out that provision of safe drinking water and adequate sanitation is a primary objective of governments in the Asian region in the efforts to meet their development targets.

Scarce and unsafe surface water has encouraged governments and their development partners to exploit groundwater. However, this meeting recognizes that groundwater can no longer be assumed to be safe: water coming from some sources is below recognized current water guideline values.

Recent knowledge indicates that the consumption of hazardous, naturally occurring, chemicals such as arsenic and fluoride through drinking groundwater puts at risk millions of people particularly women and children, to chronic disease, disablement and premature death.

Based on the recommendation of the ACC Subcommittee on Water Resources in its 21st Session in Bangkok, 16-20 October 2000, representatives and experts from nine countries and eleven international agencies met at ESCAP from May 24, 2001 to review the situation in Asia with respect to health hazards posed by arsenic and certain other chemical elements. The meeting agreed that arsenic in the environment, both in its naturally occurring forms in groundwater and from industrial and mining sources, poses a serious public health risk of great magnitude in a number of countries of the Asian Region when used for drinking and cooking.

Bangladesh, China and India have reported significant contamination of their groundwater resources by arsenic.

Arsenic contamination is also detected in Cambodia, Myanmar, Pakistan, Vietnam and Thailand. Similarly, Afghanistan, China, India, Pakistan and Thailand amongst others, reported contamination with fluoride. Lao PDR and Cambodia also expressed concern about the potential occurrence of arsenic. All these countries have expressed a need for support for water quality surveys.

The meeting recognized that the spatial distribution of and potential for contamination can be assessed and consumption avoided through greater use of geological information and water quality testing as a part of integrated water resource management.

The meeting recognizes the importance of early diagnosis of arsenicosis and the need of health systems to develop appropriate protocols for diagnosis and treatment.

The meeting recognized the critical importance of communities' ownership and participation in the management of all aspects of the arsenic problem.

Participants in the ESCAP Expert Meeting appreciated the opportunity to share experience and information about the increasing risks of hazardous elements in the environment, and in particular in groundwater. There was a consensus that this initial effort should be continued.

Recommendations

As a result of the deliberations, the meeting recommended that:

Countries compile consolidated information related to arsenic and other potentially hazardous chemicals using the existing data and documentation available in departments concerned.

Rapid reconnaissance surveys for arsenic and other water quality hazards be carried out in areas identified as high risk without further delay.

The experiences gained by Bangladesh, China and India be

shared with countries that suspect or have detected arsenic as a problem in their water supply systems.

A regional centre for collation and exchange of information on arsenic and other water quality hazards be established with the active support of countries and agencies represented at the meeting.

ESCAP be the host of the regional centre.

Stakeholders active in this field support groundwater quality surveys in countries (Lao PDR, Vietnam, Cambodia, Myanmar, China, Thailand) of the Mekong River Basin as a matter of priority.

Monitoring systems be implemented where use of arseniferous groundwater resources is already established.

Each country develops and implements country specific arsenic mitigation protocols that include community participation and empowerment.

Existing public awareness mechanisms be intensified at the local and national level.

Countries and participating agencies develop a common approach as an action plan that can be integrated into national development programmes.

The meeting calls upon the ESCAP secretariat to present the Bangkok Declaration and Recommendations at the ESCAP Committee on Natural Resources Development to be convened in October 2001 for consideration and endorsement .In addition, these recommendations should be ratified at the 22nd Session of the ACC/SWR.

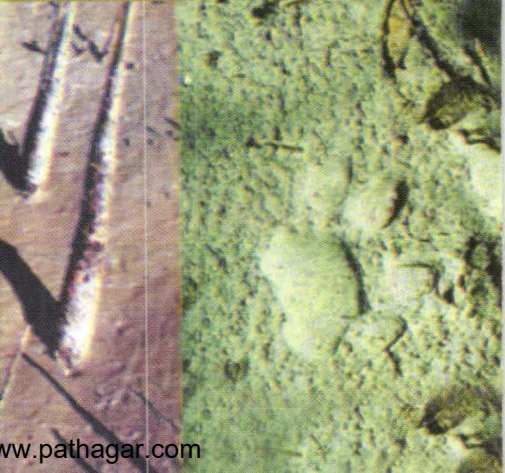


The Sundarbans: An amazing ecosystem



Photo: FEJB

Bangladesh
State of Environment Report 2001



The Sundarbans: An amazing ecosystem

**Quamrul Islam Chowdhury with Dr Mahfuzul Haque and
Shahidul Islam Chowdhury**

The Sundarbans is the world's single largest mangrove forest that extends across Bangladesh into the Indian state of West Bengal. Centuries ago, people used to refer to the Sundarbans and its adjacent region as 'Bhati' --meaning low-lying areas -- which suggests that the most important physiographical feature around was its wetlands and waterbodies. A unique reservoir of bio-diversity, the forest is more than five thousand years old. There is no archeological evidence that could provide a reliable chronological history of the Sundarbans.

Bangladesh owns about two-thirds of the forest that makes about 45 per cent of the country's total productive forest area. Located on the southern most extremity of Bangladesh, the Sundarbans comprise an extensive flat, coastal and deltaic land formed by the confluence of the three mighty rivers of the Ganges, Brahmaputra and Meghna. It is criss-crossed by large tidal rivers as well as channels and creeks, all discharging into the Bay of Bengal.

The forest encompasses a land area of 6017 sq km, of which 1874 sq km constitute the river water area. The forest is bordered to the south by the Bay of Bengal while polders and agricultural land border the forest to the north. The western border follows the Raimangal-Harinbhanga rivers, which also forms the international boundary with India. To the east lies the Baleswar river and Meghna estuary.

There are rivers and canals spread across this forest like a net with their innumerable branches. Nearly 450 large and small rivers occupy about 1 lakh 75 thousands 685 hectares or about 30 per cent of the Sundarbans. The biggest river is the Pusur. Other rivers worth-mention are Baleswar, Sibsa, Arpangasia,

Bhola, Horinbhanga, Kalindi, Andharmanik, Raimangal, Kapotaksha, Koira, Shela Bhadra etc. As one proceeds to the south, the rivers widen. Some rivers are so wide that one cannot see one bank from the other. Baleswar and Pusur rivers and their tributaries and distributaries are connected with the Ganges. As a result, these rivers and their branches have flow of sweet water. The Sibsa and other rivers in the western part have their source of sweet water only in the Ganges and the northern portion of the Sundarbans depend upon the rain water. As a result, the sweet water flow in these rivers decreases during the dry season when there is a massive intrusion of saline water. Moreover, the condition of the rivers and canals in the Sundarbans is deteriorating. Shoals are forming and navigability is declining. River erosion is taking place at some places.

The forest is within the three administrative districts of Khulna, Satkhira and Bagerhat. Administered by the Forest Department (FD), the area is divided into four forest ranges, namely; Sarankhola, Chandpai, Khulna and Burigoalini. Three patches of the forest in the south have been declared as "Wildlife Sanctuaries". They are Kachikhali-Katka sactuary in the Sarankhola range, Neelkamol at Hiron point in Khulna range and Mandarbari in the Burigoalini range. They have been declared by UNESCO in 1997 as the "World Heritage Sites".

The forest is flat and the maximum ground elevation is 3 meter above the mean sea level. The land developed through the process of sedimentation, subsidence and down-wrapping of sediments. The soil is deep alluvium of silty clay loam. It has a tropical humid climate with temperature ranging between 20.4 degree and 31.5 degree Centigrade. The annual rainfall is between 1640 and 2000 mm. The rainfall is strongly seasonal and 85 per cent falls during the monsoon, July-October. Semi-diurnal type tidal inundation regulates the hydrology of the forest. The four main seasons are pre-monsoon (March-May), monsoon (June-September), post-monsoon (October-November) and dry winter (December-February). The pre-monsoon period is characterized by the southerly winds, high temperature and high rate of evapo-transpiration with occasional heavy thunderstorms and norwesters. The forest areas are inundated by tidal water increase which also raises the salinity of river water.

The monsoon ushers in high rainfall, humidity and cloud cover. Sediment load and water levels of the rivers also increase. The salinity level is lowered due to the influence of onrushing fresh water from the upstream region. Occasional thunderstorms, cyclones, storm surges and rising salinity levels of river water occur during post-monsoon season. Generally, violent cyclonic storms brew in the Bay from mid-May to mid-June due to north coastal winds, Cyclones also occur in October and early November. The dry winter season is characterised by cool, dry and sunny weather with low precipitation.

There is a popular belief that the "Sundarbans" derived its name from the Sundari (*Heritiera fomes*) trees, a major component of the forest. Legends also have it that the forest received its name from foreign explorers, who termed it as "the jungle of sundry trees" or diverse kind of trees, which finally came to be called the "Sundrybans". There is another popular folk tale that the very name originated from local word "Samundar" meaning the seas, which later was changed to "Samundarbans".

Floral diversity

The forest supports a diversified flora and fauna. The floristic composition of the Sundarbans encompasses a variety of plants including trees, shrubs, grasses, epiphytes and lianas. Being mostly evergreen, they possess very similar physiological and structural adaptations. As the tidal estuaries deposit vast amount of nutrientrich silt in the deltaic region, they provide an ideal condition in the Sundarbans for the propagation of thick vegetation. Seemingly natural and simple, the succession of mangroves is in reality quite complicated. Each and every species in the Sundarbans has to struggle to grow and survive. Salinity, soil conditions, nutrients, weather hazard, sunshine, temperature, cyclones, tides etc. render the existence of every species difficult in various stages of life cycle.

The uniqueness of the Sundarbans reserve forest lies in its diversity of species. It is interesting to note that tree height is relatively shorter in the west-southern parts and longer in east-northern parts of the forest. Another fascinating feature of the forest is that water of the former region is more saline than that of the latter region. Flora includes 66 species of plants of

which 31 are trees. The others are shrubs and climbers. The distribution of the species is not uniform and primarily controlled by the level of salinity and not by the tidal inundation which is fairly uniform. On the basis of salinity level, three zones are recognized : fresh water zone, moderately saline zone and highly saline zone. Salinity increases from east to west and north to south.

Altogether 13 forest and four non-forest types of vegetation have been identified of which the Sundari (*Heritiera fomes*), Gewa (*Excoecaria agallocha*) and Garan (*Ceriops decandra*) are dominant in the fresh water, moderately saline and highly saline zones respectively. The Sundari prefers fresh water flushing, drainage predominance and firm higher ground. It is vulnerable to fungal infection and top-dying of the trees makes their survival difficult. Commercially, it is the most sought after tree, comprising about 21% of the forest cover of Bangladesh part of the Sundarbans. Gewa can tolerate high salinity and grows in groves in association with the Sundari, Bain, Hental and Goran bushes. Commercially very important, the Gewa timber is used for paper pulp and in match factories. Garan species of the mangroves grow in the southern Sundarbans, where the tidal influence is high. Being the fuelwood most in demand in the Sundarbans, Garan is also used as a building material.

The other major trees are Keora (*Sonneratia apetala*), Ora (*S caseolaris*), Passur (*Xylocarpus mekongensis*), Dhundul (*X granatum*), Bain (*Avicennia alba*), Kankra (*Bruguiera gymmorrhiza*). Keora and Ora look similar in appearance but Keora being bigger, spreads its branches much more extensively. The Keora is the most graceful and tallest tree in the Sundarbans. Ecologically, Keora is the most important tree in the mangrove food chain. Birds, bats, rats, monkeys, deer, fishes, insects get their food from its bark, leaves and fruits. Passur is the most praised timber in the Sundarbans as it is used both as building material and furniture timber.

Hental (*Phoenix paludosa*) is another member of the palm family commonly found throughout the Sundarbans. It is usually a slender, straight, small tree which can attain a height of 6 meter. The stems of the hental are harvested throughout the year and is sold for making rafters, fence and house-posts. The

Golpatta (*Nypa fruticans*) grows abundantly along the banks of the Sundarbans rivers and creeks. It is a stemless palm whose leaves look like coconut fronds and are mainly used for thatching roofs. Bala (*Hibiscus tiliaceous*) is a scrambling woody shrub found along the river banks and is extensively harvested for fuelwood. Garjan and Jhanna possess stilt roots, their leaves are thick and wide. They usually grow along the soggy banks of the creeks. Hogla or Elephant Grass (*Typha elephantina*) is a pioneer species generally found on riverbanks, estuarine chars (shoals) and along the edge of streams. It is used for making mats and as thatching material for temporary sheds.

Faunal variety

Animals have to struggle for life in the Sundarbans due to the forests' adverse and hostile environment. Almost all the species can tolerate brackish water and subsist on their water intake from food. All the resident species of aquatic mammals, reptiles and amphibians are powerful swimmers and habituated to meeting food requirements partially from aquatic sources. All the terrestrial animals such as birds, reptiles, fishes, plankton etc. are well adapted to the daily, periodical and seasonal tidal rhythms. All animals including birds restrict their movement during the high tide. But fishes find the high tide ideal for feeding.

The Sundarbans faunas include 32 species of mammals, 226 species of birds, 35 species reptiles and 8 species of amphibians. Sundarbans is one of the last remaining natural habitat of the Royal Bengal Tiger (*Panthera tigris tigris*). Population density of tigers in the southern Sundarbans grasslands is amazingly high due to the abundance of deer and boar population there. The Sundarbans tigers are more prone to north-south movement and rather adverse to east-west mobility. The Sundarbans offer no ideal ground as a tiger habitat. A soft-padded creature like tiger favours walking on dry ground. The Sundarbans tigers have to cross the rivers, creeks and rivulets everyday for survival. They are forced to tread on soggy, muddy terrain and negotiate the piercing roots of various mangrove species. A study suggests that the tiger population of the Sundarbans could be between 800 and 1000.

The other important wild animals in the Sundarbans are the

Chital and barking deer, wild boars, rhesus macaque, otters, cats, tree shrews, rats, civets, mongooses, porcupines etc. The Chital or spotted deer (*Cervus axis*) are reputed to be the most beautiful deer in the world and they have favoured the swamp forests of the Sundarbans as their habitat. Compared with other deer species, the Chital is of medium stature. Another deer species found in the north-eastern Sundarbans of Chandpai and Sarankhola ranges is the barking deer (*Muntiacus muntjak*), characterised by its doglike barking calls. The Chitals are well distributed throughout the southern sea-board meadows of the Sundarbans where they can graze. Their main fodder in the forest are the leaves and fruits of Keora, new leaves of passur and gewa and various grasses. Large herds of deer may be found in the sea-facing meadows of the Sundarbans in Kochikhali-Katka, Chanmiakhali, Titar Char, Jhanpa, Tinkona island, Hiron point and Mandarbaria areas. The barking deer are found only in the northern areas of Chandpai and Nalian forest ranges in the Sundarbans. The wild boar (*Sus scrofa*), another dominant mammal species of the Sundarbans, is a large and heavily built animal. Being omnivorous, the boar eats a variety of food- roots, tubes, insects, mollusks, carrion, small mammals and even the remains of a tiger kill. Notorious crop-raiders, they are used to attacking and ransacking standing crops on the forest edge.

The Rhesus Macaque (*Macaca mulatta*) lives in the Sundarbans in highly organised troops; up to thirty animals co-exist in a band under the leadership of a dominant male. They are equally at home on trees, on the spike roots infested ground as well as the mudbanks. They feed on keora leaves and fruits of telakucha, insects, small lizards, bird eggs, crabs etc. The Rhesus Macaques have developed a mutually effective relationship with the deer in the Sundarbans. A herd of deer can often be seen feeding under a tree inhabited by these monkeys. Both species react to each other's alarm calls, warning about the presence of a predator -- a tiger perhaps.

Otter is mainly an amphibian mammal and can be found all over the Sundarbans, but lesser number in the southern areas. The commonest otters of the Sundarbans are the claw-less otters (*Aonyx cinerea*). The species used widely for fishing in the Sundarbans by the Tarjali fishermen are the smooth Indian

otters (*Lutra perspicillata*). They are bigger, stockier and lighter in colour. It has a streamlined body with short legs, a thick neck and a long and powerful tail. Like the mongoose, otters sometime stand on their hind legs to see around. Forest otters are active both during day and night and they start hunting as the tide goes down. Three species of lesser cats may be seen in the Sundarbans. Being highly secretive and exclusively nocturnal creatures, it is difficult to find them. Their coats are well adapted to concealing. All three species are concentrated in the northern forests. The jungle cat (*Felis chaus*) prefers peripheral forest areas. The leopard cat (*Prionailurus bengalensis*) is the most widely distributed animal, compared with the other two. And the fishing cat (*Prionailurus viverrinus*) prefers swampy areas of the forest.

The common tree shrews (*Tupaia glis*) are among the neglected animals of the Sundarbans as they have seldom been recorded. The family Muridae is well represented in the wilderness of the Sundarbans. Among other members of the family, musk shrews, bandicoot rats, Indian field mouse, house mouse and the common house rats are frequently seen in the area. Civets, mongooses and porcupines are all nocturnal animals and very difficult to find. The presence of Indian porcupine (*Hystrix indica*) may be felt in Chandpai range areas. The mongooses (*Herpestes auropunctatus* and *Hedwardsi*) are found along the forest fringes. The common palm civets (*Viverricula indica*) can be seen in the eastern forests and the presence of the large Indian civet (*Viverra zibetha*) is hardly discernible inside the forest.

The brackish water of the Sundarbans estuary supports a number of dolphin species. The presence of the Ganges river dolphin (*Platanista gangetica*) is most common in the rivers of the Sundarbans. The Irrawaddy dolphin (*Orcaella brevirostris*), melon-headed dolphin (*Peponocephala electra*) and the little porpoise (*Neophocaena phocaenoides*) may also be seen without much difficulty. The globular and blunt-headed Irrawaddy dolphin prefers less saline waters and can be seen in the northern Sundarbans rivers. The massive melon-headed dolphins are well adapted to saline water like the porpoises. Dolphins are seen mostly in the confluence of the major rivers and the creeks. The short-finned pilot whales (*Globicephala*

macrorhynchus) are sometimes found within the Sundarbans.

In the Sundarbans, salt water or estuarine crocodiles (*Crocodylus porosus*) can be seen very often. Once they were abundant in number in almost every estuary of forest ranges. Sundarbans rivers, especially the chars of the Passur river near Khulna were infested with these reptiles. They were quite fierce. Of late, their population is on the decline, as their egg-laying habitats are being disturbed by collectors of shrimp fries. It is believed that the total number of crocodiles today may be around 250. In the Sundarbans, one can find some monitor lizards. Three of their species can be found in the forest: they are the Bengal (*Varanus bengalensis*), the yellow monitor (*Varanus flavescens*) and the ring lizard (*Varanus salvator*). The ring lizard, the second largest terrestrial lizard after the Komodo dragon, finds the Sundarbans river estuaries a congenial place for breeding. It is a voracious eater of birds, bird chicks, snakes, rodents, fishes, etc.

Among the venomous snakes in the Sundarbans, the King Cobra (*Ophiophagus hannah*) is considered to be the largest. These are diurnal creatures as their prey species like rattle snakes, young monitor lizards, etc. The King Cobra also preys on small mammals, lizards, bird chicks and other poisonous and non-poisonous snakes. They can move amazingly fast despite their huge size. The forest dwellers dread the King Cobra because of their size and open-mouth charge with hissings. Other cobra species are: Bengal Cobra (*Naja kauthia*), Binocellete Cobra (*Naja naja*). Bengal cobra is a scary creature and can attack without much provocation. They prefer water habitat and consume mammals, eggs of birds, lizards, amphibians, etc. The Binocellete Cobras are comparatively rare species in the Sundarbans and can be seen in the dry areas of the forest. They carry very potent venom and prey mostly on rodents and amphibians.

The sluggish vipers are of two species: the chandra bora or the Russel's viper and the tika bora. Thick bodied, the Chandra bora looks more like a young python. The tika bora or spotted tailed green vipers are almost undetectable as they easily camouflage their presence in the green foliage of their habitat. They prey on lizards, insects and bird chicks and eggs. The sea snakes are

highly venomous, but due to their small mouth and position of the venom injecting fangs, they seldom bite. Hook-nosed sea snake is the most common sea snake, which is highly venomous. There are a number of non-poisonous snakes including the rock pythons in the Sundarbans.

Among the other reptiles and amphibians, the river terrapin (Batagur baska) is one of the most commercially exploited estuarine turtles and is listed as an endangered species. The Indian roofed turtle (Kachuga tecta) and the peacock soft-shell turtle (Trionyx hurum), also listed as endangered, are exploited by the turtle traders. The olive ridley and hawksbill turtles can be seen wading across the shoals of the forest. The exclusive green frogs (Euphlyctis hexadactylus) could be seen in Chandpai area. Other forest amphibians include the skipper frog, bull frog, cricket frog, common toads and tree frogs seen in the forest and its adjoining areas.

The Sundarbans also provides habitat to a variety of birds. Around 226 species of birds can be found there. Most are resident birds, but some migratory ones can also be seen in the winter season. For more than 100 species of waterfowls, of which some 50 are known to be migratory ones, the Sundarbans provides an important habitat for seasonal migration. The periodically inundated muddy banks of the creeks and the rivers are the nesting and feeding grounds of these migratory waterfowls. Notable among these are the masked fin foot, white-bellied sea eagle, Pallas's fish eagle, 8 species of kingfishers, waders, gulls and terns. The loss of nesting sites and availability of food are major factors adversely affecting the distribution, composition and population trends of some of these species.

Though an exact account of fisheries resources of the Sundarbans is non-existent, it is reported that about 120 species of fish are commercially harvested from the area. Dublarchar - an estuarine island in the southern tip of the Sundarbans -- has a sprawling fish industry where seasonal fishermen have developed a fishing village of make-shift houses.

People of the Sundarbans

The Sundarbans with its vast wealth of natural resources always attracted people from different parts of country as well as from

abroad for multifarious economic interests. On the one hand, there are pirates, poachers and plunderers looting the scarce resources of the forests. On the other, slowly groups of people like Bawalis (wood cutters), Mouals (honey harvesters), grass cutters, fishermen and mollusk shell collectors converged in the area for exploiting the forest resources on which their livelihood depends. These latter section of people are the forest dwellers - - courageous, bold and adventurers. They are aware of the hazards of the forest life. Living in the forests for many generations, they have by now developed a coping strategy for survival in a hostile and inhospitable environment.

Traditionally, these forest dwellers possess the indigenous instinct and knowledge of their forefathers. They face various natural calamities like tidal surges, cyclones, rains, scorching heat, and humidity. They have to tread between the trails of poisonous snakes, wild boars, crocodiles, man-eating tigers and the pirates. They leave behind their families for months, and lead a life of great insecurity and loneliness. It can be said that lives of these forest dwellers are regulated by tidal rhythm and the movement of the moon. The Bawalis, Mouals, grass cutters, fishermen have to know about the tidal movement. Even the predators and the preys in the jungle are aware of tidal timings. The moon plays an important role in the forests. Specially, for the fishermen, Vara Katal or Vara Gone, meaning moonlit nights bring hope and fortune, as they expect a good catch this time of the month. On the other hand, Mora Katal is a period of dark nights that bring grief and miseries for them.

Bawalis, the wood cutters, receive seasonal permits from the local forest offices, which allow them to harvest mainly the Gewa trees for paper and pulp industry. Although they move in a group, they take high risk as they enter the forests and live in make-shift houses for months in isolation. Mouals are seasonal professionals who work for three to four months inside the forest during the flowering season. Honey collection season starts on the first day of April with an assembly prayers at Burigoalini range office. Permits are issued by the forest officials for the particular season. Most of the honey producing plants grow abundantly in the Burigoalini range areas. Under the leadership of a Shaindar or Bahardar , a group of Mouals, usually in odd numbers goes to Mahal, the site for honey

collection for a period of three months. The Mouals perform the most dangerous profession. Virtually, they have to traverse every inch of the forest land through the apparently impenetrable mud and slush. They walk bare-footed over the shula-ridden jungle floors and swim across the creeks and canals in high risk. In a team, there is a Gunin or a spiritual guide to provide divine blessing. Every year a few of these Mouals are killed by tigers.

The Jailas or the fishermen come to the Sundarbans from the neighbouring districts. Offshore fishermen are almost strangers having little interaction with the forest people, while the onshore fishermen are part of the forest dwellers. One-third area of the Sundarbans is water. Hundreds of water channels criss-cross the landmass and constitute an ideal habitat for brackish water fishes. The fishermen constitute the largest forest dwelling community, about 48 percent of the total forest dwellers. Of late, due to introduction of shrimp farming, shrimp fry collection in the rivers and creeks of the Sundarbans is on the rise causing destruction of fish diversity, as they only collect the shrimp fries and throw away all other species.

The forest dwellers pay homage to certain gods and deities whom they thought to be their saviors and protectors. The popularly worshipped are the Banbibibi, Gazi Shaheb, Dakshin Ray, Pir Badar, etc. These days, almost all the forest dwellers, irrespective of their religious or communal beliefs, seem to rely much more on a piece of cloth, a triangular red cloth blessed by the "Pir Shaheb" of Noapara, which they hoist atop the mast of their boat with great respect.

Depletion of bio-diversity

The bio-diversity of the Sundarbans has been under threat for various reasons. There has been increasing conversion of the forest land for agriculture, mainly for paddy and shrimp farming and for human habitation. The forest's bio-diversity is also threatened by unabated poaching, hunting, illegal felling of trees, diseases, unplanned and over extraction of resources, insufficient conservation effort, deterioration of law and order situation, corrupt practices of the forest officials and unscrupulous traders etc. Poverty, population pressure and encroachment by the forest/local people are blamed for the

depletion of bio-diversity in the Sundarbans. Contrary, to this customary belief, plundering and exploitation of forest resources by the poachers and dacoits in connivance with the corrupt forest officials are said to be the main causes of forest loss in the Sundarbans. Recurrent natural calamities like storms, cyclones and tornadoes pose a big threat to tall slender trees, which act as a barrier against the cyclones and tidal surges originating in the sea. More than a dozen of cyclones have hit the Sundarbans during the last decade. A disastrous cyclone at Dublar Char in 1988 devastated the forests and the fishermen's villages.

Besides these anthropogenic activities and natural calamities, some ecological changes like increase in salinity, outbreak of diseases like "top dying" of the Sundari trees pose a serious threat to rich biodiversity of the Sundarbans. Such diseases are taking a heavy toll of the wood lots in the Sundarbans. Actual cause of the disease is not yet known. Diversion of the natural courses of rivers, construction of embankments, dams and bridges in the upstream as well as decreased flow of fresh water in the rivers resulted in the increase in salinity level and over-silting in many places and caused subsequent changes in the mangrove ecosystem. Increased salinity and siltation within the forest area may hinder the biological functions of the breathing roots and are supposed to be the major causes of top dying of the trees. Possibility of fungus pathogens can not be overlooked. In the Sundarbans, for bringing non-commercial cover areas under tree cover in different areas of Chandpai, Sarankhola and Khulna forest ranges, plantation of exotic species, like *Acacia nilotica*, *Albizia procera* have taken place. Though at a limited scale, many other exotic species have been introduced in the Sundarbans mangrove ecosystems, particularly in areas around the forest offices. It is apprehended that these exotic species may pose a threat to the native variety of mangrove species.

Sea-level rise

Another looming threat to the Sundarbans -- the world's largest remaining mangrove forest -- is the much talked about sea-level rise that scientists have already predicted. According to a conservative estimate, the sea-level rise that is expected to inundate many a island nations as well as low-lying coastal regions across the world -- thanks to the global warming and

green house effects. It is now widely believed by experts that sea-level rise by one metre, expected to take place by the current century, will devour the whole of the Sundarbans. That is another major concern for our great natural heritage called the Sundarbans.

Following reasons have been identified as major threats to the bio-diversity of the Sundarbans:

- Population pressure, expansion of agricultural land, construction of houses, roads, embankments, bridges, etc;
- Faulty shrimp fry collection and conversion of forest lands into shrimp farming;
- Unscrupulous harvesting of forest resources and insufficient measures to regenerate the resources;
- Indiscriminate use of chemical fertilizers and insecticides in croplands and adoption of unplanned agricultural practices resulting in low productivity of the forest;
- Introduction of exotic species of trees that threaten the native mangrove species;
- Lack of appropriate policies for proper management and training of forest officials working in the wildlife sanctuary/protected areas;
- Activities of the pirates, poachers, plunderers of resources in the Sundarbans;
- Uncontrolled diseases causing a havoc, mainly on the Sundari trees;
- Unregulated testing and exploration activities by the International Oil Companies in the Sundarbans; and
- Apprehended sealevel rise due to global warming, which would permanently inundate coastal low-lying areas with saline water.

Conclusions

The World Heritage Site of Bangladesh, the Sundarbans, is indeed a treasure-trove of bio-diversity because of its wide spectrum of flora and fauna. Its range of ecosystem, species and other forest resources have supported and contributed to the existence, adaptation and well-being of the forest dwellers in particular and people in the periphery in general. Indigenous knowledge and practices of the local people -- the forest dwellers, acquired through many generations, in fact helped in

the conservation and management of the forests. They are no "encroachers". The pirates, poachers, corrupt officials and unscrupulous forest traders are in fact the plunderers of the forests. They are the infiltrators to be dealt with strictly. Rule of law has to be established in the forests with proper forest conservation policies and plans. Forest officials have to be properly trained in modern conservation practices. Forest resources are to be considered from conservation point of view and taken as commercial products.

The sanctuaries have to be strictly managed by enforcing laws and regulations. Forest users including the tourists must be made aware of the sensitivities of the nature and wildlife within the forests. Let us not forget the fact that the mangrove forests of the Sundarbans are a delicate ecosystem that must be dealt with proper attention and care.

The sordid saga of the Sundarbans

Anisur Rahman

"If there are no mangrove forests, then the sea will have no meaning. It is like having a tree without roots, for the mangroves are the roots of the sea."
- a fisherman on the coast of the Andaman Sea.

The Sundarbans is the largest contiguous block of mangrove forest remaining in the world. Along the mouth of the Bay of Bengal, it extends over 10,000 square kilometres in Bangladesh and India. Some 60 percent of the forest lies in Bangladesh and the rest in the Indian state of West Bengal. Said to be named after its maiden Sundari tree species, the Sundarbans is a globally significant ecosystem rich in bio-diversity providing habitat for around 334 plant and 453 animal species, including the world famous Royal Bengal Tiger. Several critically endangered species like rare sharks also find refuge in this forest containing Sundari, Gewa, Goran, Keora, Passur, Baen and many other trees and plants.

Besides its ecological value, more than four million people who live around the Sundarbans derive part of their subsistence extracting resources including fisheries, fuelwood, and non-wood forest products like honey. Livelihood of million others also indirectly depends upon this rich forest.

Every year a good number of tidal surges hit Bangladesh's south and southwestern coastline and the Sundarbans bears the brunt acting as a vital barrier against all such calamitous lashings of the nature to protect the country's southwestern coastlines including the regional towns and cities like Mongla and Khulna.

What is mangrove forest.

"One perceives a forest of jagged, gnarled trees protruding from the surface of the sea, roots anchored in deep, black, foul-smelling mud, verdant crowns arching toward a blazing sun...Here is where the land and sea intertwine, where the line

dividing the ocean and continent blurs, in this setting the marine biologist and the forest ecologist both must work at the extreme reaches of their disciplines." That was how the Scientific American, a US specialised journal, described the mangrove forest in its March 1996 issue.

Growing in the inter-tidal areas and estuary mouths between land and sea, mangroves, able to tolerate saline water, provide critical habitat for a diverse marine and terrestrial flora and fauna. Healthy mangrove forests are key to a healthy marine ecology.

Mangroves are the consequential product of the inter-relationships of flora, fauna, aquatic and water resources in certain natural conditions. The combinations of the resources and conditions, occupying the special ecological niche where seawater meets freshwater and fertilised periodically by sediments from the land and sea, are the foundation of its high biological productivity, uniqueness and diversity.

Mangrove forests are vital for healthy coastal ecosystems. The forest detritus, consisting mainly of fallen leaves and branches from the mangroves, provides nutrients for the marine environment and supports immense varieties of sea life in intricate food webs associated directly through detritus or indirectly through the planktonic and epiphytic algal food chains. Planktons and benthic algae are primary sources of carbon in the mangrove ecosystem, in addition to detritus.

The shallow inter-tidal reaches that characterise the mangrove wetlands offer refuge and nursery grounds for juvenile fish, crabs, shrimps, and mollusks. Mangroves are also prime nesting and migratory sites for hundreds of bird species.

Mangrove forests are comprised of taxonomically diverse, salt-tolerant tree and other plant species, which thrive in inter-tidal zones of sheltered tropical shores, "over-wash" islands, and estuaries. Mangrove trees have specially adapted aerial and salt-filtering roots and salt-excreting leaves that enable them to occupy the saline wetlands where other plant life cannot survive.

Often described as "rainforests by the sea," the mangroves are estimated to cover an area of 22 million hectares, dominating the majority of the subtropical and tropical coastlines around the world. However, over the past several decades, the global area in mangroves has greatly diminished as a result of a variety of human activities, such as over harvesting, freshwater diversion and conversion to other uses.

Mangrove forests literally live in two worlds at once, acting as the interface between land and sea. Mangroves help protect coastlines from erosion, storm damage, and wave action. Thus the stability mangroves provide is of immense importance. They prevent shoreline erosion by acting as buffers and catch alluvial materials, thus stabilizing land elevation by sediment accretion that balances sediment loss. This way they also protect vital coral reefs and sea grass beds from damaging siltations.

World's largest mangrove forest

The main feature of the Sundarbans, which is likely to mesmerize a lone tourist, is its unique silence. Without doubt, one's first impression of the dense forest will be its great silence. Forest creatures are very shy, but as the visitor picks his way along the trail or the water bodies around, which occupy one third of the Sundarbans Reserve Forest (SRF), he will realise how alive it is. Numerous living organisms are discreetly watching and waiting whilst one passes through their protective home. From time to time, the complete tranquillity will be shattered by a darting forest bird or a group of noisy monkeys jumping through the trees, disturbing the secretive residents and setting up a chain reaction when the ever-wary forest comes to a colourful and boisterous life for a moment, until silence reigns again.

Mangroves across the world are not particularly diverse in terms of their floristic composition, especially compared with rainforest ecosystems. While up to 75 species are recognised as genuine mangrove plants, the floristic composition of the Sundarbans is made up of 60 plus species. According to International Union for Conservation of Nature (IUCN) no other mangrove ecological niche in the world offers such a variety of associate mangrove vegetation as the Sundarbans does.

Historical records reveal that during the medieval period, the northern boundary of the Sundarbans extended from Hatiagargh, south of Diamond Harbour on the Hoogly river to Bagerhat, south of Jessore and Haringhata along the southern part of Fakirhat, Satgaon and Khalifabad. During the later part of the 18th and early 19th centuries, the boundaries of the Sundarbans tract extended for about 273.53 kilometres along the shoreline of the Bay of Bengal from the estuary of the Hoogly river to that of the Meghna and inland up to a distance of 96.54 to 128.72 kilometres. According to a 1998 study carried out by UNDP/FAO sponsored Forest Resources Management Project (FRMP), the total area of the SRF, representing three wildlife sanctuaries, is 6017 square kilometers stretching over the districts of Khulna, Patuakhali, Bagerhat and southern part of Satkhira. Of the total SRF, 3997 square kilometers is forest area, sandbars or grass covers 115 square kilometers and the rest 1905 is occupied by a number of rivers or channels.

With expansion of human settlements and reclamation of land for agricultural use, a large part of the forest was cleared in between 1830 and 1875, when parts of the mangroves were declared as reserved forest i.e. the SRF. Since then the territorial integrity still remained almost intact, in sharp contrast with many other mainland "protected" areas in the country. Despite large scale indiscriminate felling of trees due to management problems, the natural regeneration process has kept the SRF alive and growing all the time. While all other forests in the world are being more and more technically managed and their soil productivity, regeneration of plants, reproduction of wildlife are controlled and monitored regularly as they are tending to lose their erstwhile individual characteristics, the SRF is continuing to evolve new and newer biogeochemical cycles. However, it is also clear that the well-defined boundaries of rivers and canals, and perhaps the presence of widely feared what the local traditionally refer to as "maternal uncle" (the Royal Bengal Tiger) have added significantly to protecting the forest.

The ecology of the Sundarbans

The Sundarbans soil is characterized as moderately to slightly saline zone in the east and highly saline zone in the west. Its

ecosystem is characterised by a very dynamic environment due to the effect of tide, flooding, salinity and even the cyclones. The fragile and intricate mangrove ecosystem depends on many variable components like tides, salt contents in water and soil, duration of sunlight, contents of sediment and organic matter in water, temperature and density of seawater and fresh water. The composition of terrestrial and marine flora and fauna also plays an important role in the mangrove ecosystem. If sun is regarded as the source of all energy flow, water must be considered as the nursing mother of an ecosystem.

In the Sundarbans, the flow of fresh water received from the tributaries of the Ganges (Padma) is lighter in turbidity than that of the Bay of Bengal waters. The temperature of the two waters also varies seasonally. The fresh water carries loads of mineral and microbe-rich silts, which do not flow easily into the tidal backwaters from the sea as the influence of the tides make the water flow back and forth. The mixture of the flows of fresh water and brackish water and the mineral-microbe silts from upstream and the forest wastes like over mature leaves creates an ideal environment for different mangrove organisms.

As the forest litters and other organic materials are transported in the channels the microorganisms like bacteria and fungi starts to decompose them converting them into minerals and nutrients. These are then used by phytoplankton and insects like acron worms, nematodes and amphipods. In turn the micro organisms themselves become a source of food for small aquatic animals, which too are preyed upon by shrimps, crabs etc. The zooplanktons are again the food source for different aquatic animals like fishes, catfish, eels, groupers and giant sea perches. The planktons also provide food to sharks, crocodiles, and dolphins. In this process some die, decay and become nutrients accumulated in the mangrove soil. The amphibians and the reptiles act as connecting agents between water-based energy flow and terrestrial energy flow. In the Sundarbans, the higher order animals like the tiger, wild boar and monkey supplement their diet by eating aquatic animals and fishes.

"Zonation" often characterizes mangrove forests. Certain tree species occupy particular areas, or niches, within the ecosystem. Some mangrove species occur close to shore, fringing islands

and sheltered bays; others are found further inland, in estuaries influenced by tidal action.

World's largest mangrove forest is under threat

Mangrove forests are one of the most productive and bio-diverse wetlands on earth. Yet, these unique coastal tropical forests are among the most threatened habitats in the world as experts fear they may disappear more quickly than inland tropical rainforests because of lack of public notice. The Sundarbans too is no exception.

Most experts agree that due to direct and indirect impact of human interventions, far-reaching changes are taking place slowly but steadily -- affecting the delicate Sundarbans ecosystem. Much of such changes are not clearly visible. Direct human impacts are further worsened by the less-readily detected but perhaps more menacing impacts which threaten the mangrove ecosystem. Massive changes in both the adjacent agricultural lands and upstream areas with construction of polders, embankments or barrages are feared to have been generating fundamental changes in the hydrological regime of the Sundarbans.

The changes in freshwater flushing are visibly caused by gradual eastward shift of the flow of the Ganges river. The change is acknowledged as being historical in nature although the more recent impact of the Farakka Barrage in India and subsequent siltation in the Gorai is accelerating the process. It is believed that the changes affecting the salinity, flood intensity and periodicity, erosion, siltation and sedimentations may all be factors for perplexing and worrisome loss to the world's largest mangrove system.

A number of species like Javan rhinoceros (*Rhinoceros sondaicus*), water buffalo (*Bubalus bubalis*), swamp deer (*Cervus duvauceli*), gaur (*Bos gaurus*), hog deer (*Axis porcinus*) and marsh crocodile (*Crocodilus palustris*) became extinct during the last 100 years from the Sundarbans.

The Royal Bengal Tiger is an inseparable part of the legend attached to the Sundarbans. The tidal mangrove forest is a rare habitat for this tiger species. But today they have been pushed

due to habitat shrinkage. The SRF tiger population estimate in the past 20 years remained in the range of 350 to 400, the largest discrete population of the species in a single tract of natural habitat in the world.

But the preservation of the Royal Bengal Tigers is, by far, the most important challenge for those concerned for the protection of Sundarbans bio-diversity. This challenge has become even more compelling of late with recent media reporting of the outcome of a tiger population in the Indian part of Sundarban where the number of tigers was once estimated at something similar to that in the Bangladesh part - i.e. 300+. The figure is now down to some 50 only.

Incidental mortality due to diseases, illegal hunting and subtle changes in the Sundarbans ecosystem poses a serious risk for the survival of the Royal Bengal Tiger. Apart from that, the interaction with humans in the area, particularly the killing of humans by tiger, complicates the management of the area. IUCN has listed it as an endangered species in its Red Book.

The marsh crocodiles, once abundant, are already extirpated. The salt-water crocodile (*Crocodylus porosus*) still survives in low densities and like the marsh crocodiles its population is being reduced through indiscriminate hunting and trapping for skins, quite apart from the immediate conflict with men. Despite an apparent reduction in illegal trade in its skin, the population shows little sign of recovery.

Some 30 species of snakes have been recorded in the SRF and there appears to have been a general decline in densities or at least in their sighting particularly in the past two decades. The Rock Python (*Python molurus*) is one of the valuable SRF snake species, which is said to have declined over recent years. IUCN has listed it as a "vulnerable species."

The results of four independent inventories undertaken over the past seventy years indicate that the overall volume of wood per hectare has decreased. Moreover, closer analysis of three inventories undertaken in 1959, 1983 and 1996 indicate a marked reduction in total standing volume for the two principal species of economic importance, Sundari and Gewa.

According to studies carried out at different times by the forest department, British ODA and UNDP/FAO sponsored Forest Resource Management Plan, the mean volume per hectare of the Sundari tree was 34.5 in 1959. The volume was reduced to 19.9 in 1983 and 17.8 in 1996. In case of Gewa, the mean volume per hectare was 8.7 in 1959, which was reduced to 4.6 in 1983, and 2.1 in 1996. The dramatic decrease is blamed on their over exploitation, legally and illegally, because of their commercial value and subtle changes in the ecosystem. A number of issues related to the Sundari, Gewa and Goran trees have emerged for immediate concerns of the foresters.

According to experts, the reasons for the decline in Sundari (*Heriteria fomes*) are twofold. First, as a valuable timber species with real commercial value, it has been subject to heavy exploitation. Second, increasing salinity as a subsequent impact of the subtle ecological changes, noticeable increase in salinity and siltation have resulted in hostile anaerobic conditions in which the Sundari finds it difficult for healthy respiration. This has resulted in die-back whereby the tree is progressively defoliated from the top downwards. The phenomenon, in fact an infectious disease, is called "top dying." The infectious top-dying disease of Sundari causes another management problem as experts said poor execution of infected trees invalidate the basic rationale for the "sanitation/salvage" method to save the uninfected trees. Long delays between marking and cutting causes more trees in an area affected by top dying eventually exposing them to "axes instead of saws."

With regard to Gewa, forest officials say high pressure from deer population in some areas of forest patches have sparsed or caused nil regeneration of the species, leaving the areas understocked. The decline in Gewa (*Excoecaria agallocha*) is largely attributable to harvesting of around 50,000 m³ per annum as feedstock to Khulna Newsprint Mill for the production of newsprint over the years.

Experts say there is apparently little respect for the basic rule of leaving one stout stem to aid re-growth while cutting Goran trees, the second largest tree species of the SRF as all available merchantable stems are being cut from one area. Some officials admit there is also Goran cutting going on outside the coupe

areas, including the wildlife sanctuaries. However, acknowledging the importance of forest resources exploitation on a sustainable basis, the Forest Department imposed a logging moratorium in 1989 on all timber species except Gewa in the SRF.

Many factors contribute to mangrove forest loss, including the charcoal and timber industries, legal and illegal logging, oil spill, tourism industries, unplanned development projects, urban growth pressures, and mounting pollution problems. However, one of the most recent and significant causes of mangrove forest loss in the past decade has been the consumer demand for luxury shrimp, or "prawns", and the corresponding expansion of destructive production methods of export-oriented industrial shrimp aquaculture along the forests.

No discussion of the ecology of the SRF would be complete without noting the problem of water pollution. Pollution from various sources is a major determinant of water quality -- both in riverine and coastal areas of the Sundarbans. As approximately one third of the nearly 600,000 hectares of the Sundarbans area consists of tidal channels, and most of the remainder is subject to periodic inundation, impacts of water pollution are potentially very widespread. Pollutants are carried into the Sundarbans and ultimately into the Bay of Bengal from various upstream sources including the industrial units, municipal wastes, agrochemicals and port sewages in the Mongla and Khulna region.

The main threat today may come from outside the area in the form of pollution. On the northern edge of the area, Mongla, Bangladesh' second seaport, is situated. This port and its associated marine traffic is a frequent source of oil spills and there is a permanent risk of accidents with chemicals. Moreover, toxic products (pesticides, etc.) enter the system due to upstream pollution in the huge Ganges catchment. Pollution may not be a direct source of mortality, but it may also reduce the health of the forests, increasing the mortality rate of the flora and fauna on the long term. Many products such as pesticides have also been proved to reduce the reproductively (birth rate) in animal populations.

Almost all Khulna-based industries like the match factories, fish processing plants, jute mills, steel mills, the Khulna Shipyard and newspaper mills discharge liquid or solid wastes directly into the Bhairab-Rupsha river system. According to a DOE paper, the Khulna Newspaper Mills alone is estimated to use and discharge 30,000 m³ of processed water laden with chlorides and dissolved and suspended solids everyday along with the municipal wastes of the regional cities.

Oil spills during transfer of refined petroleum from tankers to receiving stations in Mongla and Khulna, fuel oil spillage and discharge of oily ballast and sewages from some 600 ships anchored in Mongla Port and residual heavy oil sludge, lubricants and engine oils discharged during ship breaking operations in Khulna are major sources of water pollution affecting the Sundarbans.

A future threat is the exploitation of mineral gas, which is abundant in the underground of the Sundarbans. The recent government decision to allow exploration by international oil giants in the area has caused added concerns, as mangrove environments are known to be the most vulnerable coastal habitats to such activities.

A very densely populated area surrounds the SRF. Around 1.2 million local users reside seasonally in the area for fishing and other resource use activities. Commercial hunting was a problem mainly before the 1970s and this resulted particularly in a serious depletion of the crocodile populations and to a lesser extent to the deer population. Although wildlife protection has improved significantly in the last decades, illegal hunting is still occurring on an incidental basis and fishery is having an adverse impact on the remaining turtle and crocodile populations as these animals are frequently caught up in fishing nets.

Due to natural processes the role of the Sundarbans to discharge the water of the Ganges and Brahmaputra catchment is decreasing as main waterways are shifting eastwards. As a result, the salinity of the Sundarbans is increasing -- particularly in the western region. Further, the total annual discharge is decreasing due to intensifying land use (dams, irrigation)

upstream. The role of this change is not yet clear, but is evident that it will influence wildlife populations and vegetation in the long term.

The expanding shrimp farming in the greater Khulna region has caused wide concerns for the rich bio-diversity of the Sundarbans. Experts say indiscriminate shrimp and salt cultivation already destroyed the valuable mangrove forest in Chokoria Sundarbans and fear that the ecosystem of the SRF too would be in jeopardy for the same reason in the near future. The fisheries department reckons that some 200 billion different fish fries are destroyed every year in course of gathering two billion shrimp fries from the water bodies along the Sundarbans due to the crude methods adopted for the purpose.

Several international reports suggests that vast tracts of mangrove forests particularly in Latin America, Africa and the Pacific Islands have been cleared to make way for the establishment of coastal shrimp farm facilities. The failure of national governments to adequately regulate the shrimp industry, and the headlong rush of multilateral lending agencies to fund aquaculture development without meeting their own stated ecological and social criteria, are other important pieces to this unfortunate puzzle.

The great earnings from the shrimp sector are short-lived, while the real costs of shrimp culture in terms of consequent environmental ruin and social disruption are long-term and astronomical. While the immediate profits from shrimp farming may satisfy a few, vast numbers of coastal residents, once dependent on healthy coastal ecosystems for fishing and farming, are being displaced and impoverished. Observers believe that the environmental and social losses would eventually eclipse profits from the shrimp sector.

Forest department officials admit that though slowly far-reaching changes are taking place pervasively in the Sundarbans. These arise from direct and indirect impacts of human influence in the area causing widespread quantitative and qualitative degradation of the resource base throughout the Sundarbans eco-system. According to forest inventory, it is clear

that the level of illicit takeoff, some purely illegal and some quasi-sanctioned, may be quite larger than what could be scientifically justified for sustainable management of the SRF.

The expanding tourism trade is appearing to be another major concern for the protection of the Sundarbans. Except the conscious tourists or tour operators, others tend to knowingly or unknowingly disturb the delicate ecosystem of the Sundarbans staging bonfires, playing loudspeakers or disposing of non-degradable wastes like polythene inside the forest, sea shores or water bodies. That should be stopped.

Consequence of mangrove deforestation

In many areas of the world, mangrove deforestation is contributing to fisheries declines, degradation of clean water supplies, salinization of coastal soils, erosion, and land subsidence, as well as the release of carbon dioxide into the atmosphere. In fact, mangrove forests fix more carbon dioxide per unit area than phytoplankton in tropical oceans.

With regard to the Sundarbans, experts have sounded caution that destruction of the forest will not only affect the ecology but cause far reaching impacts on national economy and causing immense damage to the marine resources of the Bay of Bengal, still economically unexplored and unexploited by Bangladesh. The loss of the Sundarbans would also expose the entire southwestern region of the country to frequent cyclones and tidal surges.

Mangrove forests once covered three-fourths of the coastlines of tropical and sub-tropical countries. Today, less than 50 percent of that is surviving. And then again, of this remaining mangrove forests, over 50 percent has been degraded and not in good form. Greater protection measures should be taken for maintaining high quality mangrove forests like the Sundarbans - a World Heritage Site. All said and done, future sustainability of the Sundarbans depends upon the political will of the policy makers, environmental awareness of the people and the improved management and conservation by the forest department and other concerned agencies.

No more jungle royalty

Ahmed Nure Alam

The estimated number of Royal Bengal Tigers in Bangladesh is roughly 362. On the other hand, their number in neighbouring India is around 3,750. The cause of the depleting number of the world famous tiger species in Bangladesh could be that the country has failed to provide a congenial habitat for the tigers.

Bangladesh had been traditionally an ideal home of the Royal Bengal Tigers. But of late, their number has been shrinking by the day--due largely to massive environmental degradation. They are now only confined to the country's southeastern Sundarbans mangrove forest.

But Bangladesh is not an exceptional case; generally speaking, tigers have been greatly endangered throughout the world. According to a conservation census, the numbers of Royal Bengal Tigers in other countries are: 220 in Nepal, 240 in Bhutan, 231 in Myanmar and 135 in China.

During the early 20th century, the world's tiger population was 10,00,000. But by the turn of the century, their number decreased to only 7,500. Over the past century, three species of tiger had simply vanished from the world forever. And alarmingly, five more tiger species are reportedly fighting for their survival. If the tigers disappear from the earth, nature will be deprived of one of the world's most important animal species.

As the tiger species have been on the verge of extinction, there has been a recent global initiative to save them. A Global Tiger Forum (GTF) was formed in 1994 with representations from major countries having tiger population. The first GTF conference was held in Dhaka in January 2000, attended by representatives from some 14 countries of the world, including India, Bangladesh, Bhutan, Nepal, Myanmar, Vietnam, Laos,

Cambodia, Indonesia, Malaysia and Thailand. The objective of GTF is to formulate an action plan to save tigers from total extinction.

The Ministry of Environment and Forest (MoEF) was the co-sponsor of the first GTF conference in Dhaka, held on January 18, 2000. Babnial Marandi, Union State Minister for Forest and Environment of India presided over the inaugural session of the Dhaka GTF conference. The chief guest and special guests were the then Bangladesh Minister for Environment and Forest Syeda Sajeda Chowdhury and the State Minister H N Ashiqur Rahman.

The delegation informed the conference about different measures taken by the country to protect wildlife, specially the tigers. In 1977, Bangladesh authorities set up a number of sanctuaries in the Sundarbans over an area of 125 square miles. Later in 1966, the area of these sanctuaries were increased to 1400 square kilometers. One commendable development was that UNESCO has declared these sanctuaries in the Sundarbans as a World Heritage Site. During the 1998-99 financial year, the government undertook the Sundarbans Bio-Diversity Protection Project at a cost of Tk. 3,800 million. For effective bio-diversity management, the Sundarbans was divided into four parts.

The Indian state minister informed the conference that his century had signed agreements with China and Nepal for cooperation to protect tigers. He said that India would sign a bilateral protocol with Bangladesh very soon. The tiger protection initiative between the two countries, the Indian Minister pointed out, would be effective if the common borders are properly taken care of. He put forward a proposal to impose a ban on the sale and purchase of tigers and parts of their body among the tiger range countries.

GTF Secretary General SC Dey, addressing the conference, emphasised the need for united and co-ordinated efforts of all countries to protect the tigers. He pointed out that it would be impossible for a single country to ensure the survival of all species of tiger whose existence is now at stake.

It was informed in the GTF conference that Bali Tiger, a rare species, vanished during in the 1940s. Caspian Tiger, another species, was last seen in 1970. Afghanistan, Iran, Turkistan and Turkey were the home of this tiger. Javan Tigers were usually found in South China and the species went into extinction in the 1980s.

The existing species of tiger--Royal Bengal, Sumatran, Amur, China and Indo-China--are on the verge of extinction. The species of China Tiger is the most endangered one. There now exist only 30 China Tiger in the world. Amur Tiger, popularly known as Sibaias tigers, live in Russia, China and North Korea. There are one only 406 Amur Tigers, of which only 371 live in Russia. The number of Indo-China species of tiger is 1785 and China, Cambodia, Laos, Malaysia, Myanmar, Thailand and Vietnam are their homeland.

In the light of nature

Michael Galvin

The Sundarbans mangrove forests form the roots of the mighty Padma (Ganges) river, that branch into the Yamuna and Jamuna rivers and their tributaries shared by Bangladesh and India. Deep into the jungle the nature is divine, an array of plants and animals in all their glories sharing this massive live delta of rivers and tributaries with millions of people upstream. The Sundarbans is a unique wilderness area, being the largest mangrove forest in the world that stretches some 6017 square kilometers across southwestern Bangladesh and into India. Listed as a World Heritage Site by UNESCO in 1988, this precious wilderness is one of the last refuges of the Royal Bengal Tiger, and home to a diversity of plants and animals some of which are found nowhere else in the world.

Through the network of estuaries, many varieties of plants compete for light and space. Common to these forests are the Sundori Mangrove that are endemic to this region and the Gewa Mangroves. The tall Sundori (beautiful) mangroves loom 30-40 feet high, constituting about 6% of the wood volume and are mostly found in less saline conditions. The Gewa Mangroves are more salt-tolerant and become more dominant closer to the beaches, constituting about 28% of the total wood volume. The mangrove trees that grow here have complex roots called Pnenmetophors. The rigid roots spike up through the mud and play an important role holding together the soil. Protecting the land from cyclones and land degradation, they absorb carbon and release oxygen in water and by the process of photosynthesis in the presence of sunlight. The Keora tree is common. It is quite tall with many branches that house the Rhesus monkeys and birds and have tasty leaves that are popular snacks for the Horeen (deer). Many other trees can be seen here, including Raintrees that actually look like rain clouds, Nipa Palms (Golpata trees) that have leaves which are used to build roofs, Horgoza trees and vines that strangle the mangrove trees.

Herds of Horeen are seen on the mud flats, grazing in the Jamtala grasslands. The larger male stags have antlers that look like the branches of a tree -- they guard the grazing Horeens, watching out for predators. The mud flats are shared by Horeens, Rhesus monkeys, and the smooth coated otters and different species of birds. There is the less adjutant stork that stands tall with long pointy legs and neck with a pointy beak, and a bright white intermediate egret with a sharp yellow beak who sits gracefully on a stump of tree. An estuarine alligator lounges on the mud flat. This prehistoric reptile is at least 12 feet long with powerful tail and jaw that could kill a person in a death roll. It is startled and dashes for the water never to be seen again. The brown-winged kingfisher has a bright blue crest and a beak that could kill a snake. The less common ruddy kingfisher has a distinctive white spot on its back and a long tail. The lesser racketale drogo has straight black feathers and greater racketale drogo has a crest and long helical feathers - they are seen dashing from tree to tree. A rare musk fin-foot duck waddles across the estuary and hides in some grasses. The Brahmanini Kites are birds of prey that have brown and white feathers. They soar and with their sharp eye sight dive into the water to catch fish.

We all share one world

Further inland around the villages grow many varieties of fruits and vegetables, including dates, jam fruit trees, mangoes, papaya, bananas, coconuts, cabbages, cauliflower, tomatoes and potatoes. With scarcity of land, the local villagers here make the best possible use of the land growing crops for food and not for cash. This ensures adequate food for their families, friends and some fair trading with their neighbors.

'We have not inherited the land from our parent, we have borrowed it from our children.'

Many small fishing boats can be seen on the water. Some fishermen look humble fishing in their traditional ways. They sit in their little boats with a fishing line, sipping tea and waving to boats as they pass by. Other less responsible fishermen use bigger boats and nets for bigger fish catches, some are even cheating by using explosives and chemicals which are highly illegal.

In addition to fish netting is shrimp netting that has large by-catch that put the aquatic ecosystems out of balance and reduce the presence of water lillies that are habitat and a major food source for many aquatic species, including turtles, fish, shrimp, and frogs. These practices are not sustainable and pose a threat to the long-term livability of these very important aquatic ecosystems.

'There is enough food for everyone's need but not everyone's greed.'

The Sundarbans forests contain natural resources that are the livelihood of many locals. Small traditional practices such as timber harvesting, grass cutting, and extracting honey from beehives must be kept small so that the next generation, too, has the privileges that nature provides. Recognition of constitutional laws and enforcement of rules and regulations by forest authorities and forest courts are necessary for the protection and sustainable use of natural resources in Bangladesh. Raising awareness and education among the wider community is important so that we can respect the earth and take responsibility of our actions.

Eco-tourism is environmentally friendly tourism that gives people the opportunity to experience the beauties of nature, to learn about the wildlife and how to be more environmentally responsible. Scientific researches on the Sundarbans are valued by people who are studying plants and animals. Scientific research is groundwork for educating people about nature and field studies help to find new species, explain reasons for declines in species, and help develop new medicines.

Managing for the future

People and the forests are natural partners with a great deal to offer each other. They have been natural partners for thousands of years; there are records of collecting revenues and earnings of people in the forests in Mogul Suttons some 500 years ago. The British recognised the importance of these forests in 1875-1876 and protected them as parks since the 1860s. Today, the Sundarbans remain uninhabited because the saline conditions make crops difficult to grow, fear of attack from the ferocious Royal Bengal Tiger, and due to the rules and restrictions on

access. The remaining wilderness area is managed as the Sundarbans Forest Reserve that ensures preservation and sustainable utilisation of natural resources under environmental laws.

The Government of the People's Republic of Bangladesh launched the Sundarbans Conservation Project (SCP) on April 1, 1999. The SCP recognises areas of international conservation significance and is aimed at long-term sustainable conservation of bio-diversity in the Sundarbans Reserved Forest.

The SCP demonstrated the government's commitment to the environment and recognition of International Agreements. Bangladesh is a signatory to: Ramsar Convention, 1971; Convention of International Trade of Endangered Species, 1973; Convention of Marine Pollution, 1973; and Convention on Biodiversity, 1973. These International Laws are non-legally binding documents that are not enforceable. However, a commitment at the highest possible level is recommended. The Government has a moral obligation for the benefit of future generations and the long-term livability of the country.

As an environmental engineering student from Australia, a volunteer for UNAA Earth Repair promoting earth repair action, I found the ferry journey into the Sundarbans to be most rewarding and truly a memorable experience. I breathed the fresh air and felt energised, I bathed in the Bay of Bengal and felt revitalised, and I sat on the white sandy beach and questioned 'who I am' and 'who is God'. I saw the water in the ocean, soil on the land, and the sun in the sky in their purest forms. The trees that grow protect soil from cyclones and land degradation, and help increase the land's fertility. They absorb carbon and release oxygen in water and air, improving water quality and air quality. The trees also play an important role in the biosphere through evotranspiration, reducing global warming and the greenhouse effect.

Trees are for life. Trees give us air, water and soil on which we, as human beings, depend for our survival. We, as custodians of the land, can exploit this precious resource, by reaping what we sow. We can conserve the land for the people by planting trees, or we can preserve the resources from the people to ensure protection and sustainable use of those resources. We live in a world that binds us and are all Spiritual by Nature.

The Sundarbans--that fearsome wilderness

Shahidul Islam Chowdhury

Poet Bishnu Dey in his rhyme, *Chele Bhulano Chhara*, gave a fearsome description of the mangrove forest called Sundarbans as an abode of venomous snakes, and man-eater tigers and crocodiles. But such yesteryears' description of the forest does not apply today as, over the years, human beings in hordes have invaded the Sundarbans, grabbing more and more of its land for their habitation and agriculture.

Today, people are not only encroaching the forest, but virtually plundering its rich resources of flora and fauna in all conceivable ways. The forest's resources, including plants, animals and the bio-diversity, are no more secured. On the whole, much of the life and environment of the Sundarbans today appear to be on the verge of extinction.

Newspapers-both national and foreign-are replete with the sordid stories of the slowly degrading Sundarbans, which is probably the world's largest mangrove forest. The electronic media, including the TV channels, also focused on the plight of this critical situation of the Sundarbans. Most of those press reports and television footage gave vivid and telling story of man's wanton and savage aggression on the Sundarbans. The only positive news about the Sundarbans was that in 1997, the UNESCO declared parts of the forest as World Heritage Site. But still, that good news could not prevent destruction of the Sundarbans where the situation on the ground has been really frustrating.

A nine-member delegation of the Forum of Environment Journalists of Bangladesh (FEJB) visited the largest for three days in early January 2001. And the delegation came back with disquieting experiences. There was the plaque of the World Heritage Site-but that's all, no development has taken place in protecting the forest that also stood for centuries as a place of pride the country.

This writer was a member of the FEJB delegation that visited the Sundarbans. Here is a brief description of our experiences during the sojourn. On the first day of our trip, we entered into the Katka-Kachikhali sanctuary on a country boat through a canal. Mangroves which came to our sight were inflicted by a disease, causing the death of the top branches of the trees. Plants along the canal were apparently bushy, but behind the groves, barren lands could be found. We later came to know that the clearings were done by unauthorised woodcutters who were active in the deep forests beyond the bushes.

In the evening, we reached the Katka Ghat. We saw four motor launches there, two belong to the Forest Department and the others brought by a picnic party from Khulna City. An amplifier kept on the roof of one of the vessels was playing music with full volume, breaking the silence of the sanctuary. Some 15 to 20 young men, apparently the members of the picnic party, were holding a campfire nearby burning wood-logs. Some of them were dancing with the tune of vulgar Hindi movie songs. One of the young men was seen chasing a deer.

Such incidents, we came to know, occur now and then-often right in front of the officials of the Forest Department. office-cum-residence of the local Assistant Conservator of Forest and other officers and Staff of the Forest Department. Those frolicking picnic party-men went about revelling in the presence of the forest guards, none of who ever came forward to resist them. We came to learn that similar activities are totally banned under the Forest Act, the Wildlife Preservation Act and the provisions of the management of World Heritage Site. Carrying of arms is not also banned in the sanctuaries. But we came to know that most visitors violated the ban and carried arms while visiting the Sundarbans. All such forest laws, including the dos and don'ts are clearly mentioned in the visit-permits issued by the Forest Department. But most of the visitors do not care to follow those rules and regulations.

Moreover, visitors throw polithenes and other wastes into the rivers of the Sundarbans, polluting not only the water but also the overall environment. Nobody takes the responsibility to prevent them. We informed that the Forest Ranger of Katka, Mr. Golam Mostafa, about the campfire in the sanctuary put up

by the revelling picnic party. He sent a staff to the spot for requesting the youths to put off the fire. But they refused to comply with the request. Later, some forest department guards and the visiting journalists went to the spot to put off the camp-fire and persuade the picnic party to switch off the loud and noisy music over amplifiers. Golam Mostafa noted with concern that such campfires could even cause the outbreak widespread forest fires in Sundarbans as a huge quantity of dry trees and logs are there inside the forest. Hence, the visitors must not play with fire while visiting the forests.

Felling of trees and hunting are banned not only in three sanctuaries, but also in the entire Sundarbans. The only exception is the Khulna Newsprint Mills authorities who are allowed to procure and purchase Gewa woods as raw materials in a limited scale. But still the deforestation process is continuing. At Badamtala, near the coastline, we saw some woodcutters were loading fresh logs on their boats. They made an attempt to flee on the apprehension that we were from the Forest Department. Mounds of logs were laying along the coast. Strong wind and tidal waves often uproot the trees along the coastline, a forest official told us.

One of the woodcutters said, "You could observe such scene in many places in the Sundarbans." These people are basically fishermen and woodcutters. They work in a group comprising 40 to 50 people under the direct supervision of some traders in the sanctuaries. Thousands of boats are usually engaged in unauthorised fishing in the Sundarbans during high tide under the full moon.

We heard about illegal poaching of tigers and deers. But forest officials did not denied such reports. Forest Ranger Golam Mostafa said that he had been posted there some eight months back and during the period, he had the opportunity to see Royal Bengal Tigers only twice. Another forest official informed us that another major threats in the sanctuaries were the armed dacoits who work in collusion with the illegal wood-cutters. They give protection to the wood-cutters with their mechanised boats and modern arms. On the other hand, he said, the forest officials don't have possess adequate manpower and arms. There is only one engine boat for Katka sanctuary to check

crimes of so many organised gangs of dacoits. Moreover, there is no guidelines for controlling the influx of tourists into the sanctuaries. Picnic parties with 8-10 motor launches enter into the sanctuaries on weekdays. A record number of 17 motor launches with hundreds of holiday makers visited the Katka sanctuary on one Friday in 2000. In such a situation, the officials pointed out, it becomes very difficult to handle so many visitors in one day. And moreover, the irony is that most of the visitors do not pay revenues or fees fixed by the government for entering into the forest. However, Dhangmari, Supati and Chandmari forest stations earn some revenue from the visitors, we were told.

Officials at Supati forest station mentioned about their limited manpower, specially forest guards, arms and logistics. An ironically, these forest guards carry obsolete arms with which they are unable to encounter the organised gangs of bandits in the forest. Every year, the forest department issues a limited number of permits to a selected group traders to extract a certain number of trees. But the wood traders, having those permits in hand, cut large numbers of trees in connivance with the bandits and often some dishonest forest guards. It was reported that sometimes forest guards recover smuggled logs. But later the gang-leaders illegally purchase those from the dishonest forest employees. Hunting of deer is another common conservation crime committed by poacher in and around the Sundarbans. Hides of deers are sold at high price, but the price of its meat is cheaper--Tk 60-70 per kg. The gangsters sometime catch deer and cubs of tiger alive for selling them, sometime in the international market, at high prices.

Chapter 6



Let we sink



Photo: Abu Taher Khokon, FEJB

Bangladesh
State of Environment Report 2001



Lest we sink

Prof. Serajul Islam Chowdhury

Professor Serajul Islam Chowdhury, convenor of a committee for saving the trees in a park in the city of Dhaka, wrote this piece last year (2000) when the authority were about to start building a conference centre there. History was indeed made, as Prof. Chowdhury pointed out while concluding this article, as the then government was eventually forced to change its decision to construct the conference centre at Osmani Uddyan. The message is clear: ultimately it is the public opinion that prevails.

It is easy to sink; and indeed we are doing that, even if unknowingly. The United Nations Human Development Report indicates that we have gone further down. Last we were 146th among 174th this year we have sunk to 100. It is not unlikely that we have sunk to 100. It is not unlikely that we will continue to do so unless we try to swim. And swimming means resistance. We must resist many things we, as a people, will be required to do, unless we decide to go down. We must take care of our environment, both human and natural.

The human environment is worsening, so is the natural one. Seemingly nature is friendly but is also knows how to be revengeful, and the revenge of nature can be crueller than that of man.

Collectively as well as individually, we have been not only indifferent but also cruel to nature, notwithstanding our famous love for it; and nature is retaliating. The phenomenon is global and not local, but the local suffering is none the better. In fact it is worse. The real if hidden, enemy is capitalism. The capitalist ideology is, unapologetically, a believer in making profit, and it is, of course, profitable to feel nature and bring it to the open market, competitively. Marginalized although we

are, we are not outside the parameters of the capitalist system and its ideology. We are perpetrating savagery on nature.

For example, this monstrous city of Dhaka had once its parks and gardens. Shahbag, Paribag, Lalbag, Hazaribag, Segun Bagicha, Kalabagan, Sobhanbag, Kathalagan, Dhoop Khola Math, Armanitola Maidan, Sirajuddoula Park, Coronation Park must have been open spaces at one time or another, but they have disappeared, with their names being mocked at by the jungles of concrete and bricks that have taken over, illegally no doubt. The town was well known for its markets and lanes. It was a conglomeration of fifty-two markets and fifty-three lanes, they used to say. Well, the markets and lanes have proliferated like worms, ugly and harmful, to the historical detriment of life-saving open spaces. The growth of markets and lanes is not accidental. It is all a piece with ideology and philosophy of capitalism, whose helpless victims we all are, and will continue to be, unless resistance is created.

It is not only the gardens that have disappeared. The river, the Buriganga, which had been, the life-line of the city has ceased to exist. The town had canals which have been allowed to be transformed into markets and lanes. All these are supposed to be developments. What has really happened is that the quality of life has declined.

The government decision to destroy Osmani Uddyan in the interest of building an International Conference Hall has astonished us all. But it is not as surprising as it looks. For governments are agents of capitalism, and they cannot afford to be friendly towards nature, to do so would mean the collapse of their very *raison d'etre*.

But we, as citizens and victims, must protest and resist. The decision is immoral and illegal. It is immoral because the destruction of the garden would mean adding to the health hazards of the citizens, which already have become ominous.

In fact it would signify a denial to the citizens the fundamental right to breathe freely. Construction of an international hall at the most busy and crowded part, indeed the heart, of the city would contribute negatively to the problem of traffic jam. The Uddyan is public property; building a hall in it would amount

to refusing the public access to its use.

The action would be illegal as well. A thing called the master plan exists for this city, which is a document prepared by the government itself. The plan shows the Uddyan area as a green spot. The government seemed to be bent upon violating a plan. Prepared by experts who must have gone into all aspects of town planning, Individuals are not allowed to disregard the town plan; should the government, which is supposed to protect the city and not destroy it, be allowed to do so? We understand that the government had consulted town planning experts on the question of sites selection for the proposed conference hall and was told, unanimously, that of all the possible sights suggested the Uddyan to be the worst. The public also thinks so. A public opinion survey shows that 90% of the city dwellers are against the government decision. That was before the Citizens' Movement for Protecting the Uddyan had made its presence felt; since then more dwellers have become aware of the consequences of the destruction. Opinion polls suggested the 99% people were opposed to the idea of destroying the Uddyan. How can a government disregard this public opinion, whatever be its own private inclinations? The government owes its existence to the support of the public, to turn against public opinion is not legal, taking law in its wider connotation. What the citizens' resistance movement is doing, on the other hand, is both moral and legal. It is the moral right of a citizen to stand up against an immoral act. What is more, the constitution of the country enjoins upon its citizens the duty of protecting property belonging to the state (Clause 21, Article 2).

Osmani Uddyan was a test case. In a sense it epitomises the very spirit and history of our liberation war. The issue at stake, is not a park, it is much more than that. People's right to live freely is being threatened. The question really is, which should prevail: public opinion or the anti-people and arbitrary decision of the government? To lose this battle would mean making way for further losses; because other parts will fall, like nine-pins; what is more, people's opinion will be defeated.

This we cannot allow to happen. For we must not sink. Parks have their history. It was, in a mango grove that the East India

Company had won the battle of 1757. A hundred years later the sepoys rose in a war of independence against the regime; and in a garden in Dhaka, which the English later called Victoria Park to signify their victory, many of the rebels were hanged. What is now called the Suhrawardy Uddyan was an open space in 1948 in which Mohammad Ali Jinnah, the "Father" of the Pakistani nation, had declared that Urdu alone should be the state language of Bengal. People were astonished, they said no: that 'no' became louder defying all the guns of state power to silence it. And it was in the same garden that the Pakistani occupation army had to bow down to the no-saying Bengalis, surrendering their arms as well themselves. History is perhaps going to be made in Osmani Uddyan- once again.

Chapter 7

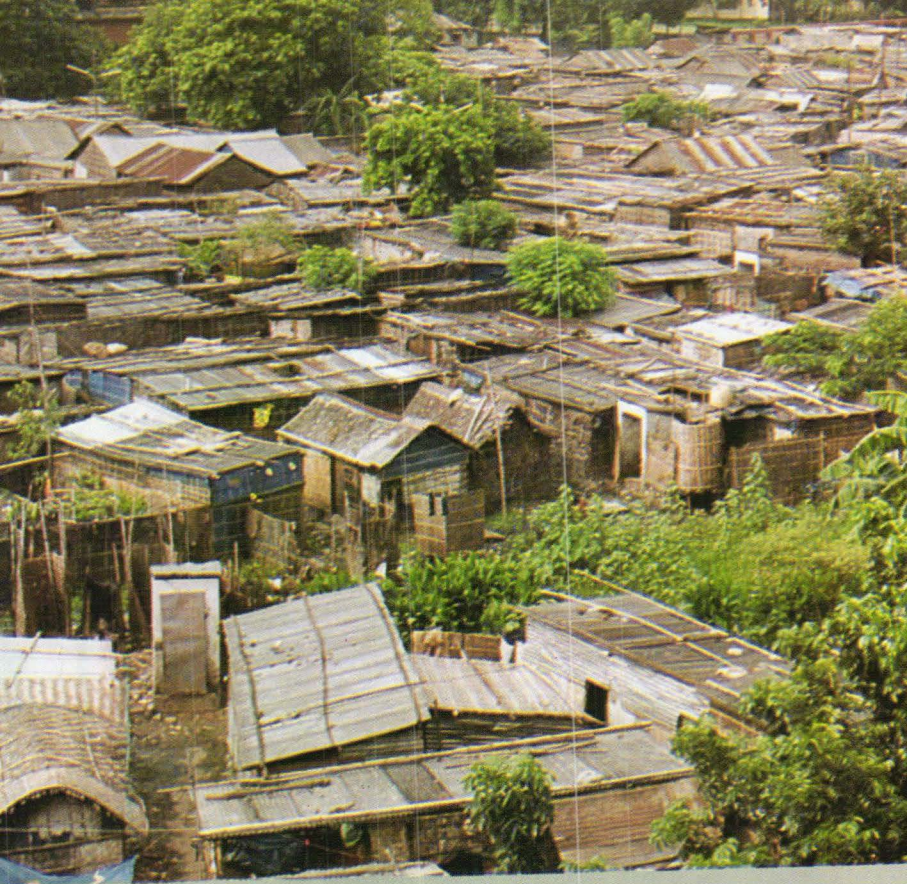


Bio-diversity: Where does bio-gas stand



Photo: Bulbul Ahmed, FEJB

Bangladesh
State of Environment Report 2001



Bio-diversity: Where does bio-gas stand ?

Syed Badrul Ahsan

The very simple truth about conditions in the Third World, or call it, in that euphemistic way, the developing world, is that there are crises which need to be addressed on an urgent basis. Of course, all those problems we speak of and have been speaking of over a long period of time have owed their origins to questions of governance. Frankly, it has largely been bad governance which has hugely set back the developing regions, or the poorer societies of the world. But consider, alongside that fact, the very real truth of a world fast losing its grip on itself. And where is that happening? It is the environment, a very risky area these days considering the many layers of destruction it has been going through. The Kyoto protocol, and its subsequent flouting by the United States, are real pointers to everything that has been going wrong with the global effort to save the environment. These days, it is no more a question of conserving the environment. It is much worse, much more telling: the environment needs to be saved, from those who have for centuries benefited from it, indeed have been indulging in the depredations which have quite impoverished it.

That is precisely where the issue of developing alternative sources of energy comes in. And in Bangladesh, where a generation of power, of a development of energy, has taken on newer and more significant meanings in the past two decades or so, the need for development of energy that will benefit an already large, and growing, population becomes that much more acute. To be sure, there cannot be any guarantee that the many projects successive political administrations in Bangladesh have undertaken over time will turn out to be as meaningful as they were originally projected to be. Even so, this very preoccupation with developing new sources of energy for a resource-strapped country acquires particular meaning. That is where the idea of bio-gas makes its entry. Now, the primary

point that must be considered here is that bio-gas, despite being particularly relevant to poor societies such as those which define Bangladesh, is also a pointer to what could be done to allow the world to carry itself forward even as conventional sources of energy begin to reach their limits. Bio-gas, till this point in time the poor man's approach to the crisis of the future, could well turn out to be the global norm in the times to be.

And what precisely is bio-gas? It is that very simple process of converting various kinds of waste -- animal dung, human excreta, decaying water plants, et al --- into renewable energy that could not only be utilized in households but also applied in the bigger area of industrial activities. A kind of idealism here? Far from it. The very potent truth is that perhaps the time is here and now for bio-gas to make its entry into the thought-process of planners. In Bangladesh, that appears to be the increasing trend, given the perennial problems the country has suffered from in the energy region. The Bangladesh Council for Scientific and Industrial Research (BCSIR) decided, in 1999, to set up as many as 25,000 bio-gas plants under a pilot project in the country. The objective was obviously one of confronting the question of future energy needs; and it was derived from the growing realization that prior to energy sources getting depleted in the country, Bangladesh would need to go for programmes that would help maintain its industry, its homes, indeed its social structure in the desired manner.

The BCSIR plan was based upon a few simple calculations. The first was of course the growing demand for energy, accompanied as it was by the requirement of a recycling of soil nutrients in order for energy to maintain itself as an on-going process. The second calculation was one which took account of Bangladesh's position as a largely agrarian (and that despite the increasing emphasis on industrialization) society. The BCSIR projection spoke of no fewer than 20 per cent of families in Bangladesh being associated directly with agriculture (the figure could well be higher). Translated in plain numbers, at least 4,000,000 people possessed the wherewithal by which the bio-gas industry could be benefited. Each of these agricultural families, it was calculated, owned anywhere from four to five cows, enough to provide the ingredients essential in the production of bio-gas resources, especially for the families

concerned themselves.

But for all the ambitious nature of the BCSIR programme, the fact remains that soil nutrients in Bangladesh happen to be rather low, 11 per cent, compared to what they are in India (where the figure is 40 per cent) and China (where it is 65 per cent). That is a pretty alarming indication of declining soil fertility in Bangladesh. Just how serious the need for bio-gas happens to be in Bangladesh can only be surmised from the establishment of two bio-gas plants, one each at the home of Bangladesh's soon to be retiring President, Justice Shahabuddin Ahmed, and the former Chief Election Commissioner, Abu Hena. These two plants serve as good morale boosters. But whether they will in the end amount to what they are meant to be depends on how soon, and how energetically, the country goes into a diffusion of the bio-gas idea. The BCSIR places good emphasis on a proper use of municipal garbage, cow dung and poultry droppings as a way of giving credible shape to the bio-gas programme. Add to that other wastes, such as human wastes and all those water plants which periodically have filled ponds, lakes and streams in Bangladesh. The possibilities arising from bio-gas are thus stupendous.

It is, as has been said already in so many words, the endless need for alternative and renewable sources of energy which has necessitated the institution of the bio-gas industry in Bangladesh. The positive aspect of the bio-gas enterprise is that it reassures Bangladeshis of a renewable form of energy, one that is dependent on a process of recycling. Why such renewable energy becomes important can be observed from the very simple fact of what has been happening to the country's forest resources over the decades. Every year, as many as 107 crore maunds of wood, dry leaves, dry grass are used as energy sources in the country, particularly in the rural regions. That in turn acts as a drain on forest resources. At the same time, it affects, in a negative way and to a very large extent the state of soil nutrients and the fertility of land. Additionally, bio-gas can come in as a way of ensuring health safety through making it possible for a rolling back of the use of traditional sources of energy, which in the end impact negatively on human health. And where human wastes are concerned, it has been seen in rural areas that an indiscriminate disposal of human excreta

results in health being put at risk. This risk can be obviated through utilising such wastes in the bio-gas production process. And the manner in which bio-gas can be utilized? Well, the areas are many and diverse. Note the following:

- a) bio-gas can be used in the cooking process;
- b) it can be utilized to provide luminosity to rural lighting systems such as lanterns;
- c) bio-gas can be used to pump irrigation water to crop fields;
- d) bio-gas can be used as alternative fuel for cars and other vehicles;
- e) all forms of electronic appliances can be operated through bio-gas;
- f) incubators can be made operational by use of bio-gas.

Apart from the many uses to which bio-gas can be put, there are the additional advantages of the element. For instance, bio-gas residues can be applied to the following:

- a) production of high quality fertilizer;
- b) production of mushrooms;
- c) production of fish;
- d) production of feed for poultry, et al.

Bio-gas, as an alternative source of energy, contains between 60 and 70 per cent methane. Obviously, it will serve as a useful source of energy in the rural regions, which by extension would mean that much of the pressure that is now being put on the nation's forest resources would recede.

The clear conclusion about bio-gas is that it is an idea whose time has come. And for good reason.

Linking bio-diversity with poverty alleviation: Bangladeshi context

Dr. M. Aminul Islam

The territory of Bangladesh is mostly covered by the Bengal Basin. It is a landscape of mysteries. It has the highest density of rural population as well as that of natural water channel in the world. It also has one of the most diverse tropical ecosystems. But in its variety it is also perhaps the least understood. The combination of deltaic landscape with abundance of water, rich bio-climatic resources, diverse agro-ecological zones, and coastal belt and the zone of brackish water has endowed the country with a lot of bio-diversity.

Where is the highest carrying capacity of nature?

Floodplains and Wetlands

Along the floodplains and wetlands where water meets life, one can find the highest population density in Bangladesh. More than 50 per cent of the territory in Bangladesh, including the coastal area, may be considered floodplains and wetlands. Such fringe areas with land and water interaction are the habitats of a wide range of terrestrial, amphibious and aquatic bio-diversity. This vast variety of life has an intrinsic value as bio-diversity provides various 'eco-system services' and there are plenty of economically useful things to exploit from it, ranging from sources of nutrition, household needs, anti-cancer drugs to eco-tourism. During the monsoon most of the low-lying crop fields go under water and are treated as the common property for capture fishery which is the main protein source for the poor people at large in rural Bangladesh.

Mangrove

The Sundarbans mangrove forest is located in the south-west coast in Bangladesh which provides a habitat for many plant and animal species. Mangrove provides resources for livelihood of the local people, ranging various items of food, fish, fibre,

fuel, fodder and construction materials. Mangroves are the breeding ground and habitats for many fish and shellfish that contribute to the diet of poor people and earns second highest export revenue for the country. The Sundarbans mangrove forest has about 283 species of fish, 229 species of crustaceans and 211 species of molluscs. Mangrove forests are also the essential spawning and nursery areas for many species of marine fish. The Sundarbans region includes the World Heritage Site, as well as reserve forests and protected areas. This vital coastal wetland with its unique bio-diversity is also home to the endangered Royal Bengal Tiger and a large number of other threatened species of plants and animals. Over 3 million people live in the Sundarbans in Bangladesh. Population pressures and weak enforcement of existing regulations have triggered the non-sustainable exploitation of the region's natural wealth - everything from excessive honey collection and use of poisons and explosives to catch fish and shellfish, to the over-exploitation of mangrove trees (and other species of trees) for building material and fuel wood. Households surveyed in 32 villages along the Sundarbans in Bangladesh showed an over-all participation rate of 78% in resource harvesting at the innermost (0-2 km) band and 64% at the outermost (8-10 km) band.

People at the centre

People are considered to play the central role in the search for solutions to the problem of the drastic reduction of bio-diversity as they are closely linked to social, cultural, economic and political issues. What is required is a multi-stakeholder analysis for adopting a comprehensive approach to the over-all management of the bio-diversity sites. Poverty, for example, is both a cause as well as a consequence of the reduction of bio-diversity due to over-extraction of natural resources. Action must be centred on solutions that address the need for viable livelihoods for the affected people. Threats to bio-diversity simply cannot be halted by measures like conservation, regeneration, tree planting and habitat restoration. It is far more cost-effective to manage the bio-diversity in a sustainable manner through stakeholders' participation than it is to regenerate an already damaged land. Increasingly, therefore, efforts have been refocused to tackle the systemic, root causes of the problem. The frontline troops in the battle against the

threats to bio-diversity are the farmers, fishermen, and women and children struggling to scrape a living from a hostile environment. This reflects the Convention's insistence on community involvement and the bottom-up approach.

Value of bio-diversity and alternative livelihood options

The loss of bio-diversity has been taking place since humans first learned to harvest natural resources and to manage the land to increase its productivity. Depletion of natural resources and rapid loss of bio-diversity took place over time to meet the basic needs of the growing population. These changes in most cases are irreversible. In view of this alarming scenario, it is important to ascertain whether the conversion of natural resources to alternative uses is more or less beneficial to mankind than the preservation of bio-diversity. Putting a value on bio-diversity is one of the methods of assessing comparative benefits and losses out of habitat conversion, destruction or conservation either in the long term or medium term. Such assessment of the value of bio-diversity is often based on the value of products derived from genetic variation. Agricultural crops are some of the few species for which the benefit of genetic diversity can be given a precise commercial value. The financial value of plants and their derivatives to the pharmaceutical industry can also be quantified. Many habitats and species possess multiple values simultaneously. A tropical forest, for instance, is valuable directly in terms of its timber, indirectly in terms of watershed protection, serving as a shield to protect life and resources from cyclones and tidal surges, and being a vast carbon sink and consequently improving air quality. Its numerous species have potential future uses as food, construction materials and medicines.

Concluding remarks

Bangladesh is far behind in raising public awareness of the ecological, economic and socio-cultural value of bio-diversity and promoting local community participation in its sustainable conservation and management programmes. Bio-diversity - being a major source of food, fibres, fuel, fodder and other useful things - needs adequate attention and increased knowledge for its conservation and wise use in a sustainable manner. Sustainable management and conservation of eco-specific bio-diversity through the poor peoples' active

participation can contribute substantially to poverty alleviation in the context of environmental conservation. Poverty alleviation programmes should be aimed at creating common property management such as common forestry, common horticulture, common fruit gardens, and community-based common wetlands management for conserving aquatic biodiversity. Agricultural bio-diversity and the identification of medicinal plants are some of the initiatives worthy of mention.

Our wetland ecosystems

Mamunul Hoque Khan

Introduction: Wetlands are the predominant and the most productive land feature of Bangladesh. They play a very vital role in the life and environment of this country. From an environmental point of view, the most influential feature of Bangladesh is the vast amount of water flowing through a flood plain. This paper will provide an overview of the wetlands of Bangladesh, its importance as a very productive ecosystem, other benefits and attributes and the need of a sustainable management strategy.

Wetland ecosystems: Ecologically, the wetlands (such as rivers, beels, lakes, canals and other seasonal and perennial wetlands) in Bangladesh are potential habitats for a large variety of plants and animals. The production potential of open-water fisheries in Bangladesh has been reduced and continued to be reduced every year as more and more of the fish population areas are removed or altered for human encroached construction, flood control, or food grain production. Besides fish species, aquatic plant species diversity is also reduced which hampered life of different wetland dependent birds (indigenous, endemic and migratory), amphibians, reptiles, and mammals.

After the '70s, when scope for further encroachment to the forested areas reduced significantly in the country, people started encroaching wetlands to meet their demands for shelter and staple food in an unsustainable way. This resulted in tremendous disruptions in the wetlands ecosystems of Bangladesh.

Although the country is relatively small, only about 144,000 square kilometers, Bangladesh serves as the drainage path for a catchment area that is nearly ten times larger. The catchment basin of the combined Ganges, Brahmaputra and

Meghna rivers covers more than 1.5 million square kilometers. Bangladesh receives nearly 1.2 trillion cubic meters of water per year. Ninety percent of this originates from outside Bangladesh in Indian, Nepal, Burma and Bhutan.

Due to the deltaic character of the country, Bangladesh is composed of numerous wetlands. The total wet season wetland area in Bangladesh has been estimated at about 7.5 million hectares, according to Akonda. The following table lists the types of wetlands and the amount of area they comprise during the wet season.

Table: Types of Wetlands and their estimated area during the Wet Season

WETLAND TYPES	AREA (000 ha)
Permanent rivers and streams	480
Estuaries and mangrove swamps	610
Shallow lakes and marshes	120-290
Large water storage reservoirs	90
Small tanks and fish ponds	150-180
Shrimp ponds	90-115
Seasonally-flooded flood plains	5,770

Source: A Directory of Asian Wetlands, 1989

Types of wetlands in Bangladesh

There are many types of wetlands in Bangladesh which can be categorized broadly into five different groups according to their basic biological and physical characteristics. In this section a system which has been adapted for the Bangladesh context from the classification used by Dugan will be described. The five major groups are categorized as: marine, estuarine, riverine, lacustrine, and palustrine. The main factor which is characteristic of the marine and estuarine groups is the presence of ocean saltwater. The remaining three groups are considered as freshwater wetlands.

Saltwater

Marine: Primarily this refers to permanent shallow saltwater wetlands such as shallow bays. It also includes coral formation like those located at St. Martin's Island off Teknaf in Cox's Bazaar district.

Estuarine: These systems occur where the saltwater of the ocean mixes with the freshwater flowing in riverine systems. Estuarine wetlands are generally influenced by the movement of tides. Examples would include tidal marshes; inter tidal mud, salt or sand flats; and, inter tidal forested wetlands. One well-known example of estuarine wetland in Bangladesh is the Sundarbans which has been declared as a Ramsar site. This estuarine wetland is the world's largest mangrove swamp and covers some 1,000,000 hectares of land and water in Bangladesh and India. The freshwater moving south through the Sundarbans influences the saltwater from intruding north.

Freshwater

Riverine: These systems are the predominant features that are found in Bangladesh. In fact, the vast majority of Bangladesh landform has been determined by the erosion and sedimentation forces of the large rivers meeting within its boundaries. It has been estimated that rivers, streams, and canals total at least 24,000 kilometers in length. According to Rashid, except for those of the Chittagong Region, all belong to one of the three major river systems: the Ganges-Padma, Brahmaputra-Jamuna and the Surma-Meghna.

Lacustrine: These are lake systems and include haors, baors, beels and man-made features such as Kaptai Lake in the Chittagong Hill Tracts. They can also include the ponds, and dighees, that are formed in villages as a result of earth-raising activities. Bangladesh has only three naturally occurring true lakes. These are located in the Chittagong Hill Tracts and the Barind Tract. True lakes have steep sides and are very deep in comparison to their surface area. Their water level also stays relatively constant. Vegetation is usually limited in the lacustrine systems to either phytoplankton, floating plants rooted to the lake bottom.

Palustrine: These are ecosystems relating to marshes and swamps. They are shallow in water depth and have large areas of emergent wetland vegetation. BCAS characterizes palustrine system as: permanent freshwater marshes and swamps with emergent vegetation; permanent peat-forming freshwater swamps dominated by Typha; and freshwater swamp forest, such as the lowland hijal (genus Barringtonia) forests of the haor region.

Usually palustrine ecosystems are the site of former lacustrine ecosystems. Gradually, over time, pre-existing lake systems become more shallow. Erosion-borne sediments are transported into the systems and are deposited on the bottom. In addition, as plants and other organisms die, their remains sink to the bottom and are decomposed. Consequently, the bottom rises, the lake becomes more shallow, and a change in vegetation occurs. The ecosystem becomes less suitable for submerged plants and more suitable for emergent vegetation. The lacustrine system gradually changes to or is succeeded by the palustrine ecosystem. This demonstrates that ecosystems are not constant, rather dynamic, and change over time.

A list of different types of wetland ecosystems in Bangladesh has been assembled in the following table. Common English names, types (such as M for marine, E for Estuarine and so on), Bangla names and brief descriptions of their characteristic have also been included in the table.

Table: Lists of the major wetland ecosystems in Bangladesh:

Common name	Bangla name	Characteristics
Pond [L]	Pukur, Pushkuruni, Dighee	Perennial. In rural areas ponds are generally constructed when new homesteads are raised. A very big pond is called a deghee. Generally these ponds are used for bathing, ozu (ablution, cleaning before prayer), washing, and fish culture.
Creeks [E]	Nala	Common in coastal areas where water remains during high tide but moves away during low tide.
Canal [R]	Khal	Often these are human-made connections between rivers and other water bodies such as beels and bide. Distributaries of rivers to floodplains.
River [R]	Nodi, Nod, Gaang	Channeled flow in nature. Main rivers of Bangladesh come from India's hilly areas. Bangladesh's economy and people's lives are highly dependent on these rivers.
Single Natural Depression [L]	Beel	Natural depressions where water retention is generally common throughout the year.

Multiple Natural Depression [L]	Haor	Single water body in the wet season which splits into a number of pockets during the dry season.
Ox-bow lake [L]	Baor	Depressed part of a dead river; generally connected with the nearest river by a canal.
Lake [L]	Lake, Roth	Commonly constructed in urban areas. Other types are situated in hilly areas. The kaptai lake is one exception in that it was human-made for a hydro-electric project.
Floodplain [R]	Bonna Plabito Elaka	Belt of low, and flat ground, present on one or both sides of a river-channel, subject to inundation by a flood at least annually and characterized by alluvium soil.
Mangrove [E]	Sundarbans	Genus of tropical shrubs or tree which grows in salt-water swamps in the estuaries of rivers in Asia and America. Sundarbans of Bangladesh is the largest mangrove forest in the world.
Coral reef [M]	Probal	Found at St. Martin's Island, Teknaf.
Spring [R]	Jharna, Chnara	Wetland in hilly areas. People use the water for various purposes, such as agriculture and household needs.

M: Marine
L: lacustrine

E: estuarine
P: palustrine

R: riverine

Functions and benefits of wetlands

In Bangladesh, wetlands serve a wide variety of functions, such as flood control, water purification, protection from natural disasters, source of livelihood, and habitat for wildlife and fish. Some of these benefits are available only in a certain type of wetlands; whereas, the majority of these benefits are common for all types. Included in the following discussion are many of the types of benefits (values, attributes, functions, uses) provided by wetlands with some examples.

A. Water Supply:

(a) Water supply to people: In Bangladesh, the rural population is 84.8% of the total national population. A good proportion of this population uses the surface water from wetlands for its everyday needs. Examples of wetland uses by local inhabitants are: washing of household goods, bathing, cooking, and drinking.

(b) Water supply to other wetlands: Wetlands can function as a water source for other wetlands. For instance, a river or beel is often the source of water for canals which lead to other beels, flood plains, and distributaries.

(c) Water supply to groundwater: Groundwater is constantly being naturally discharged (used) through evaporation and transpiration; and artificially through extraction by shallow and deep tube wells. Wetlands recharge the groundwater supply through infiltration and deep percolation. Wetlands serve a vital role in maintaining a balanced hydrological cycle which is important for our survival.

(d) Water supply to agriculture: Wetlands serve as a source of irrigation water. About 50 percent of the demand for irrigation to our agricultural fields is supplied by surface water. Out of this, 30 percent is by gravity flow, 48 percent by low lift pumps, and 22 percent by traditional methods.

(e) Water supply to industry: Wetlands are water sources for mechanical processes and equipment operation in many

industries. The washing and cooling of machines is an example. Wetlands are also water sources when used as one of the raw materials of the final product.

B. Flow regulation and flood control:

(a) Reservoir/water storage: The water-bearing capacity of wetlands helps to balance water flow following rain events. Wetlands capture rain water and release the water slowly and evenly during the rain and flood season. This reservoir function helps to reduce the intensity of floods and helps to prevent flash flooding. The reserve provided by the wetland reservoir helps to meet water needs during the dry season.

(b) Drainage network: Wetlands provide the routes for water passage through Bangladesh. They serve as collection points for various surface water sources. The Bangladesh river-system is an integrated drainage system and each wetland acts as a drainage component of this system.

C. Protection from natural calamities:

(a) Cyclone and storm surge: Wetlands in the coastal areas, such as mangrove forests, provide a buffer to dissipate the energy from strong winds or waves. For instance, the Sundarbans protects the people who live on its northern borders from the storms that come from the Bay of Bengal located on its southern shores.

(b) Erosion: Wetlands help protect lands from the loss of valuable topsoil by wind or water movement. Wetlands have a greater moisture availability in their soil and, therefore, suffer less erosion due to wind action. The presence of wetlands ensures that adjoining areas are moist enough to protect against wind erosion. In Bangladesh, wetland vegetation plays a vital role in protecting and from erosion by wave action and overland surface run-off of storm water. The vegetation helps to slow the water velocity and allows suspended and dissolved sediments to settle.

(c) Prevention of salinity intrusion:

Surface water: In the coastal areas, saline water can intrude

through surface or groundwater. In most cases salinity intrusion is not desirable because the water is too salty and is not suitable for agriculture or other uses. One exception is mariculture or cultivation of shrimp which requires mixed fresh and saline water (brackish conditions). Freshwater flow is necessary to prevent the movement of saline water north from the Bay of Bengal into the delta of Bangladesh. Since freshwater wetlands serve as the source and network for freshwater flow in the rivers, their areal extent and water volumes determine the minimum freshwater water flow available to counteract the intrusion of the saline waters. If this flow is high then the occurrence of salinity intrusion through surface water is less. Nowadays, the water discharge towards the Bay of Bengal has decreased significantly due to water control activities upstream. As a result, saline water intrusion has increased, and affecting areas in the Sundarbans.

Groundwater: Wetlands influence groundwater flows in much the same way as surface water. When the coastal ground layers are permeable, saline water can intrude into the groundwater. Fresh groundwater moving towards the sea meets the saltwater and prevents saline water intrusion. The recharge of groundwater by freshwater wetlands through infiltration and deep percolation ensures a sufficient counter force against the intruding saline water. Destruction of freshwater wetlands and removal of groundwater by extensive well water extraction greatly reduces groundwater flows. This encourages intrusion of saline water into the groundwater systems.

It is very important to retain the freshwater layer in low-lying coastal areas because it ensures supply of drinking and washing water for the local communities and irrigation water for agriculture. This fresh water quality has a great influence in the vegetation cover and bio-diversity as a whole. Also, salinity of the soil is prevented by the freshwater layer.

D. Sediment deposition:

(a) **Soil fertility recharge:** Plants consume soil minerals and nutrients. Over time, this can deplete the soil fertility.

Wetlands help to recharge the soil fertility by trapping mineral particles and organic matter carried in flood water. When a flood recedes, mineral particles and organic matter settle on the soil making it more fertile. Thus the soil fertility is recharged for agriculture occurring on these wetlands.

(b) Land accretion (formation of new land): About 2.4 billion tons of sediment come to Bangladesh each year through its river system. The strong river currents carry the majority to the Bay of Bengal past the edge of the continental shelf and into the submerged canyon, Swatch of No Ground. Nonetheless, many new char lands (braided islands) in the major rivers and estuaries are being formed. The new chars provide land for agriculture and settlement. Unfortunately, the unconsolidated nature of the new chars makes them very susceptible to erosion and flooding each year.

E. Habitat and biodiversity:

(a) Habitats for wildlife: Wetlands provide shelter, feeding, breeding, and nursery support to wildlife. They support a rich diversity of biological species. Bangladesh's wetlands support more than 330 species of plants, about 300 species of birds (resident and migratory), 120 species of commercially important fish, 50 species of reptiles, some 42 species of mammals and eight species of amphibians. The Sundarbans, the world's largest mangrove forest, is an important habitat for many types of mammals, reptiles amphibians, and birds. The Sundarbans are also known for being the home to the Royal Bengal Tiger (*Panthera tigris*).

(b) Gene bank: Every organism is composed of either single or multiple cells. The characteristic of each organism (size of animal, shape of leaf, color of person's complexion, number of fingers) are determined by information stored chemically within the genes of each cell nucleus. The word gene is derived from the Greek word *genos* which means birth. This gene information tells the cell how to reproduce and function within an organism. This is how the characteristics of the parent organisms are passed to their offspring. As generations of organisms slowly adapt to changes in environmental conditions, the new information is stored in

the genes and passed to successive generations.

A bank is a place to store important items. Genetic information are an important material for conservation and research. Scientists have developed gene banks which are sophisticated systems for collecting and storing genetic information in the form of seeds. For example, the search for improved varieties of high yielding rice has benefited from the gene information found in certain wild rice varieties found in wetlands. The gene material from the wild rice can be joined to the domestic rice. This additional information can improve disease resistance qualities or improve survival following periods of seasonal flooding.

The enormous diversity of species found in wetlands creates a similar database or pool of genetic information composed of various resident organisms. There are many local varieties of rice and also other plants in wetlands that may be of commercial importance. They can provide a valuable collection of gene information for ensuring the continued development of improved varieties for the future. Thus wetlands function as natural banks for storing and preserving genetic information. This gene bank function serves both research and conservation purposes. If the wetlands are destroyed, the genetic information in them is permanently lost for human kind's future use.

F. Water purification:

(a) Biological purification: Nutrients come from a variety of sources such as run-off of fertilizer from agricultural fields, human and animal wastes, and industrial discharge. Mostly, these nutrients are inorganic phosphorus and nitrogen. Wetland plants can neutralize, absorb or transform the nutrients into organic plant tissue. For example, the wetland plant duckweed, can take up such inorganic agents. This helps to clean the water and provides improved water quality benefits for communities downstream.

In some instances, toxic substances are discharged into waterways. These pollution sources include pesticides from agriculture fields and Discharge or run-off of oils and toxic agents from industrial sites or mining activities. Such toxic

materials do not decompose easily; however, they can bind to the surface of fine sediments. The sediments can eventually settle out of the water in the wetlands. Some wetland plant species, such as water hyacinth, can absorb metals into the plant tissue and help to remove the substances from the flowing water.

(b) Flushing action: Floods clean the countryside by washing flooded areas. This function of the wetlands is known as flushing action. During floods, the organic and inorganic wastes are diluted, neutralized or absorbed by the large ecosystem. The wastes are still present in the system but now they are distributed among a much larger area.

G. Natural cycles:

(a) Hydrological cycle: This cycle describes the movement of water between the earth's surface and the atmosphere. Wetlands serve as a major source of the water vapor that enters the atmosphere and eventually returns as precipitation. In addition, the wetlands serve as the drainage ways which channel the precipitation into the rivers and oceans. Wetlands are a principal component of the hydrological cycle.

(b) Bio-geo-chemical cycle: The bio-geo-chemical cycles describe the cyclical movement of minerals and elements between the biotic and abiotic components of the ecosystem. The amount of available elements in nature affect the life-cycle of organisms. Part of each cycle occurs within living biotic organisms; other parts occur as chemical actions in the abiotic environment. The flow of elements is cyclical and matter is reused.

(c) Production cycle: Wetlands are one of the most productive ecosystems of the earth's surface. They are a highly productive site for photosynthesis which converts sunlight energy into bio-mass.

H. Socio-economic and cultural significance:

(a) Livelihood and profession: In Bangladesh, wetlands are

an integral part of the life of rural people. Many people's lives are dependent on the fishery sector. People who do not fish professionally often fish to meet their protein needs. In addition to fishing, wetlands are a site for gathering important plants, animals and raw materials, such as wood, clay and sand. In addition to fishermen, boatmen, sand-divers and farmers are also very much dependent on wetlands. Some of these wetland-dependent socio-economic activities are the only means of livelihood for a large group of people.

(b) Recreation and aesthetic value: People like to go to wetland sites for recreation purposes and for spending their leisure time. Wetland landscapes provide a natural scenic beauty. A wetland's aesthetic beauty attracts people and gives them pleasure.

(c) Religious and spiritual significance: Wetlands are important sites for religious gatherings, ritual bathing and melas (exhibitions). On the banks of the river Turag in Tongi, the world's second largest Muslim gathering takes place each year. Llangalbandh is famous for Hindu ritual bathing ceremonies. Wetland sites are often selected for meals based on Bangladesh's history.

(d) Scope for eco-tourism and earning foreign currency: This sector is in its infancy. However, there is a substantial foundation for the view that the country's natural resources, especially the Sundarbans, could support the development of this sector. Bangladesh's economy is currently supported by commercially exporting wetland dependent species, like as shrimp. Other commercially important species are frogs, turtles, snake skins and lizard skins.

I. Production of food and other materials:

(a) Food: Wetlands provide rice, fish, meat and vegetable. The majority of the food for Bangladeshi people comes from wetlands. The inland capture fishery is Bangladesh's most important fishery sub-sector in terms of total catch, source of employment, and supply of animal protein. It is based on the country's vast freshwater resources and some 270 species of fin and shellfish which inhabit them. Essential habitats for the inland fishery comprise open and

closed water habitats, including rivers, canals, flood plains, large seasonal water bodies (haors), smaller wetlands (beels), and ox-bow lakes (baors). Although discrete in the dry season, these water bodies become interconnected during the monsoon and provide critical habitats for the completion of the life cycles of a large number of fish species.

(b) Fodder and fertiliser: Wetlands provide food for animals (fodder). Examples of this food include straw, water hyacinth, and snails. Decomposed wetland organic matter is used as fertilizer. Frequently, wetland soil is also used as fertilizer for homestead gardening.

(c) Medicine: Wetland plants are used as medicine for treating various diseases. Some wetland organisms are also used as raw material for processed medicines.

(d) Building materials: Wetlands provide most of Bangladesh's building materials, such as sand, timber, leaves, straw, goal pata, reed, cane water hyacinth and hogla. Sand is essential for making buildings and other concrete structures. Timber, water hyacinth, reed, and cane are used for making furniture. Some wetland plants are also used for making mats and baskets and for packing fish, as well as for many other purposes.

J. Navigation:

Wetlands serve as waterways for the movement of people and their goods by water transportation, especially in the wet seasons. In 1990-91, about 43,562,000 metric tons (MT) of goods were transported by the Bangladesh Water Transport Authority. This is about 34 percent of the total amount of goods transported by road, rail, water and air. Every year a large number of passengers use the waterways to reach their destinations. During the wet season waterways are the principal means of transport in vast areas of Bangladesh.

K. Energy source:

(a) Fuel: Wetland materials such as straw, dry leaves, and dry plants are used as fuels in the rural areas.

(b) **Hydroelectric power:** Wetlands with strong currents are often used for producing hydroelectric power. In Bangladesh, the only hydroelectric power plant is located at Kaptai, Rangamati.

(c) **Tidal energy:** Although tidal energy has not yet been used for electric power production purposes in Bangladesh, this energy is being used in navigation and shrimp cultivation. People use tidal energy to get brackish water into their shrimp fields; they trap the water in their fields during high tide. People can start with a heavy boat load from their local ghat (dock) by using tidal energy.

Conclusion: The above-mentioned discussion listed many of the functions and benefits of wetlands found in Bangladesh. In terms of future development, wetlands are a primary resource for Bangladesh. The sustainability of development in Bangladesh will depend upon the proper management of wetlands so that they can continue to provide the maximum development benefits to the country. These benefits will no longer be available to Bangladesh if wetlands continue to be destroyed.

Bio-diversity conservation: Vision for Bangladesh

Md. Omar Ali with Mahiuddin Ahmed

Innumerable life forms inhabit this earth. Their life support systems are very complex. No organism can live alone; everyone depends on others as a member of the plant/animal kingdom and also on non-living matter such as soil, water, air, etc. The greater the variety of these organisms (*flora* and *fauna*), the richer the bio-diversity. Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species and of ecosystems (CBD,1994). We are not certain yet about the number of living species in this earth. However, it is said that about 1.5 million species of organisms are living with us.

Importance of bio-diversity: Conservation of biological diversity is essential for keeping agricultural and forestry systems healthy, for maintaining the diversity of the sources of pharmaceutical products, for generating income from tourism, for promoting an aesthetic ambience, for stabilising different ecosystems, for widening the scope of biological investigations and for protection of the overall environmental quality. All the properties and potentials of each species, identified or unidentified, are yet to be known.

Bio-diversity influences people's economic, social and cultural development and hence their quality of life. The knowledge, cultural traditions, innovations, and management practices of indigenous communities, and the traditional practices of farmers and rural communities concerning bio-diversity, are being threatened in Bangladesh by the destruction and pollution of natural habitats due to our failure to recognise the social, economic, and cultural value of bio-diversity. This threat and the concomitant destruction

are likely to increase as population growth continues. It is believed that the problem may be minimised through effective implementation of community-based bio-diversity conservation programmes.

Present status of bio-diversity in Bangladesh:

Bangladesh is situated at the complex interface of the Himalayan and the Southeast Asian bio-geographic regions, and historically was well-endowed with very diverse complements of terrestrial and aquatic flora and fauna. Today, while habitat destruction and species depletion are prevalent, this diversity still remains within avifauna and ichthyofauna. Rampant reduction of bio-diversity apparently began in recent years. A generation ago, Bangladesh was very rich in species diversity.

Bangladesh possesses rich and diverse genetic resources of flora and fauna because of its climate and fertility of land. It has about 5000 species of flowering plants (Angiosperms) and 1500 species of fauna. But the number was remarkably more a century ago. However, a proper inventory of the flora and fauna of Bangladesh does not exist in the absence of the National Botanical and Zoological Survey organisation. Unfortunately, in Bangladesh the forests, which formerly covered most of the land area, have been drastically reduced. At least 94% of the original natural habitat and vegetation has been lost to human settlements and agriculture, and what remains today is a remnant of the forest types that once existed. The deforestation during the period 1981-1990 was about 37,000 hectares as against 8000 during the period 1971-1980. If the new plantations (irrespective of their crown cover) and other factors are included in the average annual rate of deforestation, species richness of flora and fauna is greatly diminished. Many species are now extinct in the country and many more species are listed as threatened or endangered.

Regarding animal diversity, the only information available is about mammals, reptiles, amphibians and birds. But there is no complete agreement about the total number of their species. Sarker and Sarker (1988) reported 932 species of wildlife in Bangladesh, including 123 species of mammals,

154 reptiles, 23 amphibians and 632 birds.

The 632 known bird species represent about half of the total number recorded in the entire Indian subcontinent and 7 per cent of the known species in the world. The number of mammals is about 20 per cent of those in the entire Indian sub-continent. This considerable array of species is significantly less than that of a century ago. Some 18 species no longer occur in the country and many of the remaining ones are greatly reduced in number and in range. There is no comprehensive and authoritative list of endangered wildlife in Bangladesh although a number of lists from various sources do exist : IUCN (1990), Sarker and Sarker (1998) and Rahman and Akonda (1987).

Sarker and Sarker (1998) list 133 species that are threatened or endangered. The IUCN Red Data Book (Green, 1990) and Rahman and Akonda (1987) list 129 species of wildlife as threatened or endangered, including 37 mammals, 21 reptiles, 2 amphibians and 69 birds. In addition, the Red Data Book includes a further 308 species as rare or doubtful. Thus, about 45% of the species of wildlife in the country are rare, threatened or endangered.

Regarding floral diversity, about 5000 angiospermic plants have been reported to occur in different habitat conditions (Khan, 1990). Three gymnospermic plants have been growing naturally in the humid hill forests. The homestead forests are usually composed of multipurpose fast-growing trees, fruit trees, bamboo groves, rattan bushes, medicinal and some aquatic plants.

Bangladesh has rich plant genetic resources of crops, viz. bananas, amaranths, jute, cotton and tea. There are about 8000 varieties of rice and nearly 3000 varieties of other miscellaneous crops (Mahtab, 1991). It is assumed that many of the species of flora have disappeared from the country or are greatly reduced due to factors such as deforestation, conversion of wetland into agricultural land and over-exploitation.

There are about 27 species of threatened vascular plants

including 9 endemics (MoEF, 1991, Mahtab,1991). Eight trees and woody climbers are on the list. Recently the Bangladesh National Herbarium reported a list of 37 endangered or threatened plant species. No detailed information is available about the flora of coastal wetlands except the mangrove ecosystem, i.e. the Sundarbans mangrove forest. In the Sundarbans forest, the principal commercial species, Sundari (*Heritiera fomes*), is severely infested by top dying due to, some experts believe, increased salinity. Other species of mangrove trees are also under threat. The salinity intrusion may lead to the depletion of wildlife resources and destruction of habitat for wildlife, especially of the famous Royal Bengal tiger. Moreover, increased salinity also affects the growth of mangrove vegetation greatly, including the changes of vegetation composition of the Sundarbans mangrove forest (Ahmed, 1992).

Bangladesh had also about 8000 indigenous rice varieties in the recent past. That natural rice gene bank is now on the verge of vanishing due to the introduction of high yielding varieties. Similar is the case with various other aquatic plants of the country (Ahmed, 1995).

Major factors affecting the status of bio-diversity

High population growth: Population growth in Bangladesh has been identified as one of its most serious problems. The population boom has the greatest impact on biological resources. Bangladesh's present population density is one of the highest in the world. The total population was estimated to be 140 million by the year 2000. Increase in development or productivity is often eaten up by population growth. A low land/man ratio further intensifies the problem.

Extreme poverty: More than half of the population in Bangladesh is living below the poverty level. Poverty is further aggravated by the increasing population and the frequent natural calamities. Poverty acts as a catalyst to many forms of environmental degradation, particularly in the case of depleting forests, fisheries and other biological resources.

With increasing population, landlessness and poverty, environment and sustainable resource management become key issues in development planning.

Natural hazards (Cyclone/Tidal Surge/Flood):

Cyclones are recurrent phenomena in the Bay of Bengal. The average annual frequency of tropical cyclones in the Bay of Bengal is about 12, out of which 5 attain cyclonic strength. Of the killer cyclones which develop during spring and autumn, about 75 per cent occur strictly from mid-April to mid-June and mid-September to mid-December. In many cases the cyclones may be accompanied by a tidal bore/tidal surge, reaching heights of more than 20 feet, causing mega-deaths, and destroying livestock, trees/vegetation, housing and infrastructure of the country.

Deforestation: The forests of Bangladesh are disappearing at a rapid and accelerating pace quantitatively. Whatever woodlands are there also suffer from a reduction in quality. The main causes of deforestation are over-exploitation due to population pressure, encroachments, shifting cultivation, etc. According to a FAO Forest Resource Assessment Report, the rate of deforestation in Bangladesh during the period 1981-1990 was around 3.3% annually, excluding new plantations. It is estimated that only about 61% of the Gazetted State Forests have tree cover.

Large-scale destruction of forest-cover exposes soil to accelerated erosion, reduces the soil's fertility and moisture retention capacity, causes rapid siltation in basins and riverbeds, resulting in drainage congestion and increasing damage from flash floods. But above all, it causes depletion of forest resources and bio-diversity and ultimately degrades the environment.

Water pollution/ water issues: Almost all the rivers and streams in Bangladesh receive untreated wastes from industrial factories, domestic organic wastes (sewage) and industrial chemicals - particularly effluents containing highly toxic agrochemicals - which pollute the aquatic environment, kill a huge number of fish and disrupt the aquatic ecosystem. Very often many of the toxic chemical ingredients are re-

circulated in the human body through the ingestion of contaminated fish and other edible organisms, resulting in abnormalities in the human physiological system.

The major water issues relate to dry season phenomenon such as salinity intrusion in the coastal areas, particularly in the southwest, due to reduced and still falling river flow/fresh water flushing. These reduced flows are mainly due to the construction of embankments and polders and other water development activities, causing more silting up of the river channels, depletion of fish resources, reduction of wetland and bio-diversity.

Salinity intrusion/high salinity: The coastal zone is extensively affected by the intrusion of saltwater into the rice growing areas, which reduces or in some cases makes rice production impossible in the coastal areas. There are at least three reasons for which salinity increases in the rice polders : diversion of river water in the upper riparian countries, overuse of fresh water aquifers and upstream withdrawal of river water for irrigation of rice and other crops. The affected areas include the major urban and industrial centres of Khulna and Chittagong. When the stream flow of the Ganges-Brahmaputra-Meghna and their tributaries diminishes greatly during the dry season, there is substantial inland penetration of salinity through the complex estuarine river system. This salinity intrusion limits opportunity for supplementary irrigation of dry and early monsoon crops in coastal freshwater areas and damages the same crops by flooding during very high tides.

Commercial shrimp cultivation: Large areas of the mangrove forest have been cleared up to meet the increased demand for land that is suitable for shrimp cultivation. This results in the loss of habitats and bio-diversity. The existing system of the collection of shrimp fries from natural sources is also responsible to a great extent for the loss of aquatic bio-diversity.

Major management issues of conservation of bio-

diversity

Commitment and priority: The issues of conservation and protection of biological diversity have had a low priority in Bangladesh so far. This is not surprising in view of the disruptions caused by wars, floods and cyclones in our recent history and the overwhelming demands of a huge population for basic improvements in the provision of food, health-care, shelter and education.

Most species of fauna and flora are disappearing at an alarming rate and the country is approaching a crisis in this regard. Actions to reverse the trend and to conserve the very rich biological heritage of the country are possible. They will not be easy or cheap and can only be achieved with much greater public support than presently exists. A much higher level of understanding and commitment will be required at all levels of government and society. Mass campaigns to increase awareness of conservation issues in general, and the protection of wildlife and natural ecosystems in particular, will be necessary.

Failure of traditional approaches and need for full participation of local people: The traditional approach to prevent people from utilising the resources of the forests has failed. Encroachment and illicit felling of trees, grazing, and uncontrolled firewood collection are widespread nearly everywhere. The forests of the protected areas of the country are essentially no different than any other forests in this regard.

What is needed is an entirely different approach. This approach must recognize the needs of the local people and seek to satisfy those very basic needs. The wildlife and natural areas cannot be effectively protected without the support of the people who live on the perimeter of the area and depend to some degree on the resources of the area for sustenance. Support can only be gained if their needs are met. Identification of core areas for protection, and of buffer areas which can be managed to meet local needs, is an important component of protected area management. Programmes to provide land to people and to assist them to

grow a variety of forest products in the buffer areas will be required in order to protect the core areas. Non-government organisations (NGOs) have a critical role to play in mobilising local support and launching field programmes which help in the protection of core areas by intensive managing of buffer areas. Direct involvement of the local people should be a key component in developing these programmes.

The state of protected areas: Bangladesh has 14 formally protected natural areas, including five National Parks, eight Wildlife Sanctuaries and one Game Reserve. These cover a total of 227802.02 hectares, about 1.58% of the country only. The declaration as World Heritage Site of about 139699 hectares is a remarkable event in this regard. These protected areas are officially, but not functionally, protected. There are no adequate staff, funds, plans or activities that could ensure the effective management of these areas for the protection of wildlife and the forested ecosystems as originally intended.

Lack of protection for important ecosystems: Even if the existing 14 protected areas were properly managed and protected, they are inadequate to protect and preserve the biological diversity of the whole country. A number of critical habitats, particularly freshwater wetlands and coastal char lands (shoals), are not represented. The protected areas of the forests do not represent the diversity of the forests' fauna. An expanded network of well-managed, protected areas is essential.

Endangered species: The situation of our wildlife is very serious. As we have noted earlier, some 18 species of wildlife have disappeared from Bangladesh in this century. At present, 129 species, including 37 mammals, 21 reptiles, 69 birds and 2 amphibians are on the IUCN Red List of endangered species. The situation for a good number of the mammals and reptiles is critical with only a few individuals left. Several have not been seen at all in recent years and may already be extinct. A further 308 species are listed by IUCN as rare or doubtful. Thus, nearly 50% of all the wildlife species in the country are rare or threatened. About 20% of

the birds known to have occurred in the country have not been seen in the last 20 years. Only 60 (about 10%) of the 668 known bird species are secure in their status.

A similar situation exists for the flora although the data is far from sufficient. Some 27 plant species are listed as threatened or endangered and many more could be in the same sorry position.

Lack of awareness and inadequate enforcement of law: Whatever laws we have related to the conservation of bio-diversity are not yielding the desired benefit due to different kinds of institutional and administrative weaknesses and bottlenecks and lack of general awareness to conserve the biological resources.

Legislation: The existing legislation for the conservation of bio-diversity and management of protected areas is inadequate and many laws are not enforceable. Significant changes in the legislation are required to provide a more appropriate framework for conserving and managing protected areas.

Eco-tourism development: Bangladesh does have opportunities for eco-tourism development in the National Parks and Wildlife Sanctuaries. These are not well developed at present. The potential of the Sundarbans is well known but may be over-emphasised. Good potential for more locally based tourism exists at Madhupur, Chunarhat, Himchari and the Hill Tracts and many places of greater Sylhet and Sherpur districts. Development of tourism, local or international, in these areas requires a well-managed network of protected areas.

Government's policies, legislation and major initiatives for bio-diversity conservation:

There are several legislative policies and initiatives that provide provisions for regulating, harvesting and protecting plants and animals in the country. Those are:

Bangladesh Wildlife (Preservation) (Amendment) Act, 1974:

The Bangladesh Wildlife (Preservation) Order, 1973 was promulgated under Presidential Order No. 23 in 1973 and was subsequently enacted and amended as the Bangladesh Wildlife (Preservation) (Amendment) Act, 1974. The law provides for the preservation, conservation and management of wildlife in Bangladesh. According to the Act the term wildlife or 'wild animals' means "any vertebrate creature, other than humans beings and animals of usually domesticated species or fish, and include the eggs of birds and reptiles" only. The law itself is not sufficient to provide legal protection to the significant aquatic bio-diversity component of the ecosystem. For example, by this definition, the important components of the coral species in the St. Martin's Island, and also fishes and molluscs, remain outside the legal protection of this Act.

Bangladesh Forest Act, 1878 and subsequent amendments: The law provides protection of and development of forests. The government may assign a reserve forest to any forestland or wasteland, or any land suitable for afforestation, which is the property of the government, over which the government has property rights, or to the whole or any part of the forest produce of which the government is entitled. Subsequently, the Forest Law has been amended and updated for a number of times in response to changing needs. The Forest Act, 1972, the Forest (Amendment) Act 1990 and the amendment in 2000 may be mentioned in this regard. These are contributing quite a lot to the conservation of bio-diversity, although not enough, and much more remains to be done.

Forest Policy and Forestry Sector Master Plan: The government of Bangladesh first formulated the National Forest Policy in 1979. But as the situation began to change with increased demand for forestry products and consequent depletion of forest resources and degradation of the overall environment, the Government had to update it and formulate a revised policy which is known as the Forest Policy 1994.

The bio-diversity issue has been given increased importance in the latest policy. The policy stated that attempts will be

made to bring about 20% of the country's land under the afforestation programmes of the government and the private sector by 2015. In order to achieve self-reliance in forest products and maintenance of ecological balance, the government will work hand in hand with the NGOs and people's participation will be encouraged.

The policy further stated that the priority protection areas are the habitats that encompass representative samples of flora and fauna in the core areas of National Parks, Wildlife Sanctuaries and Game Reserves. Attempts will also be made to increase the extent of these protected areas by 10% of the reserve forest area by 2015.

To achieve the objectives and targets as stated in the policy, the government has also formulated the Forestry Sector Master Plan (1995 to 2015). The financial requirements to implement the plan have been estimated to be about Tk. 80,000 million.

Protection and conservation of fish -- Fish Act 1950 and Fish Rules 1985: There are many provisions for the protection and conservation of fish in the inland waters of Bangladesh. But it is unspecific and simply provides the means by which the government may introduce rules to regulate engines and fishing gear and prohibit the destruction, and attempt to destroy, fishes by poisoning and by drying or de-watering "fishes" in "fishery" areas defined in the law. "Fish" means: (1) "fish" includes all cartilaginous, bony fishes, prawns, shrimps, amphibians, tortoises, turtles, crustaceans, molluscs, echinoderms and frogs at all stages in their life history; (1a) "fishery" means any water body, natural or artificial, open or closed, flowing or stagnant (such as river, haor, baor, beel, floodplain, canal, etc.) in which activities for growing fish, or for conservation, development, demonstration, breeding, exploitation or disposal of fish or living organisms related to such activities are undertaken, but does not include ponds, tanks or aquariums of fish used as decorative articles. The protection and conservation provisions of Fish Rules 1985 prohibit the catching/hunting of certain fishes for specified times or places and also prohibited use of certain equipment. These Acts and Rules

are undoubtedly measures in favour of bio-diversity conservation. But the results are below the desired level due to certain administrative weaknesses, mainly in the enforcement of the laws and regulations.

Environment Policy, 1992: The Environment Policy adopted in 1992 gives due importance bio-diversity and related issues. The Policy includes, inter alia, the following aspects:

- rivers, canals, ponds, lakes, haors, beels, baors, and all other water bodies and resources should be kept free from pollution;
- wetlands should be conserved for the protection of migratory birds;
- activities which diminish the area of wetlands/natural habitats of fish should be prevented and rehabilitative measures encouraged;
- existing projects on water resources development, flood control and irrigation should be examined to determine their adverse impact on fisheries;
- environmental impact assessment (EIA) should be conducted before undertaking new projects for water resources development and management, and also for the projects of other sectors that are likely to effect the environment.

Bangladesh Environmental Conservation Act 1995 and Environment Conservation Rules 1997: The Bangladesh Environmental Conservation Act of 1995 was promulgated for environmental conservation, improvement of environmental quality, control and mitigation of environmental pollution in the country. Section 5 of the Act provides power to the government for identification and protection of ecologically critical areas, if the government is convinced that ecosystem of any area has been degraded to a critical level or is likely to reach a critical level. The Bangladesh Environment Conservation Rules 1997 is another step taken by the Government to support the conservation of bio-diversity.

The Bangladesh Environment Conservation Act (ECA '95) articulates and expands upon the environmental

management and sustainable development goals of the 1992 Environmental Policy. In particular, it defines the environmental regulatory regime and the DoE's mandate with respect thereto. Among the measures instituted by this law is a provision for the Declaration of Ecologically Critical Areas (ECA).

Declaration of Ecologically Critical Areas (ECA): 1) If the Government is satisfied that due to degradation of the environment the ecosystem of any area has reached, or is bound to reach, a critical state, it may by notification in the official Gazette declare such areas as Ecologically Critical Areas (ECAs).

2) In April, 1999 the above authority was utilised for the first time when the Government of Bangladesh officially declared nearly 40,000 ha, within six separate (coastal and freshwater) wetland areas, as ECAs. This declaration was prepared in the context of the GEF PDF-B project preparation. The said ecological critical areas are the Cox's Bazar-Teknaf sea beach, Sonadia island, St. Martin's Island, Hakaluki Haor, Tanguar Haor and Marjat Baor.

National Conservation Strategy (NCS): The NCS provides specific strategies for sustainable development in 18 sectors of the economy and also a national strategy for conservation of all concerned sectors. The National Conservation Strategy Implementation Project-I is being implemented now by the Ministry of Environment and Forest.

National Environment Management Action Plan (NEMAP): The Ministry of Environment and Forests (MoEF) prepared the NEMAP, which is based on a comprehensive participatory planning process ranging from grassroots up to national levels. Inputs were provided from local communities, government agencies, non-governmental organisations, professional groups, academics, parliamentarians, lawyers and journalists. Together, this cross-section of concerned stakeholders identified key institutional, sectoral, location-specific and long-term issues and actions. The NEMAP thus constitutes a synthesis of

perceptions of the government, NGOs and the people on environmental problems and the actions required to address them. The NEMAP provides the policy framework of, and action plan for, environmental development in combination with a set of broad sectoral guidelines that emphasise, inter alia, the following:

- I Maintenance of the ecological balance and overall progress and development of the country through protection and improvement of the environment
- II. Protection of the country against natural disasters.
- III. Identification and control of all types of activities related to the pollution and degradation of the environment.
- IV. Undertaking environmentally sound development programmes in all sectors.
- V. Sustainable long-term and environmentally congenial utilisation of all natural resources.
- VI. Activities in association with all environment-related national and international initiatives.

Sustainable Environment Management Programme (SEMP): The Ministry of Environment and Forest's 'Sustainable Environment Management Programme' (SEMP), supported by the UNDP for a five-year period (1998-2002), consists of some 26 sub-projects. Each of the component areas includes some direct or indirect activities related to the conservation of biological diversity.

Government activities related to convention on biological diversity: Bangladesh signed the Bio-diversity Convention at Rio in 1992 and ratified it in 1994. Bangladesh has completed the PRIF study on Coastal and Wetland Bio-diversity Management Project under GEF (Global Environmental Facilities) and its follow-up project, titled 'Coastal and Wetland Bio-diversity Management in Cox's Bazar and Hakaluki Haor in Greater Sylhet', has already been approved by the GEF, which is going to provide Bangladesh with US \$ 5.9 million. Bangladesh has already completed some base line studies through the National Conservation Strategy (NCS) implementation project Phase-1. These are surveys of flora and fauna, land cover, and land use survey

preparation of base maps and ecological survey of some important ecosystems of the country. Other major biodiversity conservation-related projects of GOB include: Biodiversity Conservation in the Sundarbans Reserved Forest, Forest Departments; Fourth Fisheries Project, DoE; Bay of Bengal Programme, DoE; Coastal Fisheries Empowerment Project, DoE, etc. The preparation of the National Biodiversity Strategies and Action Plan has already been started by the MoEF under the supervision of CBD (Convention of Biological Diversity).

Other projects

In addition to the above, the Government has taken up the following projects concerning bio-diversity management:

- i. Madhupur National Park development project.
- ii. Establishment of Botanical Garden and Eco-Park at Sitakunda, Chittagong.
- iii. Coastal Greenbelt Project.
- iv. Establishment of Madhutula Eco-Park.
- v. Development of Bhawal National Park, Baldha Garden and Botanical Garden.

Moreover, the Government has planned to undertake the following projects related to bio-diversity conservation. They are:

- i. Final Survey of Bangladesh.
- ii. Establishment of Bay Park from Himchhari to Teknaf.
- iii. Establishment of Eco-Park at Gajoni Abokash Centre.
- iv. Conservation of bio-diversity, establishment of Marine Park and development of eco-tourism in St. Martin's Island.

Recommendations for future activities

- Accelerating the establishment of the national network of nature conservation and reserved, protected areas that include a full range, type and level of bio-diversity and which will have a reasonable distribution and appropriate area coverage.

- Establishment of a network of ecologically critical areas by including more critical areas of the country and ensuring their proper management. The 'ecologically critical area management' (ECAM) will have a significant and positive impact on the long-term viability of the nationally and globally significant bio-diversity resources.
- Conservation of special habitats and eco-systems such as hill forests, Shal forests, wetlands, mangrove ecosystems, coral reef ecosystems, estuarine ecosystems as well as the protection of migratory animals and birds.
- Conservation of habitats other than those within the nature reserve system, including but not limited to selectively felled forests, secondary bushes, farm fields, etc. Emphasis may be placed on conserving the agro-ecosystem and agricultural species by establishing a number of sites for in situ conservation of the wild relatives of crop species and by seeking gradually to establish a number of protected areas or agricultural field types which are of local significance.
- Establishment of a network for off-site (ex situ) conservation of genetic materials from rare and endangered species of flora and fauna. Establishment of regional Botanic Gardens. Strengthening activities in the domestication of rare and endangered species of wildlife, and collection, preservation and breeding of germ-plasm resources of agricultural plants. The possibility for establishing semen banks for varieties of livestock and poultry may also be explored. Parks (including safari parks) and breeding centres for wildlife should also be established.
- Strengthening research work to conserve the bio-diversity of freshwater and marine aquatic life for off-site conservation of endangered species of aquatic life forms.
- Restoration of degraded eco-systems to restore habitats that have been seriously affected by drought, salinity, deforestation, soil erosion, beach compaction, sand dune formation and deposit of coarse sand due to flash floods.

- Developing an information system for monitoring the conservation of bio-diversity. Monitoring to be conducted by using a unified monitoring technical code and by using aerial surveys, lasers, GIS and others. Subsequently, establishment of wildlife monitoring system and developing standards for surveying wildlife may be emphasised. As well as all these, national monitoring and information system for bio-diversity in agricultural systems may be set up and may focus on the monitoring, classification and storage of information about diversity in wildlife, crops, livestock, poultry and aquatic life.
- Establishment of a national information system for the conservation of bio-diversity. A national bio-diversity database may be established which will include a nature reserve database, an ecologically critical area database on rare and endangered plants and species, a database on the economic utilisation of plant and animal species, a database on classification of freshwater and marine life, a database of scientific findings in Bangladesh's bio-diversity and biological resources. The information system will process national bio-diversity information and will allow exchange of information.
- Implementation of eco-system approach, and community-based conservation programme of bio-diversity.
- Measures to mitigate the adverse effects caused by cyclones and floods and anticipated global warming and sea-level rise.
- Formulating sustainable management and utilisation strategy of living and non-living resources.
- Implementation of the regional programme of action for the protection of the marine environment from land-based sources of pollution.
- Development of detailed guidelines for freshwater, coastal and marine bio-diversity conservation.

- Establishment of educational and specialised institutions for conservation.
- Development and activation of international and regional co-operation on the protection of bio-diversity. Bangladesh will continue to expand bilateral and multilateral cooperation and wishes to enhance exchange and cooperation in the field of management, scientific research, technological development, technical transfer and manpower training. This may include joint establishment of trans-boundary nature reserves or the cooperation among countries having nature reserves on either side of a common boundary, so as to enhance the protection of migratory animals.

Bangladesh may continue to cooperate with:

UNEP -- in the management and evaluation of bio-diversity.

UNDP -- in planning projects for the protection of bio-diversity and initiating related bio-diversity activities.

GFF -- in obtaining trust funds for implementation of GEF projects related to bio-diversity, international water, climate change and decreasing the use of ozone-depleting substances.

IUCN -- in the conservation of endangered species, ecosystem diversity and sustainable use of living resources.

WWF -- in wildlife conservation projects.

UNESCO -- in the 'man and biosphere' programmes (MAB) for scientific research and manpower training.

FAO -- in agro-ecosystems, comprehensive utilisation of agricultural resources and biological pest management.

GEMS & INFOTERA -- in the exchange of data and information on the monitoring of bio-diversity and in the future with other concerned international bodies or NGOs.

- Study and development of modern bio-technologies and evaluation of the positive and negative effects of bio-technology on the protection of bio-diversity.
- Establishment of bodies for the conservation of bio-diversity, definition of their functions and responsibility and promotion of effective coordination between different bodies to help ensure implementation of the national programme of bio-diversity conservation:
 - i Legislative bodies
 - ii Administrative and management bodies
 - iii Scientific research bodies/institutions
 - iv Non-governmental organisations

In order to strengthen the administrative and management capability of the MoEF, a Bio-diversity Cell consisting of people from relevant disciplines may be established. A Bio-diversity Unit at the Forest Department for the management of forest areas and another such unit at DoE for other than forest areas may also be established to activate and empower the above cell.

- Promotion of publicity and education on the protection of bio-diversity. The promotional activities may be carried out through the use of various media. They may also be carried out by staging public events such as the Earth Day (22 April), World Environment Day (5 June), tree plantation movement, etc. Exhibitions such as plant exhibitions, environmental exhibitions, agricultural exhibitions, fish fairs, fruit fairs, flower fairs, etc. may also be held. The protection of bio-diversity can also be promoted by adding chapters on the conservation of bio-diversity to textbooks for use in primary and secondary schools, by increasing the course-relevant subjects in universities and by holding training courses for managers and scientific workers on bio-diversity.

Convention on biological diversity: An analytical overview

Dr. Mizan R. Khan

Over the last several years, bio-diversity has emerged as an issue of global concern because of its rapid reduction worldwide. The problem is more acute in the developing countries. The loss is attributed to the prevailing socio-economic factors that encourage exploitative development while discouraging conservative resource use. For example, the amount being spent at the global level to exploit resources and deplete bio-diversity are many orders of magnitude greater than the small amount of funds available for conservation.

However, conservation thinking in recent years has advanced beyond the narrow concern with species or habitat protection towards a more comprehensive integration of conservation and development goals through the promotion of sustainable use of natural eco-systems. The reflection of such changes in perspective was the adoption of the Convention on Biological Diversity (CBD) at the Earth Summit in Rio de Janeiro in 1992. The convention entered into force on 29 December, 1993. It is a binding document on the part of the signatories. It's a framework convention, meaning that the Contracting Parties may decide how they will implement the provisions of the CBD. Since it's a legal document, the purpose of this short piece is to decipher the CBD and to discover the implications of its provisions.

Objectives of the CBD

Article-1 of the Convention sets three main objectives to be fulfilled by the parties:

- The conservation of biological diversity (Articles 6-9, 11 and 14)
- The sustainable use of its components - forests,

wetlands and marine eco-systems (Articles 6, 10 and 14)

- The fair and equitable sharing of the benefits arising from the use of genetic resources
- Access to genetic resources (Article 15), taking into account all rights over those resources
- Transfer of relevant technologies (Articles 16 & 19), taking into account all rights to technologies
- Funding for conservation in the developing world (Articles 20 & 21).

Features of the CBD

The following essential features of the convention should be mentioned:

- a) The conclusion of the CBD indicates a basic conceptual shift—instead of the traditional nature conservation approaches, which emphasised the protection of wildlife in nature reserves, the CBD focusses on meeting people's needs from biological resources, while ensuring their sustainable use. Thus, conservation measures and methods for sustainable use are acknowledged as separate, albeit mutually supportive, concepts.
- b) An explicit link is established between access to genetic resources and transfer of technologies considered essential to conservation and sustainable use of bio-diversity.
- c) The earlier concept of "common heritage of mankind" with regard to biological resources has been abandoned in favour of "common concern of mankind," a broader concept, but with less proprietary connotations. At the insistence of developing countries, the concept of "common concern" was adopted as the expression of a global interest and a shared responsibility in the conservation and sustainable use of bio-diversity.
- d) The considerable cost for developing countries of

maintaining biological diversity has been taken into account and provision has been made for "new and additional" financial resources to enable them to meet such costs (Articles 20 & 21).

- e) Another innovative element that deserves to be noted is the recognition of the contribution of indigenous peoples and rural masses to the conservation of biological diversity and the sustainable use of its components. Though Article 15 of the CBD has given the State the power of determining the access to genetic resources, the provision of Article 8 (j) is still considered a significant step forward. Though the action it contemplates is subject to national legislation, it is the first time that governments have been called upon in a binding international instrument to "respect, preserve and maintain" the knowledge of indigenous communities relevant to biological diversity and to encourage the equitable sharing of the benefits arising from the utilisation of such knowledge.

Principles of the CBD

Article 3 can be viewed as the sole operative principle of the Convention. It reads:

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that all activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

Thus the CBD strikes a balance between the exercise of sovereign rights over natural resources and the responsibility to refrain from activities that cause trans-boundary effects or effects upon areas beyond national jurisdiction. The Preamble also refers to other principles and concepts of international environmental law that have equally inspired the Convention. Important amongst them is the precautionary principle that is of particular relevance to the

conservation of bio-diversity, in view of the general lack of information and knowledge regarding biological diversity as well as the scientific uncertainty surrounding the basic issues such as the importance of species diversity for the stability of eco-systems. Equally important is the reference to inter-generational equity that is presented as the rationale for conservation and sustainable use of bio-diversity.

Tools of Conservation

The Convention requires governments to adopt specific measures for the conservation and sustainable use of biological resources. To this end, it attaches the utmost priority to in situ (in-site) conservation (Article 8), but also recognises the complementary nature of ex situ (off-site) measures (Article 9). For the purpose of in situ conservation, governments are required to establish a system of protected areas, or areas where special measures need to be taken to conserve biological diversity. The first type of area (i.e. protected area) is defined in the Convention (Article 2), but the exact meaning and scope of the latter category is not given anywhere. In view of the increasingly limited land available for nature reserves, wilderness areas and national parks, the Convention provides the alternative option of areas with special measures to conserve bio-diversity. This would presumably allow for a broader use of sustainable resources extraction. It would also help avoid conflicts with local communities who have traditionally depended for their livelihood on the land.

The measures used for ex-situ conservation, include botanical and zoological gardens, arboreta, aquaria, seed banks, tissue and cell culture and culture collections. The most wellknown ex situ conservation facilities for plant genetic resources are seed banks. Historically, the most ex situ conservation has been undertaken in the developed countries. Lack of financial resources and technology did not allow the developing countries to do much in ex situ conservation. As a result, Article 9 stipulates that ex situ conservation should only serve as a complement to in situ conservation. Even then, the measures adopted for the ex situ conservation and the facilities established or maintained

for that purpose should preferably be in the country of origin of genetic resources.

Institutional arrangements

After long negotiations, a consensus has been reached that the Global Environmental Facility (GEF) will function as the financial mechanism for conservation of bio-diversity. In addition, the Convention provides for the establishment of three other institutional arrangements to facilitate the implementation of its provisions:

1. Conference of the Parties (COP) [Article 23]
2. The Secretariat (Article 24)
3. Subsidiary body on scientific, technical and technological advice (Article 25)

To make its implementation more effective, a number of gaps will have to be filled and loose ends tied up. The Convention itself provides a mechanism for doing so in the form of adoption of additional protocols. Such protocols will be required in a number of areas:

- Modalities for sharing of knowledge and transfer of technologies
- Research, training and public education
- Monitoring and early warning of bio-diversity erosion in hot spots of the earth
- Promotion and protection of indigenous knowledge and practices
- Risks associated with living modified organisms and genetically modified organisms

Cartagena Protocol on Bio-safety

Ecological concerns about releases of living modified organisms (LMOs) into the environment include adverse impact of LMOs on non-target eco-systems and species, and transfer of genes to wild plants resulting in herbicidal traits or antibiotic resistance. Article 19(3) of the CBD addresses this concern, and calls for the parties to consider the need for, and modalities of, a Protocol setting out procedures in the field of safe transfer, handling and use of LMOs.

Attempts were made to finalise a Protocol on Bio-safety during the third week of February, 1999, which was to have been adopted by an Extraordinary Meeting of the CoP in Cartagena, Colombia. The main objective of the Protocol (Article 1) is to contribute to an adequate level of environmental protection from modern bio-technology that may have adverse effects on the conservation and sustainable use of biological diversity. One area of contention was the relationship between the proposed Protocol's provisions and the WTO rules. For example, disagreement exists even within the industrial countries as to what extent the introduction of genetically modified crops should be allowed for food production. As was evident, the negotiations were very intense among the following groups of countries:

- Miami Group (USA, Canada, Australia, Uruguay & Chile) - this group insisted that the Protocol exclude commodities from the agreement (i.e. 90% of GMOs).
- Like-Minded Group (the South): protocol to cover all GMOs.
- Compromise Group (EU, Switzerland, Norway, Japan, New Zealand & some others) that worked for bridging the differences between the two other groups. Despite all the differences, the common concerns in the negotiations were:
 - Uncertainties of technology and science should not be an excuse to postpone action (precautionary principle).
 - Conflict with WTO provisions. Less than a year after the CBD came into force, the WTO was established in place of GATT with a quite different agenda. The latter was devised to ensure free and unhindered trade among nations. The Trade Related Intellectual
 - Properties (TRIPs) is a part of WTO provisions. The main points of TRIPs are:
 - Entails obligations of IPRs for all fields of technology.
 - Sets up the first global system of IPR on bio-diversity,

specifically plant varieties.

- Requires the application of either patents or an 'effective' sui generis (unique) system to 'protect' plant varieties at the national level.
- Must be implemented in the South by 2,000.
- Must be implemented in the Least Developed Countries by 2005.
- Will be reviewed in 1999 (Art. 27.3b) and 2000 (the entire Agreement).

Main Conflicts between the CBD and TRIPs

CBD	TRIPs	Conflict
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Source: Farhad Mazhar's "CBD and TRIPs: A Review of Conflicts and Contradictions," a paper presented at the Workshop on Environmental Law and Sustainable Development in Bangladesh, organised by the Department of Environment, Govt. of Bangladesh, and sponsored by SACEP/UNEP-EAP, 22-23 September, 1999.

Chapter 8



The impact of shrimp culture on people and environment

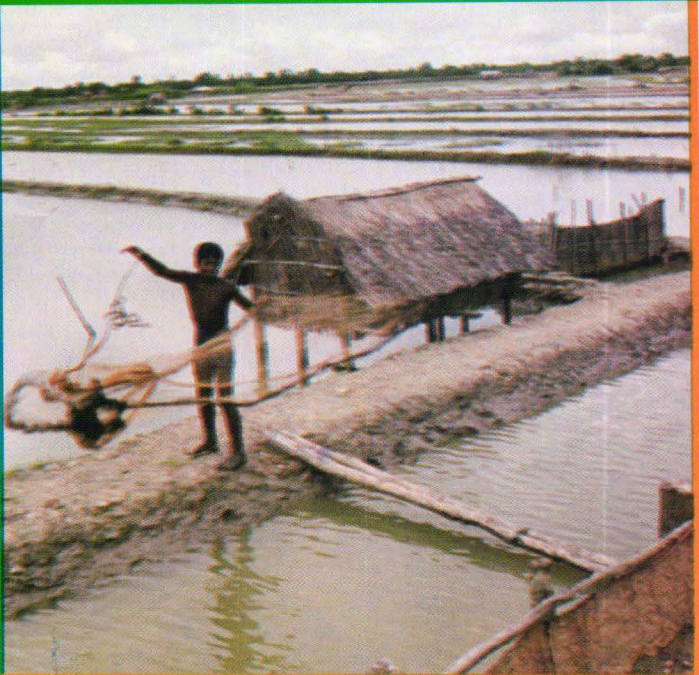


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The impact of shrimp culture on people and environment

Quamrul Islam Chowdhury

Shrimp culture in Bangladesh has emerged as an important economic activity contributing significantly to the country's export earnings. But its rapid and unplanned expansion created a lot of social and environmental tension at the local level including the question of its sustainability, benefit-cost distribution, and equity. It has also created employment opportunities. However, environmentalists and experts are still concerned about the possible ecological damage it may afflict on the country's coastal belt where shrimp farming has been developed over the last three decades.

Shrimp cultivation is suitable where brackish water is available. Initially, businessmen from outside seeking profit introduced shrimp farming in the coastal areas, particularly in Khulna and Cox's Bazaar areas; and there was little participation by the local people in this trade. Neither there was any national policy or strategy for the industry. Many of the owners of these farms used to take land on lease either from the government at a very nominal price or from the local people. And having little or no knowledge of shrimp cultivation, villagers initially provided labour to those farm owners. With the passage of time, shrimp cultivation has now become deeply rooted in some coastal areas of the country, generating employment for men and women of those localities.

The shrimp sector has been contributing significantly to the national GDP by earning over US\$ 300 million a year in foreign currency. However, this macro-level performance of the sector is not a reflection of well-being of the people at grassroot level. At micro-level many issues have been raised by the concerned people and agencies such as access to water, control of land, environmental degradation, health

hazards, fertility of soil, etc. All these issues are closely related to the present and future livelihood of the people of the locality.

A report by UN/ESCAP on the role of shrimp culture in socio-economic development and its effects on environment and ecology found that unplanned and uncontrolled growth of shrimp enclosures have led to the destruction of mangrove forest areas and reduction in livestock. Besides, shrimp culture produces adverse effects on the subsistence economy because the level of employment is reduced. Experts have pointed out that unplanned shrimp farming has largely been responsible for the socio-economic and environmental problems in the coastal areas.

Mofizur Rahman, a "Gher" owner: "Somebody is causing harm to environment while cultivating shrimp. I have shrimp enclosures (Gher) -- one on my own land and three others on leased property at Ashashuni Upazila.

"When I began shrimp cultivation some eight years ago on my land, there was no tree on that plot because it is a naturally saline-prone area. I had planted several types of saplings including mango trees. I have got good yields of guava. But you must keep it in mind that the characteristics of soil here - it is very salty. You will get good yield if you plant trees or cultivate crops which are suitable in this type of soil.

"However, cultivation of Bagda shrimp causes some impact on the soil since it needs preservation of saline water for a long period of the year. You will not expect a good yield of paddy on a piece of land which was used for shrimp farming for some years. This is a loss. But compared to the amount of profit, the extent of such loss is minimum.

"Shrimp cultivation alone should not be blamed for change or degradation of the soil. Several decades ago when there was no embankment in the Sundarbans belt, the influx of saline water during tides did not allow us to cultivate rice. Rice cultivation actually began in this region after the construction of embankments (Beribandh). Now we have come back to the old situation with only one difference that currently the saline water compartments are developed for

shrimp and the land is not allowed for being flashed by tides.

"Even in non-saline areas once we used to hear the croaking of frogs. But with the expansion of infrastructures and increase of population, none can see frogs in expanding towns. But how can one stop the population increase and expansion of infrastructures.

Rangalal Mondol, seed trader: Rangalal Mondol (65) is a street side seed trader who vends vegetable seeds at a local market on the Satkhira-Shymanagar road.

He said that the shrimp cultivation did not affect his business as his commodity still has a demand among the local people. "Rather people are now more interested to buy vegetable seeds for kitchen gardening since the shrimp farming has replaced rice cultivation in most areas of the neighbourhood. They are getting the yield too."

But the people in his village, which is inhabited by a minority Hindu population, have so far refrained from shrimp cultivation ignoring all the lures and offers when it was introduced in the area some eight years ago.

"Our deceased village chief had told us : Look men, shrimps cannot meet the requirement of your stomach when you are hungry. You need rice to eat," Mondol recalled. Since then the people of his village forgot the idea of cultivating shrimps.

Abus Shukur: van driver / farmer
Munshiganj Bazar, Shymnagar

Abdus Shukur (35) owns a piece of land he had inherited from his father. The land provides his family with their meals for nearly eight months of the year. The rest of the time he earns the bread for his family driving his rickshaw van.

He realises that the shrimp has caused a significant loss not only to the traditional agriculture, but also to the environment. "You will not find any fruit bearing trees around. During the (Bengali month of) Chaitra, the concentration of salinity on the soil becomes severe causing

deforestation over the years."

But he thinks that the people of his locality have accepted the shrimp cultivation as their livelihood because of its economic benefits. The shrimp-related violances that once claimed many lives due to outsiders' control of the industry are also slowly dying down. Shukur himself is now interested to start cultivation of shrimp. But he was yet to do it because his land was not in a "proper location".

Abdus Salam: shrimp fry collector
Nildumur, Sundarbans

Abdus Salam, 25, is originally a "bawali", the profession he had taken from his forefathers who used to live on felling trees from the Sundarbans, of course complying with the forests rules.

But shrimp cultivation changed his profession making him a shrimp fry collector. "This gives me more profit with no risk of life since we don't need to enter into the deep forests anymore," he explained. But still we remain dependent on the Sundarbans where "you get more fries inside the forest compared to the quantity you get from river banks."

Abdus Salam and his fellow colleagues now collect some 2000-3000 shrimp fries everyday from the Sundarbans where they spend more than ten days of a month. They sell each fry to the traders at a cost of Tk two to three, which give them a huge margin after paying for the nets or boats.

The researchers have not produced any conclusive evidence that shrimp culture alone has damaged coastal environment. Examining the socio-economic impact of shrimp farming, Mazid and his colleagues (1993) notes that shrimp farmers who lease out land are mainly medium to small farmers and most of them are owners-cum-sharecroppers. The conflicting relationship between large shrimp farmers and small farmers led to long-term socio-economic problems, such as discriminatory income distribution, increase of landlessness, migration to urban areas, violence etc.

A study by the Institute for Development Policy Analysis

and Advocacy has found that marginal households are less benefited than the non-marginal households. Most importantly, shrimp culture has raised the land value, forcing the households to opt for fishing for their livelihood. The Institute of Fish Research in 1994 reported that shrimp culture destroyed fertility of land, food for cattle, and mangrove forestry, which in turn changed the livelihood patterns of the local population.

Rahman (1990) had identified a number of shrimp-related environmental and social problems in Khulna and Cox's Bazar areas. The study's most important finding was the sudden change in the cropping pattern in the coastal area with the advent of shrimp farming. Other negative impacts of shrimp culture includes fall of poultry and livestock population, decline of productivity of land, destruction of trees, decline of meat and milk supply and shrinking of grazing fields in both Khulna and Cox's Bazar areas. The study concluded that shrimp farming had in general brought gains individually and socially. In an earlier study, Rahman and his colleagues (1987) had pointed out that shrimp culture created various jobs for the poor people during harvesting season.

They also pointed out that shrimp cultivation had reduced the number of livestock and poultry in the shrimp producing area because of converting grazing land into shrimp enclosures. The study also observed that standard of living had deteriorated for the vast majority of the middle and small farmers, landless, and day labourers. The commercial shrimp cultivation thus left a longstanding impact, changing the livelihood patterns of the vast majority of the coastal people. In a later study, Rahman (1994) contended that shrimp cultivation had not only destroyed the sustainable livelihood but also intensified social contradictions, which had broken the traditional safety nets. They also noted that the primary beneficiaries of shrimp culture have been the outside-leaseholders -- not the local poor.

Ahmed (1997) gave a dismal picture of environmental and social impacts of the shrimp industry that includes violation

of human rights, crime and violence in the coastal villages, rape and sexual assaults of the woman. He further showed that due to salinity over a decade, livelihoods of the coastal villages have been devastated. The study said that shrimp cultivation has brought an end to share-cropping and thus has restricted a supplementary source of income for the land-less. Evaluating the socio-economic impact of shrimp farming, Mazid (1993) pointed out that primarily medium to small farmers lease out their lands who were mostly owner-cum sharecroppers. The conflicting relationship between large shrimp farmers and small farmers might cause long-term socio-economic problems such as unequal income distribution, increasing the proportion of landlessness, migration to urban areas, violence etc. In other words, the most affected people are the small landholders.

Ahmed (1996) reported that unregulated shrimp cultivation left negative impacts on people's livelihood because extensive shrimp farming resulted in destruction of biodiversity and disruption of local economy through loss of employment in fresh water fisheries, and decline in livestock and poultry farming. Ahmed suggested the formation of an institutional framework to protect the human rights and people's livelihood.

In general, fishing incomes have regular seasonal variation. A report by UNIBIG (1987) revealed the seasonal variation of employment and income of the fry collectors in shrimp farming areas. This study provided early evidence of the problems faced by many people engaged in the shrimp sector in sustaining a livelihood. In a similar study, Ahmed and Rahman (1996) described the impact of shrimp farming on the livelihood of people. The authors reported that shrimp culture affected the poultry and livestock as well as local fisheries resources. Shrimp cultivation increased unemployment for those involved in agriculture, fishing, home gardening, poultry and livestock rearing. As a result, rural poverty had increased. In the face of severe unemployment many people had started migrating to different localities to earn their livelihood. It also has affected the social system that has contributed negatively to sustainable occupational patterns in the coastal areas.

Most recently, Begum and Alam (2000) noted that the local shrimp farmers have started replacing outside investors resulting in reduction of poverty to a great extent. But still, the social tension among different interest groups has increased. The authors argued that shrimp culture has produced some economic benefits in the communities that include increased savings, better infrastructures, greater local solidarity, and improved social and natural environments. The study also reported some negative effects, such as increased dowry demands and violence against women. Most importantly, shrimp culture has led to social conflicts evolving around sluice gate and water management, payment of lease money, etc. The study concluded that proper planning of shrimp farming could result in positive social and environmental benefits for the smaller shrimp farmers, marginal farmers and the landless. Begum and her associates also conducted a study in polder 23 under Paikgacha Upazila and polder 33 under Dacope Upazila in which they reported that the livelihood of people in those areas were mostly dependent on agriculture, fishing, crab and shrimp fry collection, etc. Shrimp culture has created opportunities for employment of the rural poor and marginal people that substantially changed the livelihood patterns of people of the area.

Ahmed (1997) contended that commercial shrimp farming had resulted in unsustainable livelihood. He found that salinity threatened people's livelihood by reducing water and soil quality and food supply. Thus, intensive shrimp production should be discouraged. Huq (1983) examined the effects of shrimp cultivation on the livelihood of the coastal region. Shrimp cultivation involves activities, such as beheading of shrimp, ice breaking in the ice factories and shrimp fry catching. These new activities have generated new jobs for the local people. Initially, shrimp cultivation needs additional labour for embankment construction. However, in the subsequent years labour demand decreases as embankment construction is not required every year. Huq further argued that compared to paddy cultivation, employment opportunities in shrimp culture is unstable, which affects the livelihood patterns of the poor and

marginal population. Increased shrimp cultivation is affecting the supply of grass for cattle and duck rearing, he pointed out.

The authors (Ahmed, 1997 and Huq, 1983) predicted that shrimp cultivation would undermine sharecropping as a supplementary source of income of the landless and in the long run result in the creation of a surplus labour. Thus, in the absence of job opportunities in their own locality, migration would take place (labor displacement). In other words, job opportunities and the long-term security that the local agrarian economy provided earlier would be seriously affected due to large-scale cultivation of shrimp. With the spread of shrimp farming, fishermen have lost access to common property resources, such as ditches and canals. Net income has significantly increased through shrimp cultivation but it is unequally distributed. A survey by Agriculture Research Institute revealed substantial reduction in cattle production.

In sum, review of shrimp related studies suggested that shrimp culture significantly changed the livelihood patterns in the coastal belt. A large number of households are pursuing shrimp related activities as a means of their livelihood. Many of them are pursuing this under compulsion as saline water is penetrating in and around their cropland. Almost all studies have shown immediate benefits of shrimp farming. And a number of studies have shown its negative impacts, such as exploitation of the poor, creation of landlessness, environmental degradation, violation against women and children, unequal distribution of gains, reduction of access of rural poor to natural resources, and creation of class conflicts. The introduction of shrimp reduced the cultivation of paddy as more agricultural land have gradually been converted into shrimp Ghers. There has also been reduction in tree coverage, bushes and grazing land which constituted an important feature of the pre-shrimp land use pattern in the coastal areas.

Critical time for -- the 'white gold'

Quamrul Islam Chowdhury with Khairul Anwar and Shahidul Islam Chowdhury

Shrimp, the 'white gold' of Bangladesh, is now passing through a critical period. In recent times, there has been a severe fall in the production of shrimp, one of the principal foreign exchange earning commodities. Thus, there has been a concurrent fall in the export of shrimp and the commodity is now in danger of losing its international market.

At present, shrimp is being cultured on 150 thousand hectares of land. Bangladesh can produce 4.1 per cent of world output of commercial shrimp. During the last one decade, the area under shrimp culture has spread along the country's 750 kilometers of coastline. Some 95 per cent of shrimps are produced in the Chittagong, Cox's Bazar, Khulna, Satkhira and Bagerhat areas. Some 30 per cent of the total output is gathered from the coastal belt. Harvest by trawling the sea and from fresh water culture constitute 23 and 47 per cent respectively.

Shrimp occupies fourth place in the country's export trade. Some 32 per cent of Bangladeshi shrimps are exported to the United States, 18 per cent to Japan and 11 per cent to the United Kingdom. Besides, shrimps are also exported to Belgium, Germany, Italy, Holland, France, Denmark, Malaysia and Singapore.

A sum of Tk.1,512 crore was earned by exporting 28,500 metric tons of shrimp in the 1999-2000 fiscal year. Bangladesh had exported shrimps worth US\$ 2.9 million in 1972-73. At that time, shrimp formed less than 1 per cent of the country's total exports. In 1983-84, exports rose to Tk. 155 crore. In 1990-91 a sum of Tk. 1,062 crore was earned by exporting 20,127 tons of shrimps.

Multifarious problems of cultivation and export of shrimps:

Only 44 farms export shrimps though there are several thousand shrimp enclosures in the country. Of those, only 30 farms follow HACCP (Hazard Analysis Critical Control Point) method which is the internationally recognised shrimp processing method. However, some farms produce shrimps on sub-contract from the exporters.

Disorganised sector: This sector is nearly 30 years old. On securing foreign market after independence, the sector flourished rapidly. Though it is one of the country's top sectors of foreign trade, it still remains disorganised. Shrimp production process is divided into several stages. Shrimp farmers are the main producers directly involved in shrimp culture in the field. The middleman collects shrimps from the farms or enclosures and reaches those to the money lenders or suppliers. Under the terms of the contract, the middlemen are bound to supply the shrimps to them. These money lenders are listed with the export houses as shrimp suppliers. Another name for them is "account holder" (AC). It may be mentioned that producers, if they want, cannot supply shrimps directly. The shrimps are deposited in the name of the "Account Holder" (AC). Therefore, it does not matter who supplies shrimps to the export houses-- whether they are the producers, the middlemen or the small traders. The representatives of the exporters, after determining the gradation (size) and weight of the shrimps, issue a slip to the suppliers. The price is paid to the "Account Holder". In fact these "Account Holders" control the shrimp trade and determine the prices.

The production stage is the most important of all the stages of shrimp industry. Ironically, at the primary stage of large scale shrimp farming, it is not the farmers but the outsiders who dominate the scene. First they involve some 'people having land holding' and then take possession of other people's land in the adjoining fields to set up the enclosures. Those lands are then surrounded with dykes and flooded with salt water. They also occupy other people's land by inundating those with salt water--thus placing them in an awkward situation. This is how most of the "shrimp enclosures" were created by influential outsiders. Such actions had often resulted in violent clashes and even murders. Of late, such murders have been checked to a great extent.

So far, about 100 shrimp processing plants or factories have come up. These plants have been granted the status of an industry and are being liberally provided with bank loans. But it is alleged that the real shrimp farmers are being deprived of such loans. Banks, however, do not admit such allegation. Bankers say that the 'collateral' system is the biggest hindrance in providing bank loans to the shrimp farmers. According to rules, the borrowers should deposit the land deeds with the banks for taking the loans. Hence, many cannot avail the bank loans simply because in most cases the shrimp farmers are not the actual owners of the land. They are the outsiders who take lease of the land for a fixed period.

Problem of shrimp fry: Availability of fry has been a great problem for shrimp culture. The season for releasing fry into the shrimp enclosures is from February to May. But every year full-scale release of fry into the enclosures is hampered as the owners of hatcheries producing them allegedly create an artificial crisis to earn large profits. Instead of increasing their production they go for cutting down their supply to raise the prices of the fry. This is an unscrupulous means to earn more profit without facing much risk. There are complaints that some hatchery owners were even importing inferior quality fry from India and Myanmar and passing those as the fry from their own hatcheries.

According to sources, a handful of owners representing some 36 hatcheries in the Cox's Bazar area have decided to control the production of fry to have the monopoly in profits. Although those hatcheries have the capacity to produce more fry, they would produce only according to a quota fixed by themselves. Those hatcheries, it was learnt, decided to produce a total of 222 crore 45 lakh fry. But the land under shrimp culture in the country requires more than 600 crore fry in one season. There are 43 hatcheries in the country of which 40 are located in Cox's Bazar, 2 in Khulna and one in Chittagong. Ironically, while most of the shrimp enclosures are located in the southwestern Khulna-Satkhira areas, the hatcheries have been built in the southeastern Cox's Bazar region. This creates a lot of problems for the shrimp farmers.

According to the owners of the enclosures, the demand for fry obtained from natural sources is greater because of their lower mortality rate. The price of such fry is also higher. The cost of naturally-obtained fry, which are becoming short in supply, is about Tk. 2,500 per thousand. The mortality rate of hatchery fry is about 40 per cent. The cost of per thousand of these fry is Tk. 1,500. But the fry from the hatcheries, as has already been pointed out, are also short in supply due to the policy of the hatchery-owners to cut down production.

Shrimp farmers have already informed their association of the problems of short supply of fry caused by the decision of the organised hatchery owners based in Cox's Bazar. The hatchery owners have increased the price of fry abnormally by creating this artificial shortage. Some rich middlemen in collusion with the hatchery owners are reportedly buying the fry and selling those to the enclosure owners at exorbitant prices. This will allow only the owners of big enclosures to survive while owners of thousands of medium and small enclosures will suffer. And there remains the danger that the situation will give way for the import of inferior quality foreign shrimp fry, exposing the country's shrimp enclosures to the risks of virus attack. Observers believe that such foolhardy decision to control the fry production could bring a disaster for the country's potential shrimp industry.

Salahuddin Ahmed, President of Bangladesh Frozen Food Exporters Association, has said that the market price of shrimp fry is much higher than the real production cost. He said that the fry were being sold at a rate of between Tk. 700 and Tk. 1500 per thousand. If the farmers could buy fry directly from the hatcheries, their price would be much lower, Ahmed said the production and exports of shrimp would decline unless the problem of artificial shortage of fry is immediately addressed.

Unscientific production method has been one of the reasons for the risk that Bangladesh faces in the international shrimp market. Although production has increased, this factor has resulted in decreasing exports. Last fiscal year, some 45,000 tons of shrimps were produced; of which only

28,500 tons were exported -- most of which went to European Union countries and the United States. But the authorities in those countries were reportedly dissatisfied with the standard of the shrimp processing plants in Bangladesh. European Union and the United States emphasize the need for following HACCP (Hazard Analysis Critical Control Point) method in the production and processing of shrimps. But very few plants follow this method. To follow the HACCP method, there should be good communication facilities. Besides, depots should be constructed at places where there is good supply of water and drainage facilities, and the floor of the depots are cemented and smooth and built at least 30 centimeter above the ground level so that rain water cannot get inside. HACCP method prohibits the beheading of shrimps outside the plants. Unfortunately, most of the plants in Bangladesh do not want to abide by such rules and regulations.

To improve the situation and ensure the standard of the production, some 20 service centres were set up under government initiative on an urgent basis. Of these, 12 were set up in the Khulna region and eight in the Cox's Bazar area. Only two entrepreneurs have on their own initiative made two of such centres operational while the remaining 18 centers are yet to be made suitable according to HACCP specifications. As a result, dirty and unhygienic depots are still in existence.

Vanishing forests: One of the many side effects of shrimp culture is that it is detrimental to forests. In 1972, the Chakoria Sundrbans in Cox's Bazar occupied an area of 19,000 hectares. By 1981, this forest area squeezed down to a mere 9,000 hectares and, in 1985, it was further reduced to only 4,000 hectares. And again, half of this forest was destroyed by 1991. Chakoria Sunderbans is an example of how unplanned shrimp culture can be the cause of destruction of a flourishing forest.

Dr. Ainun Nishat , country director of the International Union for Conservation of Nature (IUCN), said that the dykes of the shrimp enclosures hinder free flow of flood water and cause acute salinity which is damaging the forests.

He pointed out that although shrimps contribute greatly to the national economy, in Bangladesh their production is being done in an unplanned way -- mostly under the semi-intensive method. The industry is now beset with many kinds of problems. There is an element of force and violence involved in the process of shrimp culture, he explained. If a farmer once gives his land for shrimp culture he does not easily get back the possession of his land. This leads to law and order and various social problems in the area.

Moreover, shrimp culture has a detrimental impact on nature and environment. In the shrimp enclosures, land remains under salt water throughout the year. Although, on those land shrimps can be produced, paddy cannot grow. Besides, simultaneous culture of shrimps and cultivation of rice is not possible on the same piece of land. On the other hand, shrimp fry are being collected in an unscientific way. Fry of other fishes are also being caught with the shrimp fry. Fry collectors should be trained so that they release back into water fries of other fishes while sorting out the shrimp fry. And the farm labourers should not throw the heads and shells of shrimps into the rivers and water bodies. Instead of setting up shrimp enclosures here and there in an unplanned way, those should be localised in a particular area.

Dr. Atiur Rahman, a senior research fellow of the Bangladesh Institute of Development Studies (BIDS), said the sudden flood in 2000 in the southwestern region of the country had caused immense loss to the shrimp farming. The floods had created large-scale water logging of the shrimp enclosures. He said shrimp culture leaves adverse effects on nature and environment. On the other hand, it is very difficult to innovate an environment-friendly method of shrimp culture.

Experts say that necessary steps should be taken on an emergency basis to solve the multifarious problems being faced by the country's shrimp industry. There should be a policy for the shrimp industry. And such a policy should also take into account the environmental aspects. Shrimp culture reduces the fertility of the land and that is why there should be a cost/benefit analysis of the industry.



Foul air

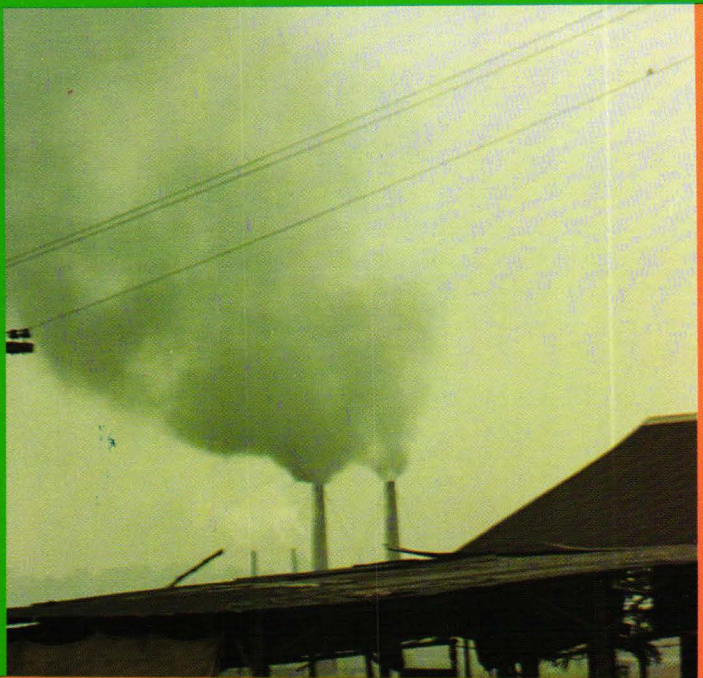
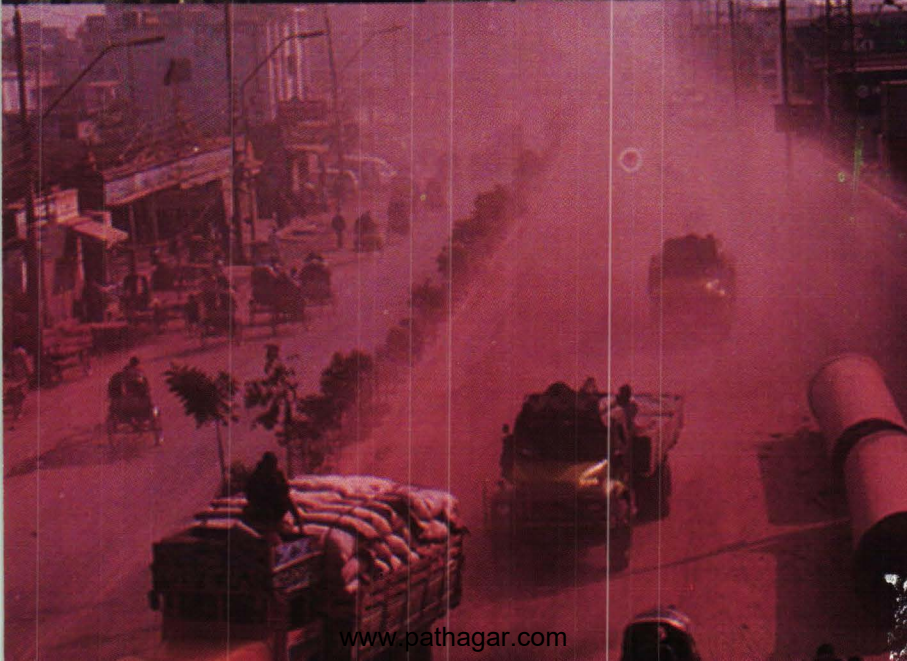


Photo: Shahadat Hossain, FEJB



Foul air

Quamrul Islam Chowdhury
with Gaziur Rahman, Mostafa Kamal Majumder
and Bakhtiar Rana

The long queue of the victims of the pall of yellow-orange smog that blankets Dhaka city, the capital of Bangladesh, gets longer everyday, and the number of patients suffering from respiratory diseases continues to rise unabatedly. Smoke and dust are ubiquitous throughout the city. Trees and ponds and empty spaces continue to disappear at an alarming rate. The once green, tree-filled town is now a horrific jungle of concrete and bricks, with the dirtiest air and water in the whole world. It is becoming more and more unliveable, and is heading for disaster unless drastic steps are taken to protect its environment.

Dhaka, which is both the nation's administrative capital and business hub, has a total estimated population of more than nine million, which is an unbearable burden for the city's limited facilities. The population is expected to swell to 16 million by the year 2015, making Dhaka the seventh most populous city in the world. This over-crowded city is already considered to be one of the world's most polluted urban centres, so what will happen when the population reaches the above figure boggles the imagination.

Nowadays, on any working day, a filthy grey haze, composed of vehicular emissions and dangerous chemicals from the smoke of factories, blankets the city. The smog causes the eyes to water, and coats the lungs with layers of microscopic, noxious soot, which is composed of dangerous particulate matter.

Emissions from all types of motor vehicles like cars, jeeps, buses, trucks, mini-buses, micro-buses, two-stroke engine-powered vehicles (auto-rickshaws, tempos, mini-trucks) and motor cycles have been unabatedly polluting the city's air. Aircraft, railway engines, industrial plants, power plants, brickfields, open incineration, solid waste disposal sites and

dust particles are also contributing to the air pollution. Dust pollution due to road diggings, construction and other development activities further aggravates the city's air pollution problem.

The principal pollutants from gasoline-powered internal combustion engines are carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide, particulates of lead compound and unburned carbon particles (soot). Emissions from diesel engines are smoke, carbon monoxide, unburned carbon, nitrogen oxides and sulphur dioxide.

Paul Martin of The World Bank said that in Bangladesh rural air pollution is much higher than urban air pollution and for that reason respiratory infection is the number one disease in Bangladesh. He emphasised the need to phase out three-wheelers with two-stroke engines and to switch over to the right kind of fuel to minimise air pollution.

Dr. Atiq A Rahman of the CEN said that rural kitchen-based air pollution is ignored like all other things in the rural area. This situation should be resolved by using improved cooking stoves.

The Department of Environment (DoE) has procured sophisticated equipment to detect air polluters in the city, particularly the automobiles that belch out black smoke. DoE has also set up modern laboratories to determine the nature and quantum of air pollution. But the fact is that the pollution level of air in Dhaka city has reached such a peak that no equipment is necessary to detect it. Anybody whose sense organs are working normally will, after a few breaths, realise how polluted the air is.

According to an assessment made by the DoE, 80 per cent of the 200,000-plus automobiles that ply on Dhaka's streets are faulty and emit black smoke in excess of the prescribed limit. Black smoke is primarily unburned carbon that is agglomerated into small particles caused by over-loading and faulty condition of the vehicles' engines.

With growing urbanisation and affluence, the number of vehicles is also rising rapidly, causing more and more air pollution. Narrow roads, traffic congestion, poor quality of

fuel and improper traffic management are further aggravating the air pollution problem.

The DoE and other concerned agencies and organisations have identified the two-stroke engines used in auto-rickshaws, tempos, mini-trucks and motor cycles, and leaded petrol, as the main culprits responsible for polluting Dhaka's air. Besides, many dilapidated vehicles, including 40-year-old trucks, are still plying in the city streets, emitting toxic gases at a dangerous rate.

Among the polluting vehicles, the 2-stroke engine-powered auto-rickshaws (also called baby taxis) have been identified as the worst polluters. At present, there are about 35,000 baby taxis in Dhaka city, according to a Bangladesh Road Transport Authority (BRTA) source. (If unregistered vehicles were counted the number would have been much higher). The official revealed that the two-stroke engine of a baby taxi emits 13 times more smoke than a four-stroke engine of the same size. This is because the fuel combustion is not efficient in a two-stroke engine as lubricant is mixed with its fuel. As a result, unburned hydrocarbon is emitted in excessive quantities. Thus a baby taxi is sometimes found to emit more smoke than a bus of normal size.

The two-stroke petrol engines are less fuel-efficient and release about 30-100 times more unburned hydrocarbons and more carbon monoxide than the four-stroke or diesel engines, experts say. Two-stroke petrol engines do not have a proper lubrication system, and in most cases, the lubricant is poured into the fuel tank along with gasoline. This aggravates the situation by producing more hydrocarbon and soot in the exhaust.

Because of their excessive pollution, the use of two-stroke engines is now being discouraged in India, from where most of the three wheelers are imported, informed sources said. In view of the serious air pollution in the metropolis, an initiative was taken with World Bank support to introduce big buses in the city and discourage the plying of small automobiles, including baby taxis. The introduction of the premium bus service is an outcome of that initiative.

According to available government statistics, the numerical

growth of auto-rickshaws and tempos in Dhaka city in 1997 was 29 per cent, cars and jeeps 20 per cent, minibuses 6 per cent and buses only 0.6 per cent. It is estimated that the current demand for buses in Dhaka city is more than 5,000 against an existing fleet of 1,500. Then again, only 1,300 of the existing number actually ply in the streets, of which 1,100 are old and dilapidated. There are fewer than 200 buses of improved quality.

The International Development Association (IDA), the World Bank's concessionary lending arm, has recently announced the approval of a US\$ 177 million credit to help solve Dhaka's air pollution and traffic crisis under the Dhaka Urban Transport Project. The total project will exceed US\$ 234 million. Air quality management and control is a significant part of the project.

Slow-poisoning of Dhaka city dwellers: The citizens of metropolitan Dhaka are being slow-poisoned by air pollution. But the city dwellers are not aware that they are being slowly poisoned by lead particles dispersed in petrol, which is used as fuel. The fuel, when burnt, releases invisible lead particles into the air.

A recent monitoring of the air quality of the city shows that the concentration of suspended particles in the ambient air is many times higher than normal. This air, which the city dwellers and the road-users breathe regularly, contains lead in concentrations almost ten times above the government safety standard set by the Department of Environment, according to a survey conducted by the scientists of the Bangladesh Atomic Energy Commission (BAEC). According to an estimate made by BAEC, 50 tons of lead are emitted into Dhaka city's air annually and the emission reaches its highest level in the dry season, from November to January. Earlier reports from scientific studies say the density of lead in the air of Dhaka city in the dry season reaches 463 nanograms (one nanogram is one billionth of a gram) per cubic metre, the highest in the world. The lead concentration in the polluted air of Mexico City is 383 nanograms and in Mumbai, India, it is 360 nanograms per cubic metre.

According to another survey, the concentration of lead in

the blood of most people in Dhaka city is higher than the tolerable limit of eight parts per million (ppm). Lead concentration in the blood of automobile drivers and office-goers was found to be as high as 120 ppm!

Effects of air pollution: Air pollution adversely affects the respiratory tract, and causes irritation, headache, fatigue, asthma, high blood pressure, heart disease and even cancer. Experts say that if this trend continues unabated, most residents of the metropolis will become exposed to the risk of these ailments and other complications. The mental faculties of the children will be impaired by lead pollution, which can also affect the central nervous system, and cause renal damage and hypertension. Excessive lead in the blood of children can damage their brains and kidneys. Scientific studies have revealed that children are three times more vulnerable than adults to lead poisoning. Dust pollution is causing many respiratory diseases, including asthma, according to concerned physicians and experts.

According to experts and physicians, children are the worst victims of air pollution as their breathing rate per minute is much higher than that of adults. Public exposure to air pollution in Dhaka city is estimated to cause 15,000 premature deaths and several million cases of sickness every year, said a recent World Bank report.

In Bangladesh, no survey has yet been made on the impact of air pollution on health. However, surveys on the quality of air in Dhaka city, made during the second half of the decade, show that pollution has attained alarming proportions. Automobile exhausts fill the air in Dhaka city with volatile organic compounds (VOCs) beyond tolerable limits; some of these compounds cause cancer.

Recently, Prof. Abul Hussam of the George Mason University, Virginia, USA, detected 200 organic compounds and identified 35 of them by analysing four air samples collected from the Shewrapara area of the city. It was the first such advanced analysis of air quality ever done in Bangladesh. The air samples were analysed at the time of installing ultramodern equipment at a privately set-up research, development and technology centre in the area on August 18 and 19, 1998. The tests showed that exhausts of

auto-rickshaws contain VOCs, the amount of which is four to (more than) seven times beyond the allowable limit. The presence of these compounds in the ambient air in Shewrapara is close to the threshold limits, the tests revealed.

The air quality analyses have been carried out on behalf of the Intronics Technology Centre being set up with financial support from Prof. Mohammad Alauddin of Wagner College and City University of New York, USA. The centre -- having the capacity to test water and air quality, detect toxic trace constituents in them, and carry out trace element analysis of blood, urine, hair, skin lesions and other tissues - will be formally launched soon. Prof. Amir Hussain Khan, pioneer of trace analysis in Bangladesh, is the academic adviser of the centre.

Prof. Hussam said the analyses of the exhausts of auto-rickshaws showed the presence of toluene, a cancer-causing agent, at a rate of up to 200,000 micrograms per cubic metre as against the threshold limit of 2000 micrograms per cubic metre. The 35 volatile organic compounds identified included carcinogenics: benzene, toluene, octane, ethylbenzene, 1-isocyanato-3-methoxybenzene, o,p-xylene, propylbenzene, trimethylbenzene and butylbenzene. The tests, however, were conducted at a relatively less traffic-congested area in the metropolis. Prof. Alauddin said that a much higher concentration of air pollutants would have been found if tests were carried out at heavily congested areas like Hatkhola, Shapla crossing, Sonargaon crossing and Farm Gate. Prof. Hussam said that apart from automobile exhausts, chemical processing plants and biogenic sources contribute to the extremely bad VOC pollution of Dhaka's air. He shared the results of the air quality tests with the scientists of the Dhaka Centre of Bangladesh Atomic Energy Commission (BAEC).

Areas worst affected: The worst-affected areas in Dhaka city include Hatkhola, Manik Mian Avenue, Tejgaon, Farm Gate, Motijheel, Lalmatia, and the inter-district bus terminals. Surveys conducted between December, 1996 and June, 1997 showed that the concentration of suspended particles at Farm Gate goes up to as high as 2,465 micrograms per cubic metre as against the allowable limit of

400 micrograms per cubic metre. The concentration of sulphur dioxide and nitrous oxide at this spot, however, was still below the permissible limit of 100 micrograms per cubic metre.

In the Tejgoan Industrial Area, on the other hand, the maximum concentration of suspended particles was 630 micrograms as against the allowable limit of 500 micrograms per cubic metre. However, the presence of sulphur dioxide in the air over Tejgaon I.A. was found to be higher than the maximum permissible limit of 120 micrograms per cubic metre. The tolerable limits of pollutants in the air are different for residential areas, industrial areas and commercial areas. The concentration of pollutants in Dhaka's air was the maximum during the dry months of December to March, according to surveys conducted by the DoE.

Fuel Quality

Sulphur and lead content of different fuels available in Bangladesh are shown in Table-1 and 2.

Table-1: Sulphur content of different fuels available in Bangladesh.

Motor Gasoline-Premium	Max. 0.1 mass%
Motor Gasoline-Regular	Max. 0.1 mass%
High Speed Diesel (HSD)	Max. 0.1 mass%
Low Sulphur HSD	Max. 0.5 mass%
Light Diesel Oil	Max. 1.8 mass%
High Sulphur Furnace Oil	Max. 3.5 mass%
Kerosene	Max. 1.0 mass%

Table-2 : Lead content (as Pb) in Motor Gasoline available in Bangladesh.

Motor Gasoline- Premium	Max 0.84 g/l
Motor Gasoline- Regular	Max 0.5 g/l

Air Pollution in several industries in Bangladesh

Textile and Dyeing

Gaseous emissions adversely affect the health of workers due to inadequate ventilation and noxious vapours from the printing and dyeing operations of textile industries. These

mills often burn their solid wastes in the open air or pay contractors to collect and dispose of the wastes. This is often done in an irregular and unscientific manner, characterised by dumping of wastes here and there. Nobody is using incinerators for burning solid wastes.

Tanneries

Air pollution in tannery area is mainly caused by the emission of foul odour from putrefying raw hides and solid wastes. Foul odours also rise from open drainage channels, sedimentation pits and wastes dumped inside the tannery premises.

Pulp and Paper

The most dangerous emissions from the Kraft pulp mills are sulphur dioxide, total reduced sulphur compounds and particulate matter, hydrogen sulphide and methyl. These are highly malodorous. This group originates mainly from the sulphate cooking process in the digester system, the brown stock washes, the multiple effect evaporators, the black liquor oxidation, the recovery furnace, the smelt dissolving tank, the lime kiln and the condensate stripper system. The principal sources of particulate matter are the recovery furnaces, the smelt dissolving tank, and the lime kiln. Fly ash particles consist mainly of carbonates and sulphates. Chlorine emissions can occur but these are mostly of the diffused type and originate from tank vents, wash filters, sewers and other similar sources. The gases are mainly chlorine or chlorine dioxide. Generally, concentrations are not significant. Hydrogen sulphides can collect in the stock chests.

Cement

Air pollution can originate from several operations:

Sl. No.	Source	Emission
1.	Raw materials grinding, handling	Particulate dust
2.	Kiln operation and clinker cooling	Particulate dust CO, HC, SO ₂ . NO ₂
3.	Product grinding, handling, Particulate (dust)	packaging, shipping

Metal industries

A number of metals and surface treatment operations generate acid mists, particulates and solvent fumes. Toxic pollutants such as nitrous vapour, chromic acids and chlorides are emitted and may cause health hazards to workers and the residents of adjoining areas.

Fertilisers

Severe air pollution may result from ammonia leakage during the production of nitrogen fertilisers. Phosphate fertiliser plants generate a considerable amount of dust while phosphate rock is being ground. Fluorine may be produced by the acidulation process. Specific air pollution problems are caused by Triple Super Phosphate (TSP) production.

Environmental Legislation

The Environment Conservation Act, 1995 and the Environment Conservation Rules, 1997 have been enacted by the Parliament. Under the Rules of 1997, the following standards have been set:

- Ambient Air Quality Standards.
- Vehicular Exhaust Emission Standards.
- River Transport (Mechanised) Emission Standards.
- Standards for Gaseous Emission for Industries or Projects.

Ambient Air Quality Standards are shown in Table-3:

Table-3: Ambient Air Quality Standards.

Concentration in micrograms per cubic metre

Area Category	SPM	SO ₂	CO	NO ₂
Industrial and mixed use	500	120	5000	100
Commercial and mixed use	400	100	5000	100
Residential and Rural	200	80	2000	80
Sensitive	100	30	1000	30

Vehicular emission standards are shown in Table-4:

Table-4 : Vehicular Emission Standards

Parameters Value	Unit	Standard
Black Smoke*	Hartridge Smoke Unit (HSU)	65
CO	g/km	24
	Per cent volume	4
Hydrocarbon	g/km	2
	ppm	180
Oxides of Nitrogen	g/km	2
	ppm	600

**Measuring at two thirds of maximum rotating speed.*

One of the primary objectives of the National Environment Policy 1992 is to identify and regulate activities which pollute and degrade environment. The primary purpose of enforcement measures is to stop or prevent polluting activities by making offenders accountable.

The Environmental Conservation Act 1995 also contains laws on the protection of environmental health and control of environmental pollution.

Articles 31 and 32 of the Constitution of Bangladesh guarantee the "right to life" of a citizen. In two recent cases, the Supreme Court has held that the "right to life", which is enshrined as a fundamental right, includes the "right to a healthy environment".

Effective cooperation of the public in general and the concerned agencies in particular was lacking in the implementation of all laws and regulations for reducing air pollution. There was almost no cooperation by the transport owners, drivers and other transport workers in this regard.

Steps taken so far: Against this backdrop, the daily monitoring of automobiles at certain points in Dhaka city, recently initiated by the Department of Environment (DoE), did not work out due to non-availability of the members of the law-enforcing agencies. DoE has not succeeded in continuing the checking of vehicles even at one single point near the Parliament building.

DoE officials initially faced resistance from auto-rickshaw drivers who were suspicious of the initiative and even tried to attack them. They, however, succeeded in making them

understand that monitoring the state of the air is in the interest of public health. DoE requires the cooperation of the Bangladesh Road Transport Authority (BRTA) and Dhaka Metropolitan Police (DMP) to monitor the extent and quality of automobile exhausts. It also needs the services of the Dhaka Metropolitan Magistracy to penalise owners and drivers for not maintaining smoke emission standards.

Preventive measures like publicity campaigns against the dangers of excessive emission of black smoke have so far been inadequate. The curative measures like the daily checking of automobiles for penalising the offenders are also not being pursued vigorously.

The DoE had a programme of organising mobile courts every month in cooperation with the BRTA, DMP and Dhaka Metropolitan Magistracy for some time. The owners and operators of faulty and polluting vehicles were penalised. But on many occasions, the mobile courts actually did not function due to lack of coordination among the four agencies involved. The measure, thus, did not produce any tangible results in controlling air pollution in the city.

An assessment made by DoE suggests that about 80 per cent of the over 200,000 automobiles that ply in the streets of the metropolis emit smoke in excess of the prescribed limits. By late 1996, BRTA had taken a decision not to allow more than 35,000 imported three-wheelers in Dhaka city. To achieve the objective, it had decided to give registration to not more than 35,000 three-wheelers per year. BRTA had also decided to restrict the registration of 'Mishuks', a locally-manufactured auto-rickshaw, to 500 a year in the city. (BRTA officials believe that Mishuks, with their 4-stroke engines, emit less smoke. But then, they add to the problem of traffic congestion).

An attempt was made not only to control automobile pollution but also to reduce traffic jams by implementing the above decision. But the decision was challenged in the High Court Division of the Supreme Court by one Ali Murad Habib, and the learned court imposed an injunction. Meanwhile, the baby taxi manufacturers are said to be lobbying hard with the authorities concerned to soften their

attitude towards the 2-stroke three-wheelers. Representatives of manufacturing companies are claiming that they have evolved a special lubricant for use with fuel to reduce emission of black smoke.

Way ahead (policy and planning issues): A consultative meeting was recently organised by the World Bank in association with the DoE and the Bangladesh government. The Atomic Energy Commission reportedly came up with some important recommendations on an integrated approach to vehicular air pollution control in Dhaka. They deserve the attention of the government for implementation. The meeting called for the creation of public awareness about the magnitude of the problem as well as on the need to use unadulterated fuel and lubricants in motor vehicles.

The meeting suggested the phasing out the use of leaded petrol as soon as possible, stopping the issuance of new licences and route permits to three-wheelers with 2-stroke engines and phasing out the existing 2-stroke engine-powered three-wheelers. It was further suggested that the sale of loose lubricants should be stopped to prevent adulteration and the use of compressed natural gas (CNG) in vehicles should be promoted. The meeting also suggested that the big gaps in the prices of gasoline, diesel and kerosene should be removed to prevent adulteration.

The participants at the meeting called for increasing fines for repeated violation of motor vehicles regulations and for establishing emission standards for all types of vehicles. Daily inspection of motor vehicles was emphasised. They further recommended effective transportation planning to promote mass transit in the city through building a route network for big buses. The need for improving traffic planning was also underlined. The meeting called for ensuring the effectiveness of air pollution control programmes through regular air monitoring.

The government and the relevant agencies are well aware of these recommendations. What is needed is their implementation through participation of all the stakeholders. Organisations of Dhaka-dwellers should be

promoted to build up pressure to establish their right of access to clean air in the metropolis. The owners and operators of motor vehicles should be made aware of the need to stop excessive vehicular emission, not only in the interest of the residents of the city, but also in their own interest. A package of incentives should be given through policy measures that should also financially benefit the owners and operators of environment-friendly vehicles.

Meanwhile, the government has recently decided to ban the import of motor vehicles powered by two-stroke engines in order to curb air pollution. News reports say that under the decision taken at a high level meeting, the movement of vehicles like baby taxis and auto-rickshaws will be prohibited, in phases, in the four metropolitan cities of Dhaka, Chittagong, Khulna and Rajshahi within five years. The government has also decided to offer financial incentives for converting four-stroke automobiles using petrol and diesel to compressed natural gas (CNG) that is low in sulphur content and has no lead. Registration and renewal fees of such vehicles will be reduced.

These are the decisions taken in the light of the long debate among the environment journalists and their environmental campaign over the years. One should, however, take note of the fact that the decisions are also subject to changes and modifications. In our government's case, most often, decisions are taken only to flout them subsequently. Implementation of decisions is very important. We should make sure that phasing out the most polluting vehicles does not take a long time. What today is a soluble problem may become insoluble tomorrow. We just cannot afford to waste any time at all in protecting our environment

PM for quickly making vehicles CNG-run

Kazi Shahnaz

Prime Minister Khaleda Zia asked the Ministry of Energy and Mineral Resources and the other departments concerned to take urgent steps to make vehicles to run on CNG for proper use of natural gas and curbing environment pollution.

The directives were given when State Minister for Energy AKM Mosharraf Hossain apprised her of the different steps of the ministry on October 29, 2001 regarding expansion of CNG (compressed natural gas) programme at her office.

The Prime Minister advised the state minister and the officials concerned to take urgent steps for CNG conversion of all public sector vehicles, Political Secretary to the Prime Minister Haris Chowdhury told newsmen after the meeting.

Khaleda also directed the officials to take measures for quick recovery of outstanding bills in the sector. She stressed the need for phasing out two-stroke engines to check air pollution in the capital city.

The Prime Minister inquired about the reasons behind slow progress of CNG conversion as so far only 1,500 vehicles have adopted it since 1994-95. She suggested increase in the number of filling stations for CNG and encouraging private sector participation in it.

She advised the officials concerned to take steps to enhance technical know-how in this sector, adding that the fuel cost would be saved substantially with the increased use of CNG, which is TK 7.45 per cubic metre.

She said auto-rickshaw owners should be provided with loan for CNG conversion by arrangements with leasing companies or banks. The CNG refueling facility should be made obligatory while giving permission to set up new petrol pumps.

During the meeting, among others, Political Secretary to the

Prime Minister Haris Chowdhury, Energy Secretary M Akmal Hossain and other officials concerned were present.

The government is likely to provide financial incentive to auto-rickshaw owners for converting their petrol-fuelled two-stroke engine vehicles into engines using Compressed Natural Gas (CNG) to help reduce air pollution level in capital Dhaka.

Environment and Forest Secretary Syed Marghub Murshed said this at a press briefing on April 19, 2000, while announcing a plan for 'CNG conversion' of the city's worst polluters -- about 50,000 auto-rickshaws.

The Department of Environment (DoE) has taken up Bangladesh Environmental Management Project (BEMP) under which some auto-rickshaws using CNG will be run on an experimental basis in the city in the coming months. The project, supported by Canadian International Development Agency (CIDA), targets conversion of the existing fleet before a ban on auto-rickshaws is imposed in phases over the next few years. CIDA is providing a grant of 10 million Canadian dollars for the project.

Tests have already been conducted on Bajaj auto-rickshaws in Toronto, Canada, as part of a CNG conversion programme in Pakistan, acting head of CIDA Monique Angers told the press briefing held at the DOE. BEMP engineer Rory Wong estimated the conversion cost to be about Tk. 20,000 for an auto-rickshaw. But the cost could be reduced, he added. Wong said a gas cylinder similar to a scuba diver's oxygen cylinder would be fitted under the seat of an auto-rickshaw. It would not only reduce air pollution level but also provide financial incentive to the drivers, facilitating a 200-250 km run with a full cylinder.

Murshed assured that CNG would be made easily available, ending the current hassles. The state-owned Rupantarita Prakritik Gas Company, set up in the early eighties, has been providing CNG to all converted vehicles. The Environment Secretary said that along with the CNG conversion programme for auto-rickshaws, the government plans to phase out auto-rickshaws in 12 years, ban further import and discourage their use by imposing 300 per cent duties.

Solutions are being sought for controlling the city's pollution without entailing drastic and painful action that might cost jobs and transport disruption. Autorickshaws with two-stroke engines that cause incomplete combustion have been listed as the principal cause of air pollution in the city. Concentration of lead in the city's air rose to such a high level that the government is now contemplating to impose a ban on the import of auto-rickshaws.

The environment-friendly CNG holds great promise in this regard. Conversion of two-stroke engines into CNG-powered vehicles is considered to be feasible from environmental, economic and technological points of view. CNG-powered autorickshaws are non-pollutant and entail lower maintenance cost. It is important to note that bad maintenance of vehicles is one of the causes of air pollution.

To carry out mandatory conversion of autorickshaws speedily, logistics and management will have to be improved. The initial cost of conversion may prove forbidding for many. Here local technology and technocrats can do their bit to bring down the cost. Also, fiscal and other incentives may be provided for conversion of the vehicles.

It should be realised that while conversion will limit the level of pollution, it will not ease traffic jam. If the mileage cost of CNG-run autorickshaws falls, which one would reasonably expect, the fare may also decrease, which means that more people will want to hire autorickshaws and greater demand will lead to larger supply and more of such vehicles will ply on the city roads. The present number of autorickshaws is estimated to be about 50,000. Switchover to CNG as fuel is no doubt a sound option to improve the environment, but at the same time it should be ensured that dependence on autorickshaws -- which have already become a major mode of urban transport -- is not allowed to increase.

Pollution down on rickshaw off-limits

Kazi Shahnaz

Vehicular pollution has come down to a significant low on the city roads off-limits to rickshaws in the last half of year 2001 as the Caretaker administration's clamp down followed by the new government's tough measures, say environmentalists and police officials.

The Traffic Department of the Dhaka Metropolitan Police (DMP) has so far declared half a dozen city thoroughfares off-limits to rickshaws. The roads are Panthapath, Tongi Diversion Road, Kakrail, part of the Mirpur Road, part of the Gulistan Intersection, and the Inner Circular Road. Traffic congestion has almost disappeared, giving the road users an easy and smooth ride.

Also, noise pollution on these roads has decreased significantly, as motorists no longer use horns frequently to warn rickshaws and other slow-moving vehicles.

"Since there is no pressure of slow-moving vehicles and the motorists do not change gears frequently, toxic emission has been at a low, improving the quality of air in the areas", said Environment Secretary Sabihuddin Ahmed.

According to an estimate, about 500,000 rickshaws are playing the city roads providing livelihood to thousands of youths.

Rickshaws are considered environment-friendly, but their overwhelming number results in traffic jam and pollution. They are also held responsible for slowing down fast-moving vehicles.

In the recent past, Dhaka City Corporation (DCC) implemented a Tk 5 crore project to segregate rickshaws by building separate lanes along the main thoroughfares. The project proved to be a complete failure as the then mayor

failed to make the rickshaws use the lanes. The DCC allocated fresh funds for removal of the lanes in the face of widespread criticism.

The Traffic Department officials said that they are now trying to make all roads with bus routes off-limits to rickshaws.

The next move to free roads from rickshaws would start on the Mirpur Road between Gabtali and Azimpur. The task would be tough, as the Traffic Department needs to man various lanes and by-lanes along the road to prevent rickshaws from sneaking in.

A traffic sergeant said that to keep Panthapath free from rickshaws they had to deploy dozens of ansars and policemen at different points.

But rickshaw users living in congested areas said that rickshaws have not been given alternative routes to ply. Lanes and by-lanes rickshaws are expected to ply are run-down. The rides on the streets with big potholes are bumpy for travellers and painstaking for pullers. Rickshaws also need frequent repairs due to the bad condition of the roads, drivers complain.



Too much noise



Photo: Bulbul Ahmed, FEJB



হর্নবাজানো
নিষেধ

স্বাস্থ্য
সংক্রান্ত
বিজ্ঞপ্তি



Too much noise

Anwar Hossain Manju

With the rising population in Bangladesh, the pace of industrialization and urbanization has continued to accelerate. In the process, the number of vehicles is increasing and manufacturing plants are multiplying to meet the growing needs of the bulging population. The result is an increasing threat of noise pollution that induced hearing loss, annoyance and other adverse effects on the health and well being of our people.

Noise may be classified as steady, nonsteady, fluctuating, intermittent, impulsive, quasi-steady, ambient, etc. Steady noise is a noise with negligible small fluctuations of level within the period of observation. Non-steady noise is a noise whose level shifts significantly during the period of observation. Fluctuating noise is a noise whose level varies continuously and to an appreciable extent during the period of observation. Intermittent noise is a noise whose level suddenly drops to the level of the background noise several times during the period of observation. Impulsive noise is a noise consisting of one or more bursts of sound energy.

A study was recently conducted in the cities of Dhaka, Chittagong and Khulna by the Department of Environment (DOE), sponsored by the World Health Organisation (WHO), to measure the extent of sound pollution, types of noise, sources of noise and exposure to noise. It specified sensitive localities of the three cities of Bangladesh where public health is liable to be affected by noise pollution. Classification of the surveyed areas of the three cities on the basis of the level of noise pollution, comparison of observed noise level of the surveyed localities to the noise level permissible for those areas by the government of Bangladesh. leading to identification of severe, moderate, mild red-zone areas and green-zone areas have been mentioned in the survey report.

Noise pollution in Dhaka city: Some 45 localities in Dhaka city

were surveyed using the sound level meter, which covered 18 generic sensitive areas that comprise silent areas like educational institutions, hospitals, mosques, temples, residential areas. Some 22 specific sensitive areas covering commercial and industrial areas, busy traffic, bus or launch terminals, airport and five mixed areas consisting of residential, commercial and industrial areas.

Out of 45 the areas surveyed in Dhaka city, 29 showed noise level above the permissible limits accepted by DoE. According to the severity of the noise pollution, they are sub-classified as severe red-zone, a moderate red-zone and mild red-zone areas. The remaining 16 areas showed noise level fluctuating in and around the permissible limits accepted by DoE.

The highest dB of 100 in Dhaka city was observed at Zia International Airport take-off point of aircraft in contrast to permissible limit of 85 dB. The lowest 50 dB was observed at National Institute for Preventive and Social Medicine (NIPSOM) though the permissible limit there was 45 dB. The green zone areas are also vulnerable to increasing noise pollution beyond the permissible limits in decibel due to many factors, such as increased population, increased number of vehicles, unregulated use of microphones, noise from construction works, running of factories, etc. The level of noise pollution in 10 representative areas in Dhaka city has been specified as follows:

Areas	Type of Area	Observed dB	Permissible limit	Level of noise pollution
Shakahry				
Patty	Residential area	75.5 dB	45 dB	25.5
Shaheen	Silent Zone	67.6 dB	45 dB	22.6
School				
Dhaka	Silent Zone	70.8 dB	45 dB	25.8
Medical College Hospital				
Inside Nabisco	Industrial Area	89. dB	75 dB	14
Biscuit Factory				
Mohakhali	Busy Traffic	89 dB	85dB	04
Bus Terminal				
New market	Commercial Area	86.4 dB	70 dB	16.4
Mouchak	Mixed Area	92.6 dB	60 dB	30.6
Motijheel C/A	Commercial Area	82 dB	70 dB	12
Banani R/A	Residential Area	61 dB	50 dB	11.4
Bashabo	Silent Zone	65.25 dB	45 dB	20.25
Temple and Churches				

The findings indicates an ever-growing noise pollution in Dhaka city.

Noise pollution in Chittagong city: Another 45 locations covering silent, residential, commercial, industrial and mixed areas in Chittagong city were surveyed to determine the noise level limit. Out of the 45 areas, 28 showed noise level exceeding permissible limits and 17 showed noise level fluctuating in and around the permissible level. In other words, 62 per cent of the surveyed areas in Chittagong city showed noise level higher than the acceptable limits. The noise level of 36 areas of Chittagong city showed a similar pattern of level compared to that of 36 areas of Dhaka.

Noise pollution of Khulna city: Some 34 areas in the Khulna city were surveyed, of which 18 showed noise level exceeding the permissible limit. The highest observed decibel in Khulna city was found to be 95.6 decibel in Shiromoni BSCIC Industrial Area where the permissible noise limit is 75.6 decibel. The lowest noise of 58.60 decibel was observed in Khalishpur Residential Area where the permissible limit is 50 decibel. The findings revealed the existence of noise pollution in Khulna city.

The findings of the survey on noise pollution in the cities of Dhaka, Chittagong and Khulna not only proved the existence of the grave situation of noise pollution in the country's three main urban centres, but also vindicated the prediction of a report by ENT medical specialists of the country. It read : "After 20-25 years, 50 per cent of the population of Dhaka city would be losing their hearing capacity by 30 dB if immediate steps are not taken to prevent, control and monitor noise hazard and the ill effects and annoyance produced by noise pollution."

To face the aggravating state of noise pollution it is necessary to raise public awareness to curb it.

How to go about curbing noise pollution :

- Implementation of regulations prohibiting use of hydraulic horns, as well as stopping import and marketing of

hydraulic horns used by motor vehicles.

- Development of a multi-disciplinary hearing conservation programme involving industrial hygienists, engineers, nurses, audio-metric technicians, audiologists etc.
- Reduction of noise level in the workplace by adopting engineering control methods which include regulation of spacing between source of noise and receiver.
- Siting of new housing, schools and hospitals away from noise areas.
- Setting up of Traffic Police Anti-Noise Brigade by government.
- Conduct social survey concerning feeling of public as regards traffic noise and involvement of the media to support noise abatement campaigns.
- Locating highways away from populated areas and use of bypasses and circumferential routes.
- Introduction of underground transport system to reduce the load of the existing surface transport system.

Sound pollution: A health hazard

Kazi Shahnaz

Sound pollution is a major health hazard in the country, particularly in the urban areas. But nothing has so far been done to curb the hazard though so many seminars, discussions and meetings on the problem are held round the year. When many countries have made tremendous progress in controlling sound pollution within the tolerable limits, in Bangladesh the problem is yet to be addressed seriously. The problem of sound pollution has exposed millions of our people to a number of diseases -- from deafness to fatal heart attack.

This is definitely a frustrating scenario for the city dwellers. Mothers carrying their babies in any noisy part of a city is a common sight in Bangladesh. Sound pollution is caused through various means like the hydraulic horns of vehicles, microphones, etc. And children are the worst sufferers from the sound pollution. It is slowly destroying the auditory power of thousands of children everyday. The hydraulic horns used by buses and trucks in the crowded city streets are dangerous for anybody, even adults.

According to experts, if a child below three years of age hears 100 decibel (DB) sound of horns from a close range, he might lose his auditory power. It is not only hydraulic horn that does harm to the children, the other deterrents on the way to child health are the high sounds of radio, television, cassette players, microphones, sound of mills and factories and any other loud noise. When the sound crosses the normal audible limits, it becomes polluted as every human being has a normal capacity to tolerate certain level of sound. Ears act as an organ of listening on the one hand and maintain balance in man's body on the other. Ear is divided into three parts: outer ear, middle ear and inner ear. The sound wave with the help of air enters the ear-hole of outer ear and creates vibration in the tympanum. This vibration becomes stronger with the touch of three bones

located at the middle ear and then reaches paralymp and endolymp. And the "organ of koti' located at the cocklia excite auditory cells there and the excitement ultimately reaches the auditory center of the brain through auditory nerve. This is how one hears or listens.

The unit of sound frequency is hertz. We usually hear 15 to 20 kilohertz frequency sound. According to the World Health Organisation (WHO), generally 60 decibel sound can make a man deaf temporarily and 100 DB sound can cause complete deafness. But the sound of the noise of any busy street in Dhaka has been estimated to be at 60 to 80 DB, with the sound of vehicles being 95 DB, microphone 90 to 100 DB, mills and factories 80-90 DB, hotels and cinema halls 75-90 DB, festivals 85-90 DB, scooter or motorbike 87-92 DB and truck-bus 92-94 DB. But our desired sound measure is 25 DB in bed-room, 40 DB in dining or drawing room, 35-40 DB in office, 30-40 DB in class room, 35-40 DB in library, 20-35 DB in hospital, 40-60 DB in restaurant and 45 DB in the city during night. And when the sound exceeds this limit, it becomes polluted. The sound pollution beyond this limit destroys our auditory power that might even lead to the losing of one's mental balance. The sound pollution also causes peevish temperament, affects lungs, hampers the intellect of the children and makes them apathetic towards their studies.

According to the survey of the Department of Environment (DoE), sound causes mental and physical illness among people. It causes high blood pressure, heart-beat, headache, indigestion, peptic ulcer, and also affects sound sleep. Anyone may become deaf for the time being if 100 DB or more sound pollution occurs for half an hour or more in any place. Working in an atmosphere of loud sound for a long period can cause complete deafness to any person. Any sort of sound pollution seriously affects the expecting mothers. It has been observed, that pregnant mothers living near big airports like Los Angeles, Heathrow or Osaka give birth to more crippled, deformed and immature children than those living in other places.

What will be the perfect sound condition for the country? According to the Department of Environment (DoE), it is 45 DB for daytime and 35 DB for night in peaceful areas, 50 DB for day time and 40 DB for night in residential areas, 60 DB for day time and 50 DB for night in mixed areas (residential, commercial and industrial localities), 70 DB for day time and 60 DB for night in commercial areas and 75 DB for daytime and 70 DB for night in industrial areas.

Another survey of DoE shows that the sound pollution has increased in different parts of Dhaka city. As per the survey, the level of sound pollution is : At Shaheen School- 74 DB during day time and 83 DB at night, at Motijheel Government High School- 79 DB during day time and 83 DB at night, at Dhanmondi Government Boys School- 75 DB during day time and 80 at night, at Azimpur Women College- 74 DB during time and 80 at night, at Tejgaon Women College- 67 DB during day time and 75 DB at night, at PG Hospital- 74 DB during day time and 82 DB at night, at Dhaka Medical College Hospital- 69 DB during day time and 80 DB at night, at Mitford Hospital- 73 DB during day time and 76 DB at night, and at Shishu Hospital- 69 DB during day time and 72 DB at night.

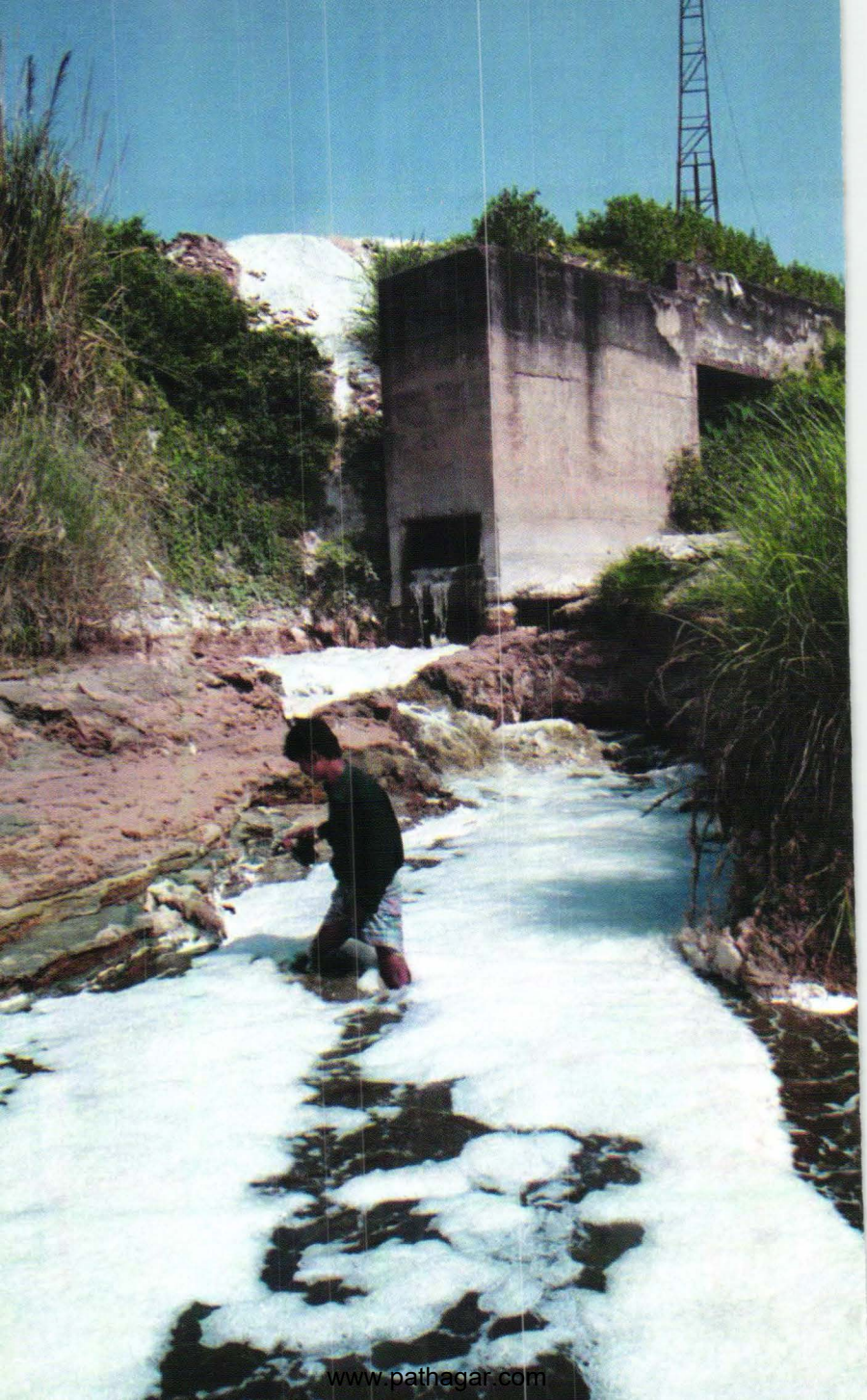
Whatever it may be, there is no denying that sound pollution is a serious health hazard which should be addressed seriously to reduce its level to a tolerable point. However, Director General of DoE, Mr. A. R. Khan, expressed his optimism that the DoE would soon take effective measures to prevent sound pollution. In this context, DoE officials stressed the need for creating consciousness among the people to fight the hazard of sound pollution.



Managing the hospital wastes



Photo: Shafiuddin Ahmed Bitu, FEJB



Managing the hospital wastes

J. Hasan

Hospitals and clinics are places where people suffering from various diseases seek help for treatment. In Bangladesh health facilities in the private sector are increasing rapidly to fulfill public needs. There are government health facilities at upazila level, union level and in some cases at district level in the country.

Most of the health centers at upazila and thana level lack manpower, basic infrastructure and logistic support. In the private sector, there are over 250 small to medium sized hospitals/clinics scattered around Dhaka city. In other major cities like Chittagong, Rajshahi, Khulna and Sylhet, private health facilities are now rapidly growing.

The disposal of medical waste has largely been ignored in Bangladesh. Dhaka City generates 3,500 metric tons of garbage per day, 200 tons of which originates from medical establishments; 20 per cent of the latter or 40 tons are infectious and hazardous.

With rapid growth of private health sector, the need of safe and proper medical waste disposal has become important. Most of the hospitals, both government and private have an outdated environmental management system. Since the hospital managers have very little accountability to appropriate authority, they are not very worried about the issue. There is no proper treatment facility for medical waste in the country, either in the government or in the private sector. Awareness regarding the hazards of medical waste is lacking and the handling and manipulation of medical waste is still very crude. Therefore, the possibility of getting infected for professionals, workers, waste collectors and general people is very high.

The present practice in almost all cases is to have little or no scientific handling of the materials within the clinics and less

consideration of their disposal. In hospitals and clinics, wastes are generated basically in wards, cabins, operation theatre, stores, pharmacies, nurses' and doctors' rooms and pathological laboratories. These are thrown in baskets first, then to the in-house dustbin and finally to the street dustbin. Within hospitals and clinics, wastes are handled by ward boys/girls and cleaners. From street dustbins, these wastes are collected by street children and municipal authorities. Human body parts are also found in certain bins.

BRAC and Association for Rural Development and Studies (ARDS) conducted a study to know about medical waste management and its effects in Dhaka city. Out of 26 government hospital, 133 private hospitals and clinics and 318 diagnostic centers in Dhaka city, the study investigated the waste disposal practices in 11 private clinics, 13 diagnostic centers and 14 government medical facilities. In addition government hospitals, private laboratories and clinics were also visited in Mymensingh and Dinajpur.

The study found that a variety of methods were used by the medical facilities to dispose of waste. These included burning, burying, selling, dumping, reuse and removal from municipal bins. In all labs and clinics, liquid waste was seen to be disposed of via drains, latrines, or municipal garbage bins.

Syringes, plastic materials, paper cartons and other materials were found to be gathered daily by burned monthly or after a long period of time in open pits. There is also lack of specific burning pits. In some hospitals, human waste like fetus and placenta are buried near or within hospital boundaries.

The chance of infection is thus extremely high. Because hospital wastes are not like ordinary domestic waste. They contain highly infectious pathogens and dangerous chemicals. Open dumping of hospital waste poses a serious threat to public health.

There is a high risk of outbreak of infectious diseases from the pathogenic germs in the waste. The liquid and solid wastes often containing hazardous materials are simply dumped in the nearest drain or garbage heap where they are prone to contaminate the rag picking street children sifting through the

garbage dumps.

They not only expose themselves to hazardous materials like used contaminated needles, but also open the route of transmission for infectious diseases to the general public by collecting used syringes, needles, blood bags and IV bags. They sell all these items to unscrupulous traders. They in turn resell these contaminated items to unsuspecting consumers. This presents a grave risk of spreading of deadly diseases like hepatitis and AIDS.

It is believed that the improvement of waste management in the clinics and hospitals will have long term impact on containing the spread of infectious diseases and result in a cleaner environment.

Environmental impacts associated with medial wastes include: accumulation of toxic chemicals within soil, ground water contamination, adverse effect on soil microbial population, reduced rate of decomposition, lowering soil fertility, general degradation of habitat. Wind can carry pathogens from original dumping ground. The risk of reintroducing pathogenic micro-organisms into the human body through the food chain also exists.

As to legal provision, there is no specific clause pertaining directly to the handling, transportation or disposal of medical wastes in Bangladesh Environment Protection Act, 1995.

Medial wastes, however, can be classified under section 2(1) which defines waste as "any liquid, solid and radioactive substance that is discharged, disposed, or dumped which may cause adverse/negative change to the environment."

In a study conducted by Bangladesh Centre for Advanced Studies (BCAS), it was found that both clinical and non-clinical wastes were thrown together into the municipal dustbin, which are left for several days before collection.

For correct disposal, all the hospital wastes must be collected separately and safely disposed. Except at International Centre for Diarrhoeal Diseases and Research, Bangladesh (ICDDR, B), no hospital or clinic in Bangladesh has the arrangement of any

sort of scientific disposal.

Most of the hospitals and clinics in Dhaka city are situated in residential areas. Average distances of these hospitals from the nearest municipal dustbin are within 100 feet. The wastes generated by these clinics and hospitals are collected by untrained, unprotected and unaware ward boys/girls.

None of these hospitals and clinics practices proper separation or disposal. Many hospitals sell the empty saline bags, bottles, syringes and other materials for recycling process. The key findings of the BCAS study were:

- There is no central facility for medical waste treatment. Only ICDDR, B in Dhaka has got a small incinerator, Rajshahi and Dhaka Medical College Hospitals are installing incinerators.
- There is no well defined rule or legislation for medical waste management.
- Medical wastes are not well classified according to hazards.
- No awareness regarding occupational and environmental hazards of medical waste.
- Lack of accountability of concerned authorities.
- Least priority is given by the Government and mass media.
- Medical education curriculum has no priority for medical environmental management.

After the study, BCAS conducted a training programme for the staff of the studied hospitals/clinics titled 'Hospital Environmental Management'. In the Asia Foundation funded programme, use of different coloured bags for different types of waste was suggested. Training was given on public health hazards of medical waste.

When the training was completed, increase in awareness regarding the safe disposal of medical waste was noticed among the hospital staff. The general population around the hospital and the informal waste collectors also developed remarkable awareness. But the hospital staff did not continue this good practice for a longer period. In fact private clinics were found to be interested in disposing their wastes properly.

If their workers are trained they can separate out and destroy such wastes in an incinerator or dispose them through any other

safer disposal method if available.

In Khulna, Water and Sanitation Programme-South Asia (WSP-SA) and Swiss Development Cooperation (SDC) have come forward with a prospective solution for managing hospital waste. A local NGO named Prodipan has been engaged in collaboration with the Khulna City Corporation (KCC) and Bangladesh Medical Association (BMA) to formulate and demonstrate a safe hospital waste collection and disposal process that may be replicated in other major cities and towns of the country.

Under the project, in-house waste management have been introduced in 24 hospitals and clinics. The first step is to segregate the waste into hazardous and non-hazardous category. Hazardous wastes include contaminated cotton, gauze, syringes and needles while food, paper, and packages etc. are non-hazardous. These are stored in different coloured containers. Needles and other sharp items are stored in plastic bottles contained in metal boxes. Hospital staff has been given special training in following waste management procedure.

An auto-rickshaw has been specially designated to collect waste from hospitals. This vehicle has lockable, completely covered compartments to accommodate waste bags. This van arrives at the hospitals everyday to collect waste. After collecting wastes from all hospitals, the van unloads the wastes at a place eight miles away from the city.

There the needles, bottles and sharp items are deposited into a concrete lined pit. The pit is covered with a lockable lid to prevent unwanted access. The contaminated hazardous wastes are burned in a specially designed furnace located at the disposal site. The non-hazardous wastes are disposed of in the normal dumping ground for municipal waste.

Participating clinics and hospitals pay monthly charges ranging from Tk. 100 to Tk. 600, depending on the quantity of waste. This covers about half of the operating and maintenance cost. The rest is still made up by the donor.

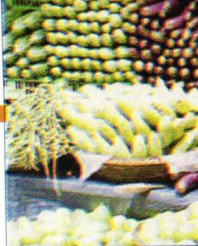
The project will be financially viable if more hospitals and

clinics can be brought under service with a subsidy contribution from the Khulna city Corporation. Already a good number of health establishments have expressed keen interest to join the programme.

The government can help in installing bigger disposal or treatment plants in major cities. The Department of Environment can take up such programme on a commercial basis. Small incinerators can be set up in hospitals if plastic/polythene and sharps can be separated beforehand so that emission of chlorinated gas and heavy metal gas can be prevented.

Feasibility of other alternatives such as autoclave, bio-oxidation and chemical treatment still need to be studied. Other recommendations include: safety protection in handling hazardous waste, central treatment of waste collected from different hospitals, minimisation of generation of hospital waste using cleaner production technology, training hospital staff on handling of hospital waste etc. Involvement of NGOs and government in a multidisciplinary approach for a sustainable hospital waste management is essential. A code of conduct can be developed in this context on a consensual basis. The existing laws of environmental protection should not be generalised for medical facilities. There should be separate environmental mandate for medical facilities.

Reference: Hospital Environmental Management in Dhaka, BCAS



Check the rot in kitchen market



Photo: Shahadat Hossain, FE|B



Check the rot in kitchen markets

Abdul Hye Siddque

The usefulness of kitchen market in day-to-day life is undeniable; its importance in the city life is even greater. Almost everyone has to run to the kitchen market for daily necessities. But what is the condition of such kitchen markets in Dhaka metropolis-the country's capital? This can not be answered in one word. But it must be admitted that the condition of these markets in Dhaka is not at all healthy.

Dhaka city has a long tradition. There is a 16th century saying about the city : "Fifty-two markets and fifty-three lanes, yet I could not fathom the bottom of Dhaka" (ref. the daily Ittefaq, 2 June 2002). The population of Dhaka metropolis is now about one crore and the number of authorised kitchen markets under Dhaka City Corporation (DCC) is only 101. But in reality, their number is double. The trading in these markets is expanding daily because of the city's rising population and gradual increase in the demand for daily necessities.

Commodities worth crores of taka are traded everyday in these markets. The yearly revenue earnings of DCC from the wholesale deals in fish and vegetables of the kitchen markets is nearly Tk. 21 crore (source: The daily Ittefaq, 19 January 2001). Yet nobody bothers much about improving the environment of these markets. The DCC authorities are very indifferent in this respect. The business community or their organisations are also not serious about improving the condition of these markets. Even the customers also care very little about this environmental aspect of these market places.

This paper aims to identify:

- a. the environmental problems of the kitchen markets in Dhaka;
- b. to study the nature and conditions of the environmental problems of these markets;

- c. to find out the persons and organisations responsible for the environmental problems of the markets;
- d. and to recommend steps to halt the environmental pollution of the kitchen markets.

The method of study:

The present study has been done on the basis of preliminary facts and data, taking help from reports in the newspapers and periodicals. At first, 10 out of 101 kitchen markets approved by the DCC were selected as sample for the study. From these 10 markets 100 shopkeepers and 200 customers were interviewed on a random basis, but diversity has been maintained in interviewing different section of people including male, female and representatives of various professions.

The 10 kitchen markets that were included in the purposive sample are: Badamtali Kancha Market, Thathari Bazar, New Market, Banalata Kancha Bazar, Kawran Bazar, Malibagh Bazar, Shantinagar Bazar, Khilgaon Railway Kancha Bazar, Hatirpool Kancha Bazar, Bashabo Bazar and Rampura Katcha Bazar.

There are many limitations too in the study. No kitchen market from such posh areas like Gulshan, Banani, Baridhara and Uttara had been included in this sample. It is also difficult to reflect the true picture by taking the opinion of only 200 out of a vast number of customers. Yet efforts have been made to get a gross estimate of the situation of these markets.

Nobody now denies that the kitchen markets in Dhaka city are victims of severe environmental pollution. The shopkeepers are being stricken with serious diseases. The buyers are also not immune from such diseases. The polluted environment is also impeding merchandising programme.

Who are responsible for the polluted environment of these kitchen markets? Most of those interviewed think that the City Corporation is to be blamed for the environmental pollution in these markets. This is due to the neglect of duty by the City Corporation and other limitation of the institution, as most of the interviewees said. Most of them observed that if the City Corporation was responsible the environment in these markets and their adjoining places would have been better and healthy.

On an average 4,000 tons of wastes accumulate in Dhaka

everyday. Of this huge quantity of wastes, only 42 per cent is collected by the DCC and dumped very unhygienically somewhere at the outskirts. (Source: Hasan Hafiz, Bakhtiar Rana, Kazi Shahnaj, 'Efficient Waste Management' -- Bangladesh Environment Scene 1406 edited by Quamrul Islam Chowdhury). The environment of the meat shops in the kitchen markets is frightening, emitting foul smells. Though there are six designated slaughter houses under the City Corporation, most of the butchers slaughter the cattles in and around the markets or right on the roads nearby. The butchers are able to carry on such illegal activities because they make regular monthly payments to the officials and employees of the sanitary department of the City Corporation. There are allegations that these officials and employees of that department export tolls of about taka two and a half lakh per month from over one thousand meat shops in the metropolis (Source: The Daily Janakantha, 9 June 2001). This is only a small example of the limitless corruption in the City Corporation.

Dhaka City Corporation has 950 brick-built dustbins in and around the kitchen markets. Besides, some 408 container dustbins had been put in place at various points of which 90 were out of service within five years. The City Corporation has some 5,000 cleaners to remove the wastes. There are some 318 scavenger trucks and 4,000 hand trollies to remove the wastes. City Corporation officials said the number of dustbins, vehicles and manpower to remove the huge quantity of wastes in Dhaka metropolis is very small. There should have been 9,000 to 11,000 cleaners to handle the mountains of wastes in the city. (Source: Mahmud Shafiq, The Great Crisis in Waste Management of Dhaka City: Bangladesh Environment Scene 1406; Edited by Quamrul Islam Chowdhury).

But the City Corporation alone should not be blamed for the environmental pollution in the city markets; there are others who are responsible too. Many interviewees also blamed the Bazar Committees, shopkeepers as well as the customers for much of the pollutions in the kitchen markets.

Table-1

Who are responsible for environmental pollution in the kitchen markets (according to shopkeepers)

Who are to blamed	Number	Percentage
City corporation	68	68%
Bazar committee	7	7%
Traders	1	1%
Buyers	2	2%
All the above	22	22%
Others	-	-
Total	100	100%

Table-2

Those responsible for environmental pollution in kitchen markets (according to buyers)

Those responsible	Number	Percentage
City corporation	46	48%
Bazar committee	10	7%
Traders	64	32%
Buyers	-	-
All the above	30	15%
Others	-	-
Total	200	100%

Kitchen markets and their various problems: There are innumerable problems of the kitchen markets of Dhaka metropolis. Among the shopkeepers, 23 per cent view the polluted environment as the main problem. Of them, 10 per cent have identified drains and dustbins and 13 per cent have identified garbage, filth and foul odour as the problems. Some 31 per cent of the shopkeepers consider the toll collection by local mastans as the biggest problem in the kitchen markets.

Traders at Kawranbazar are sick of the trouble being caused by the mastans and snatchers. Vegetable vendor Abul Kalam said the toll collectors cause trouble even at the dead of night. Truck driver Rezaul complained that no loaded truck can enter Kawran Bazar without paying the fixed toll (Source: Daily Inquilab, 16 August 2000). This problem beset not only Kawran Bazar but almost every big kitchen market in Dhaka city. Besides, some 17 per cent shopkeepers complained about electricity problem and 21 per cent of other problems (Table-3).

Table-3

Main problems of the kitchen markets (according to the shopkeepers)

Nature of problem	Number	Percentage
Environmental pollution: drains and dustbins	10	10%
Detergent and odour	13	13%
Trouble caused by local mastans and toll collectors	31	31%
The police and the city corporation	8	8%
Electricity problem	17	17%
Others	21	21%
Total	100	100%

Various diseases due to polluted environment of the kitchen markets: Heaps of refuse lying everywhere in the kitchen markets and the foul odour and poisonous gas emanating from the dustbin wastes are harmful for health. Pollution from wastes causes various kinds of diseases. During the survey, some 60 per cent shopkeepers were found stricken with more than one disease. Besides, 3 per cent of shopkeepers suffer from asthma, 4 per cent tuberculosis, 12 per cent skin diseases, 10 per cent gastric ulcer, 8 per cent diabetics and 3 per cent suffering from heart diseases (Table-4).

Table-4

Shopkeepers stricken with diseases:

Disease	Number	Percentage
Asthma	3	3%
TB	4	4%
Skin disease	12	12%
Gastric ulcer	10	10%
Diabetics	8	8%
Heart disease	3	3%
More than one disease	60	60%
No disease	-	-
Total	100	100%

Kitchen markets and the cause of customers' annoyance: Most of the customers are dissatisfied with the kitchen markets because of their polluted and dirty environment. Some 78 per

cent of customers are annoyed with the foul odour and filth of these markets (Table-5). And five per cent of customers are dissatisfied with the markets because of the spiraling prices of goods (Table-5). Manirul Islam Babul of Motijheel Bank Colony complained about high prices as well as the tyranny of adulterants in the markets. Shopkeepers raise prices at their will and often sell adulterated edible items. (Source: The Daily Prothom Alo, 15 June 2001). Five per cent of customers are aggrieved by the rude behavior of the shopkeepers (Table-5). Muhammad Abdul Motaleb of Motijheel said he felt distressed at the rude manners of the shopkeepers who behave as if it is the sellers' market. (Source: The Daily Prothom Alo, 15 June 2001). Many people are averse to shopping because the markets are so overcrowded. (Table-5).

A research survey conducted by Razia Begum, Associate Professor of Marketing Department of Dhaka University, found that 17.57 per cent of the married women and 23.64 per cent of unmarried do not like to go the kitchen markets (Source: Razia Begum, Buying Behavior of Educated Professional Women, Dhaka University Magazine No. 45, February 1993).

Table-5

The reasons causing most annoyance during buying in the kitchen markets (Opinion of customers):

Reasons of annoyance	Number	Percentage
Polluted and dirty environment (Foul odour, filth and garbage)	156	78%
Upward trend in prices	10	50%
Rude behavior	12	6%
Overcrowding	16	8%
Noise and bustle	2	10%
Others	4	2%
Total	200	100%

Kitchen market and the tendency to bargain: The relation between kitchen markets and bargaining is almost eternal. But man's preoccupation with the city life has become great nowadays compared to earlier times. Besides, almost all the kitchen markets are afflicted with environmental pollution. The study shows that the tendency to bargain, a distinguishing

feature of a kitchen market, is gradually diminishing. Some 63 per cent of buyers buy goods after bargaining (Table-6). 24 per cent buy goods without bargaining and some 13 per cent bargain occasionally. According to the study, some 15 per cent of buyers do not bargain just to save time, 17 per cent do not bargain just to escape from the pungent smell, 6 per cent due to their confidence and trust in the shopkeepers and 62 per cent for all the three reasons together (Table-7).

Table-6

Customer's tendency to bargaining:

Bargaining tendency	Number	Percentage
Those who bargain	126	63%
Those who don't bargain	48	24%
Those who occasionally bargain	26	13%
Total	200	100%

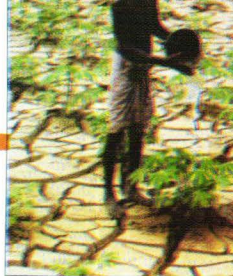
Table-7

Reasons for not bargaining:

Reasons	Number	Percentage
To save time	30	15%
To avoid pungent smell	34	17%
Confidence and trust in shopkeepers	12	6%
For all the above reasons	124	62%
Total	200	100%

Conclusion: There is no end to the problems of the Dhaka city's kitchen markets. Yet every one has to do shopping for their daily necessities. This is the hard fact. Over the years, the environmental problems of the kitchen markets have become very complex. Though Dhaka City Corporation is being blamed for such problems, this organisation is not the only one to blame. The concerned Bazar Committees, traders and even the customers are also directly or indirectly responsible for the environmental pollution in and around these kitchen markets. That is why everyone has to be conscious of environmental pollution and active in resisting it. And for very valid reasons, Dhaka City Corporation has to play an effective role in this regard. The importance and significance of the kitchen markets in considering all the socio-economic aspects of the country are very great. There is, therefore, no scope to treat the environmental problems of the kitchen markets casually. All concerned should come forward to solve the problems of these markets.

Chapter 13



State of land degradation in Bangladesh



Photo: Shahadat Hossain, FEJB



State of land degradation in Bangladesh

M. Reazuddin with Mahiuddin Ahmed

Bangladesh is a signatory (1994) to the United Nations Convention to Combat Desertification (UNCCD). It has also ratified the Convention in 1995. The convention came into force in 1997.

The country faces a host of environmental problems. Land degradation due to aridity and loss of crops due to droughts have caused and are causing considerable economic losses and human sufferings in Bangladesh. As a result of such problems, desertification process has already started in some vulnerable regions of the country.

Bangladesh comprises of the floodplains of such mighty rivers like the Jamuna, the Padma and the Meghna as well as crisscrossed by hundreds of smaller rivers. The Madhupur Tract, the Barind Tract, and the Akhaura Terrace stand slightly above the country's floodplain level and the Hills lie to the East and the North and North-East. The Western-Northwestern parts of the country are generally dry regions. The total precipitation in the dry regions is low but rainfall often occurs in sudden heavy storms, which sometimes lead to largescale flooding and soil erosion.

Between 1960 and 1991, droughts occurred in Bangladesh 19 times. Very severe droughts hit the country in 1951, 1961, 1975, 1979, 1981, 1982, 1984 and 1989. Past droughts have typically affected about 47 per cent area of the country and 53 per cent of the population. An analysis of the relative effects of flood and drought on river production between 1969-70 and 1983-84 shows that drought is more devastating than floods to aggregate production.

Characteristics of land degradation in Bangladesh

In drier parts of Bangladesh, low soil fertility is recognized to be at the root of the land degradation spiral leading to desertification. Around 6.0 million ha of our agricultural land are under sever stress in the context of soil fertility and moisture content and are the underlying cause for land degradation. Land degradation in Bangladesh may be considered as temporary or permanent lowering of the productive capacity of land. Natural processes that lead to land degradation in Bangladesh can be considered part of the ongoing land formation process. During 1983-84 and 1997 period, and 11% decline in total cultivable area, and specifically a 14% decline in cultivated area, has been observed.

Further evidence of land degradation is show on satellite imagery which indicates a definite change in vegetation cover and soil moisture through many of the western regions of Bangladesh including Rajshahi, Kushtia, northwestern Jessore, Pabna, western Bogra and southern Dinajpur. These affected areas are known as the Barind Tract, a largely mono cultural area with shrinking wetlands, notably the Chalan Beel wetlands. Human intervention from densely populated adjoining regions (around the national average of 900 persons per km) makes these areas vulnerable.

There are accounts of groundwater table level going below 8.95 m to 18.56 m in dry season in regions in the northwestern region of Bangladesh. This indicates that most of the shallow tube-wells go below the suction lift capacity in the peak irrigation period. The groundwater levels beneath Dhaka City have fallen steadily over the last twenty-five years in response to continuously abstraction. Water level have dropped and reached a maximum depth of 20 meters below ground surface in 1989 (from about 3 meters in 1965).

These accounts of lower water table levels, decreasing vegetative cover and decreased agricultural yields indicate disturbing trends of land degradation in many parts of western Bangladesh. As a result, alternatives practices to meet the demands for water, fuel and bio-mass have emerged but are deemed to be unsustainable including.

- the use of surface water for irrigation. A problem due to reduced water volume in most of the rivers of northwestern Bangladesh in the low flow season due to upstream utilization withdrawal at increasing rates. This also adversely affects groundwater recharge potential;
- indiscriminate and inefficient use of chemical fertilizer and pesticides. There appears very little monitoring and regulation of these chemicals which may pose threats to the sustainability of agriculture.
- attempts to intensify agriculture and increase the irrigated areas. This has led to loss of bio-diversity through the conversion of forestland into agricultural land, abandonment of many indigenous crop varieties in favor of High Yielding Varieties (HYV), and the resulting depletion of soil nutrients and organic matter due to intensive cropping.

Initiative to combat land degradation

To combat land degradation and to attain sustainable land management and development, current government programs have focused on field-oriented activities in concert with strengthening institutional capacity that would enable policymakers to make informed decisions on best practices and appropriate mitigation measures. The current programs to combat land degradation also include strategies for alleviating poverty because these two goals are complimentary.

Current and completed GoB programmes include:

- Afforestation programs on denuded FD lands, and marginal lands controlled by a variety of other government agencies;
- The Barind Integrated Area Development Project (BIADP) (later renamed as Brained Multipurpose Development Authority (BMDA) started in 1985 covering Rajshahi, Naogaon and Nawabganj districts, was implemented to mitigate the processes of land degradation of the Barind region;
- Soil conservation and watershed management as a major component of the Fifth Five-Year Plan (FFYP). The FFYP also emphasizes to measures to arrest further degradation of the land system and desertification process. The National

Conservation Strategy (NCS) lays down the guidelines for integrating environmental concerns with development imperatives. Some of the longer-term measures that have been suggested under NEMAP have relevance to combating land degradation;

- GoB-developed national plans or strategies in combating land degradation, prior to the convention including:
 - The national Environment Policy;
 - NEMAP;
 - Bangladesh Forest Policy; and
 - The National Water Master Plan (NWMP).

These strategies lay the foundation for promotion of homestead and social forestry, agro-forestry and reforestation of degraded sal forest regions as well as irrigation facilities to the vulnerable land;

- Annual afforestation and tree planting programs between MoEF and DAE activities. These afforestation activities are taken up under various schemes and programs of different ministries of the GoB. Under the Forestry Sector Project (FSP) plantation of 40,000 ha of sal forest are planned during 1997-2003. Other programs and projects include BIADP and SEMP.
- Ecosystem Management in the Barind Area was designed to improve the ecosystem of the dry and degraded Barind and through community based sustainable environmental activities. The environment management action plan for Barind Area was aimed at combating desertification and environmental awareness; social mobilization and motivational type of activities have yet to be implemented;
- Electronic database on agro-ecological and drought prone areas of the country as managed by BARC. The database contains information on the country's land resources including physiography, soils, climate, hydrology, cropping systems, and crop suitability. The Agricultural Research Management Project supports strengthening of the management of the national agricultural research institutes and the promotion of research by private organizations;
- The CCD TrustFund has been mobilized through a

partnership arrangement with MoEF providing funds to selected activities for implementing NGOs.

- Attempts have been made to raise awareness among policy makers on issues related to land degradation through seminar / workshops etc organized by MoEF/DoE involving various stakeholders. The issues covered in various seminars/workshops include.
 - exchange information and experience on land degradation and desertification and effectiveness of existing policies and programs;
 - raising public awareness on the importance of land improvement and its contribution to food production and natural resource management; and
 - deriving a set of priority program areas for National Action Plan (NAP);
 - recommending, *inter alia*, various actions for the NAP process, which are related to the identification and assessment of hot spots and rehabilitation of degraded land; and
 - outlining a program of corrective or remedial measures for combating degradation and desertification in western Bangladesh.

Donor-assisted government programmes include:

- SEMP, funded by UNDP as the follow-up implementation of National Environment Management Action Plan (NEMAP), addresses the major environmental priorities identified by people through NEMAP. It consists of 26 projects components and is being executed by MoEF and implemented by 21 government and NGOs throughout Bangladesh. SEMP will benefit at the grassroots level, particularly women in eco-specific intervention areas;
- Forest Resource Management Project (FRMP);
- Bangladesh Environment Management Project (BEMP), CIDA-funded institutional strengthening project to assist the DoE in meeting its mandate as defined in the ECA 1997;
- Water Sector Improvement Project (WSIP);
- Follow-up on River Bank Protection Project (RBPP);
- Bangladesh Arsenic Mitigation and Water Supply Project (BAMWSP);

- Coastal and Wetland Biodiversity Management at Cox's Bazar and Hakaluki Haor funded by GEF. The threats of excessive cutting of mangrove, fuel wood, beach compaction by vehicles used in tourism, will be addressed through land protection measures, village conservation and sustainable use, and integrated management plans.

The GoB is considering the formation of a National Coordination Body (NCB) under which formal institutional measures for implementing the convention will be undertaken. Six ministries with their associated department and directorate along with NGOs could be the party of NCB to implement the obligation and activities drafted under the convention. The DoE is presently the implementing organ of MoEF and responsible for implementing the mandates of the UNCCD.

The GoB is also considering the development of a separate National Action Program (NAP) in the spirit of the convention. Under the existing policies and programs, the contents of the NAP will aim for resource management and poverty alleviation. A bottom up approach is planned for drafting the NAP involving stakeholders and people at the grass roots level, similar to those who participated on NEMAP. Priority areas have been identified and considered in formulation of the action programs inline with the UNCCD convention. The key actor and stakeholders for the NAP have been identified as government organizations, NGOs specializing in soil conservation and forestry, and Community Based Organisations (CBO), and the private Sector.

Chapter 14

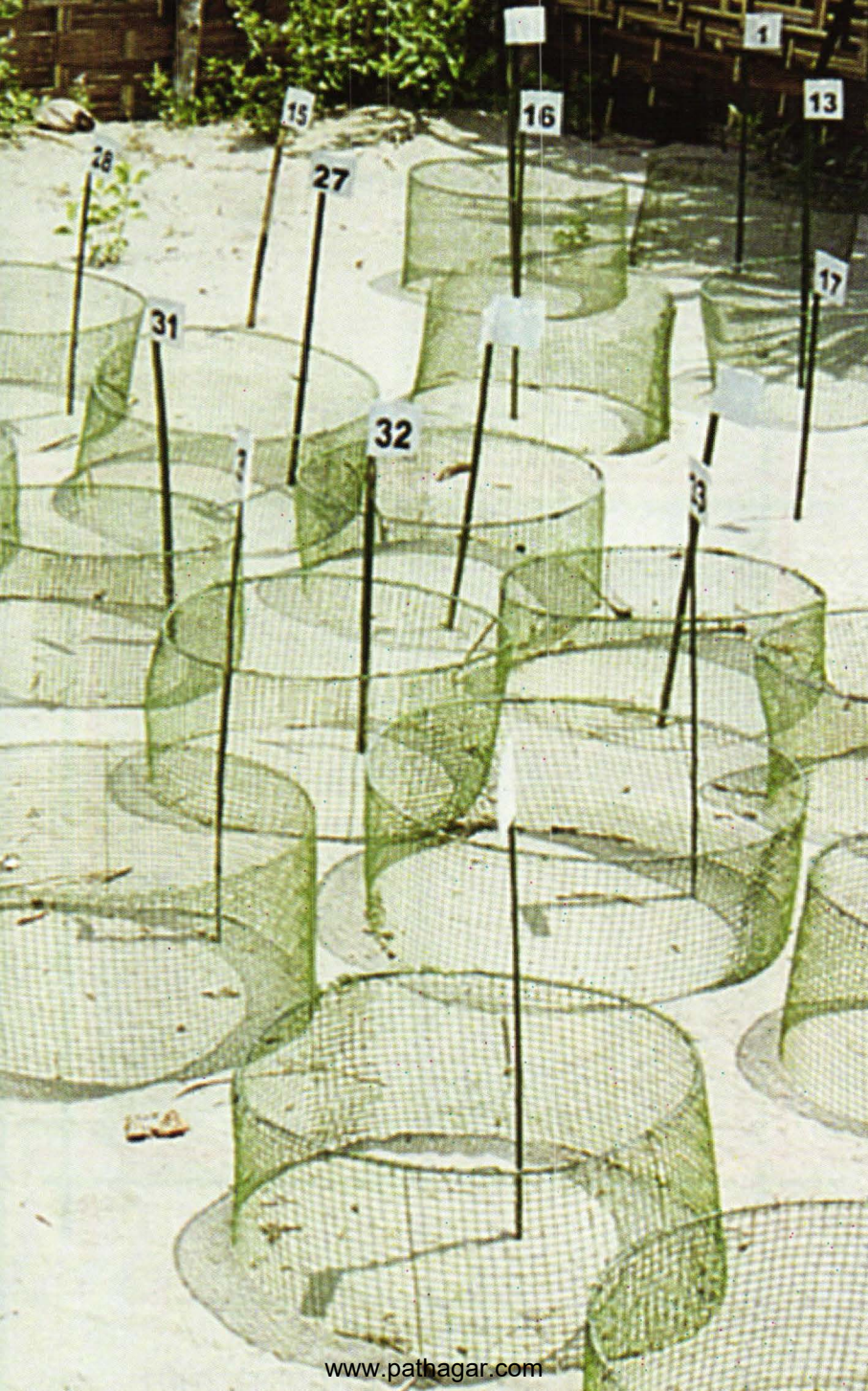


Alarm bell rings in the St. Martin's



Photo: Dr. Ali Reza Khan

Bangladesh
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Alarm bell rings in the St. Martin's

Khairul Anwar

An alarming expansion of human habitat today threatens the existence of St. Martin's Island, the country's only coral island off the coast of southeastern Chittagong region. It has been reported that the natural resources of the island are also being extracted unabatedly. Particularly excessive extraction of coral, fish, snails, oyster, lichen and rocks is destroying the natural and ecological balance of the island. To protect this island, popularly known as Narikel Jingira, the Ministry of Environment has finalised a project. Conservation of biological diversity, setting up of a marine park and an environment-friendly tourist resort on the island are included in the Tk. 13 crore project.

Located in the Bay of Bengal, the St. Martin's Island is separated by a nine-km-wide channel from the mainland Chittagong. The geophysical structure, geographical location and biological diversity of the island have resemblance with those of neighbouring Chittagong and the Arakan Hills. Although small in size, the island is rich in biological diversity with a variety of coral species having made it so important.

A recent survey has found that 66 species of coral, some 300 species of snails and oysters, 150 species of fish, 5 species of amphibians, 5 species of reptiles, 5 species of sea turtles, 15 species of snakes, 200 species of birds and 20 species of mammals inhabit the island. Besides, various species of flora and plants have enriched the island. The survey also observed that a place like the St. Martin's Island--so rich in coral species--is rarely found. The coexistence of coral, lichen and rocks that are found on this island is unique.

The project has been initiated to protect the island rich in natural beauties by setting up of a marine park. This island has

enormous potentials of eco-tourism due to attractive water resources of the Bay of Bengal and the variety of coral species. The project document has proposed to take effective steps for conservation and development of the coral resources of the island, conservation of animal and plant species, and setting up of a marine park. The project also includes plans for setting up of a laboratory for conservation and development of gene-pool of aquatic animals and plants, establishing a breeding center for conservation of sea turtles, creating employment opportunities for the island inhabitants and proper use of the sea resources around the island. The island has been divided into six areas for setting up of the marine park. They are general area, buffer area, coral expansion area, coral conservation area, turtle breeding area and coral sanctuary. The Prime Minister's Office has already approved the project and issued a notification in this regard.

The cry of the coral island

Ahmed Nure Alam

The St. Martin's Island is changing very rapidly. Tourist activities are transforming the lifestyle and environment of the people of the island. According to police, there is no incident of murder or any other crime in the island. Though unbelievable, but it is true that people of the island are not acquainted with theft, robbery or mugging. The society is very conservative here. The rate of literacy among the islanders is very low while the rate of population growth is high. Only one out of 3,500 island women is a matriculate. None of the islanders has got the opportunity to get higher education in any university. Only one person is engaged in government service.

But the island is now on a course of rapid change. A two-km-long road has been constructed at the north end of the island. There is a small three-storied residential hotel. A bazaar or market has been set up in the port area, although neither of them can be called a proper market or a port. The port area has been named so because boats and trawlers cast their anchors at that particular point. Some shops and restaurants have formed the so-called market.

Coming back to the island after around one decade, it has been felt that the islanders are living in abject poverty. But the small island with numerous coconut trees in green crystal water is losing its beauty and charm too. The number of tourists in the coral island is surprising. Hundreds of young tourists are landing everyday on the island. A good number of foreign tourists are also seen. Local UP member Farid Ahmed informed that during winter, the number of tourists exceeds even a thousand a day.

Commuting to the island located in the deep bay is difficult. There is no landing dock or jetty in the so-called

port. It causes difficulties for new tourists. But it does not stop them from coming regularly to the island. The islanders have been demanding for constructing a jetty in the port and introducing a sea-truck service for facilitating communications with the mainland. But this demand has not been met.

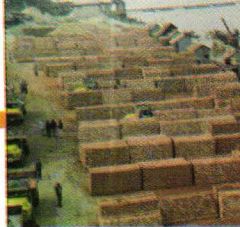
The influx of tourists in the island of eight and a half square kms testifies that tourism is getting popular with the people of new generation in Bangladesh. The young tourists come to this island in search of a variation in life. But the infrastructures on the island cannot cope with the increasing influx of tourists. A 'St. Martin Tourism Guide Center' has been set up at the initiative of a rural physician named Dr. Shafiq. He has a pharmacy business and in addition to that, he provides the tourists with required information on site seeing and lodging facilities on the island. He does not charge any fee for his service but takes whatever the tourists give him being pleased with his service. This private initiative reminds that necessity is the mother of invention. Despite having no major tourist infrastructures, thousands of tourists are coming to the island. This has played an important role in alleviating poverty of the islanders. The face of poverty that I saw here a decade ago has changed. Although most of the inhabitants of the island are poor, the level of poverty is no longer that much acute.

Some islanders have now turned their residential houses into 'hotels' for providing shelter and food to the tourists. A poor man of the island now dreams of how he can repair his wretched house to accommodate a tourist. Most of the islanders live on fishing. Providing services to the tourists is their additional source of earning. Rent of a room for a tourist in a house of an islander surpasses that of a five-star hotel room. Renting house to the tourists has changed the life of the well off islanders. Local UP Chairman Shamsul Alam Master commented that if a bank or any other financing institution comes forward to provide loans, tourism can be developed as the main source of earning in the St. Martin's Island. A

signboard of Sonal Bank can be seen on the island but there is no sign of their activity.

The rural physician suggested that the only-metalled road of the island, if extended up to 'Chenra Dwip', can attract more tourists. The no-man's 'Chenra Dwip' has been named so because it becomes separated from the island during high tide. The local UP member said that if small cottages can be constructed on the 'Chenra Dwip' it will reduce pressure on the main island. Fawn Brawnmithil, a visiting German tourist, alleged that the islanders are too much conservative. He was not given a paracetamol tablet by a pharmacy because he had drunk beer in open public place.

But old values are disappearing day by day. Empty cans of beer and bottles of whisky are seen littered along the beach. An islander said that this change cannot be halted, but at the same time complained that the tourists were cruelly destroying the untold beauty of the island's beach.



Claws stretched to the capital's lakes



Photo: FEJB

Bangladesh
State of Environment Report 2001



Claws stretched to the capital's lakes

Khairul Anwar with Kamal Uddin Sabuj

Life in Dhaka, the capital, has been bedevilled by environmental hazards of all conceivable kinds -- the black smoke emitted by dilapidated automobiles and two-stroke engines, industrial pollution and high lead content in the air along with other toxic particulate matter, and the ubiquitous road dust. The situation is being worsened by the fast expansion of the metropolis, both horizontally and vertically, with its population continuing to swell by the day. Its open spaces and green areas have been shrinking and its natural canals, ditches and lakes are slowly vanishing. All this presents a grim environmental scenario. Let us take a look at the capital's two lakes in the Dhanmondi and the Gulshan-Banani-Baridhara areas that were once known for their natural beauty as well as serving as pleasant leisure spots.

The Dhanmondi Lake has been under the threat of land-grabbers and acute environmental degradation. It is no more the same beautiful lake that it once was. Due to unabated occupation of its banks by encroachers and its multifarious use including bathing, washing clothes and dumping of wastes, the Dhanmondi Lake, which was once a spot of attraction for people in this metropolis, has become a dying water-body. Managed by the Dhaka City Corporation (DCC), the lake stretches from Road No. 2 in the south to Road No. 32 in the north, passing through parts of Dhanmondi, one of the capital's oldest and poshest residential areas.

In December, 1999 the FEJB undertook a physical investigation of the lake that revealed its sorry plight. Between Road No. 2 and Road No. 32, at least 18 different spots were found where the lake was being used for daily bathing by slum-dwellers and vagabonds of all conceivable kinds. And at some points, people were not only bathing -- many of them were using the lake

water for washing their clothes and household utensils. At some points, street urchins were seen diving, swimming and even fishing.

The banks of the lake all around were littered with all kinds of garbage while all kinds of paper, polythene bags, cans and other waste products were found floating on the lake's water. Plastic bottles, leaves falling from lakeside trees and aquatic weeds like water hyacinth were also found in the lake. Nowhere was the lake water fresh or clean -- mostly its water looked greenish with full growth of algae. And most importantly, in some parts the lake became too narrow -- thanks to the gradual encroachment by unscrupulous people.

In mid-1995, Dhanmondi Lake faced disaster when polluted wastes from the city's two storm sewerages were allowed to overflow and mingle with the lake water on the northern side. Since then, the lake has become a dumping ground of all kinds of waste and garbage from the nearby houses, clinics and other establishments. According to a report of the Department of Environment (DoE), some 44 drains and 4 storm sewerages have illegal connection with the lake.

The DoE has reportedly requested the DCC and Dhaka WASA to plug those drain connections. But due to their negligence in addressing the problem, pollution of the lake has continued unabated, local residents as well as some DoE officials said. As a result, fishes were dying on the northern side of the lake and their corpses were often found floating on the water.

The local residents have been the worst sufferers from the pollution of Dhanmondi Lake. Some of them have even approached Bangladesh Environmental Lawyers Association (BELA) for legal assistance against the management of the lake, i.e. the DCC. BELA reportedly sent a legal notice to the concerned authorities.

However, as a follow-up of the newspaper reports focussing on the plight of the lake, the authorities took some measures to plug the sewerages connected with the lake. But these are only stopgap measures, as some residents of Dhanmondi pointed out. They asked for a long-term solution to save the lake from the hands of polluters and land-grabbers.

They pointed out that the most serious problem facing the lake has been illegal encroachment into the lakeside land. Informed sources complained that those who have occupied the land are so powerful that they even defied eviction orders from the highest office of the government. Even after the approval of a Lake Improvement Project in 1997, the number of illegal encroachers rose to 42 from 28. In May, 1998, the PWD, the Department of Architecture and RAJUK had prepared a list of 28 encroachers. According to a survey conducted by PWD in September, 1999 the number of illegal occupants was 37. In a recent list prepared by the recommendation committee of the ministry of local government, the number of encroachers was 42.

Those 42 encroachers, it was learnt, have grabbed some 98 kathas of land valued at about Tk. 20 crore at the current market price. At some places, the encroachers have already constructed pucca or semi-pucca houses on the illegally occupied land. As a result, the project to improve the lake, including construction of sidewalks around it, has come to a halt.

The government formed a three-member committee in August, 1999 headed by a Joint Secretary. The committee was expected to investigate the delay in the implementation of the Dhanmondi Lake Improvement Project, its enhanced cost and other aspects. The report submitted by the committee also acknowledged the existence of extensive encroachment on Dhanmondi Lake.

Background : During the sixties Dhanmondi was developed as an ideal residential area of Dhaka, the capital of the erstwhile East Pakistan. To create a better environment and for the beautification of the area, the lake was dug on an area of 550 acres of land. Trees were also planted around the lake. To keep the Dhanmondi Residential Area clean and provide a healthy habitat, the area was provided with all the ancillary facilities like wide roads, drains and sewerage systems.

But over the years, some of the plot-owners on the lakeside started to encroach silently and illegally to expand their premises and build structures on the occupied land without any

permission from the RAJUK. Meanwhile, many original owners even sold their plots along with the illegally occupied land to other parties.

Among the encroachers, 28 have occupied lakeside land, and 9 have occupied roads, open spaces and footpaths along the lake. Land by the side of drains has also been occupied by some of them. The total area occupied by those 42 encroachers, as has been mentioned before, is some 98 kathas. Five among the encroachers have already constructed buildings on the illegally-occupied land while 29 have established their possession by erecting walls or barbed wire fences.

Across the residential area, many other illegal establishments like kindergarten schools, training centres, restaurants, clinics, diagnostic centres, beauty parlours, rent-a-car establishments, etc. have sprung up here and there. At the dead end of Road No. 26, a cow-shed was built, and recently it has been expanded further.

Besides, plot- and house-owners on the eastern side of the Abahani playground have allegedly occupied about 2.50 bighas with the help of some corrupt PWD employees. About 50 brick-built or semi-pucca houses have been built there.

The Dhanmondi Lake Improvement Projects of 1997 under the DCC envisages a total face-lift and development of the lake by pumping out all polluted water, repairing its banks, roads and sidewalks. It also includes plans for construction of a theatre, setting up a boating club, a childrens' park, a restaurant, a swimming pool, public toilets and creating an island in the lake. All these facilities are to be connected by footbridges.

For developing the Dhanmondi Lake and its adjacent areas, the Planning Commission reportedly approved nearly Tk. 10 crore. The expected deadline for completion of this expensive repair and development work was June, 1999. But in the meantime, the project was revised and the cost also increased. The revised cost of the project rose to Tk.14.82 crore. The revised target for completion of the lake improvement was December 31, 1999.

Because of illegal encroachers, the repair work had been going on at a snail's pace for the last one year. Concerned authorities

required orders for reclamation of the occupied land. But even after the orders were issued by the highest authorities, the unauthorised occupants could not be evicted from the lake and its adjacent areas, informed sources said.

Syeda Rizwana Hasan, Director of BELA, told FEJB that negligence on the part of the management and lack of coordination among the different departments responsible for maintaining and developing the lake is the cause of the deterioration of the Dhanmondi Lake. There is a trend of shifting responsibilities with the PWD and the DCC accusing each other of failure in protecting the lake. "As a result, looking after the lake has been nobody's headache", said the BELA Director.

But more alarming was that in 1994-95, a decision was taken to fill a part of the lake for construction of houses for government officers. However, the decision was later cancelled in the face of protests by the local residents and environmentally conscious people.

The Gulshan-Banani-Baridhara lake, which once used to serve as an environmental relief to the local citizens, has also been gradually shrinking with influential people grabbing the land of the lake. Today it exists in name only -- there is little clean water and no more gentle breezes and greenery along its banks. Garbage and unauthorised establishments -- most of them slums -- and new multi-storied structures and houses have besieged the lake on all sides.

Despite the government's avowed commitment to stop grabbing of the lake's land and to maintain its natural beauty, it has failed to stop some influential quarters from consolidating their hold on the Gulshan-Banani-Baridhara lake. There was a lot of hue and cry over the illegal grabbing of the lake's land, but the encroachments continued unabated. According to sources at RAJUK and the DCC, this lake has an area of over 210 acres of land. It was planned and dug out of the low-lying land in the Gulshan, Banani and Baridhara residential areas, providing the residents with an environment-friendly landscape. But now the lake, which stretched from Banani to the Kalachandpur area, has, in fact, been reduced to a closed pool of polluted water.

Most of the vacant land on both banks of the lake has now been taken over by the illegal occupants, some of whom have already raised multi-storied apartments, reclaiming the lake's land. Slum-dwellers have built their makeshift shanties right inside the lake area. A 20-storied apartment building has been built by Mariam Construction, a real estate developer. At least half of this huge structure has been constructed on the land of the lake. Another multi-storied building, near the American Embassy at Baridhara, has been constructed illegally, occupying land from the lake. On the west side of the lake, a hospital is being constructed at Road No. 71 in Gulshan. Besides, other dwellings are being raised on land grabbed on both sides of the lake. In the Taltala area, a locally influential leader has reportedly established slums by illegally occupying land of the lake. An investigation in Gulshan, Banani and Baridhara areas revealed that the occupants were mainly real estate developers, political leaders, influential persons of the society and bureaucrats and officials of the RAJUK. Many of them have grabbed the land of the lake to expand the areas of their own plots. Sources in RAJUK informed us that about 32 acres of the Gulshan-Banani-Baridhara lake and 13 acres more on the sides of the lake have been under illegal possession.

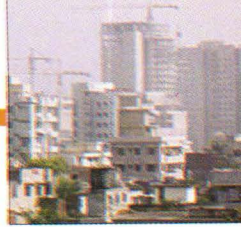
RAJUK officials were reluctant to reveal the names of the illegal occupants. Though there is some vacant land on the banks of the lake on its eastern flank near No. 2 Gulshan bridge, there is no vacant land on the western side. So, the Gulshan-Banani-Baridhara lake has lost the characteristics that a recreational lake should possess. There are some trees on the bank of the lake, stretching from the eastern side of No. 2 Gulshan bridge to Kalachandpur. But despite the presence of some greenery, there is no arrangement to use the open space as a park. The Banani part of the lake has become a grazing ground for cattle. Though a signboard has been put up there strictly prohibiting washing of clothes, fishing, raising of dwellings and cultivation inside the lake area, it is not heeded. People are seen bathing and washing their clothes in the lake water. Local people said the dirty clothes from adjoining hospitals and clinics are also being washed in the lake, further contaminating its water. There are also some unauthorised nurseries selling plants.

At many places inside the lake area, signboards have been put up with the names of the owners of the land. Worse is the condition of the northern parts of the lake near the Kamal Ataturk Avenue at Banani. Though some slums were demolished there, quite a large number of 'kutchha' toilets inside the lake can still be seen. The water here is so polluted that even the local slum dwellers do not use it. Unscrupulous people have resorted to dumping all kinds of garbage and wastes for landfill in this part of lake. Some small-scale dairy firms have also developed on the bank of the lake and a large amount of cow-dung is being drained into its water.

All government moves to evict the land-grabbers and restore the beauty of the lake have so far made little headway. Following a formal announcement on April 4, 1999 the RAJUK launched an eviction drive against the illegal occupants of the lake's land. But the drive ended in a fiasco. The RAJUK had carried out similar eviction drives on earlier occasions, but without much success. After the new government took over in 1996, a circular was issued from the Prime Minister's Office, informing RAJUK that it would require approval of the highest authority if any quarter wanted to fill up natural pools, lakes or canals. Under no circumstances, the circular said, could any lakes be filled up or any natural water-flow be changed without permission from the Prime Minister's Office. But contrary to that circular, much of the land of the Gulshan lake has been grabbed in recent years. The eviction drive last April only resulted in the removing of some signboards and makeshift shanties.

Meanwhile, the BELA and the Gulshan-Banani-Baridhara Welfare Society have filed a case in the High Court against the construction of houses by grabbing the land of the Gulshan-Banani-Baridhara lake. It is now pending before the court.

Chapter 16



The changing face of Dhanmandi



Photo: Bulbul Ahmed, FEJB

Bangladesh
State of Environment Report 2001



The changing face of Dhanmondi

Syed Abdal Ahmed

The environment of Dhanmondi, one of the posh residential areas in capital Dhaka, has changed drastically over the last decade. The bungalow-type one-floor or two-storied houses with their spacious lawns and gardens under the tall green trees are now gone. Those green, peaceful and healthy features of Dhanmondi residential area have vanished, giving way to a jungle of concrete, high-rise apartments and shopping centres. All this transformation has taken place just over the last few years. The condition of the once-famous Dhanmondi lake is also very sordid.

The face of Dhanmondi changed in three ways: its transformation from a residential area to a veritable commercial area, building of multi-storied high-rise apartment buildings and the degradation and subsequent renovation of Dhanmondi lake. This once exclusive residential area is today the home of hundreds of kindergartens, schools, colleges and private universities and computer training centres. Besides, there are innumerable clinics, hospitals, diagnostic centres, shopping malls, hotels, restaurants, community centres, fast food outlets, beauty parlours, banks, offices of insurance companies, NGOs, pharmaceutical companies and foreign missions. Even government also set up some offices in rented houses in the area. As a result of all this, Dhanmondi become an overcrowded. area. The transformation has been specially very fast in last 2-3 years.

Today, Dhanmondi bears different features at different times of a day. Some roads become busy before school hours as well as at the time when the schools break. The main thoroughfares from the Science Laboratory crossing up to Road No. 27 crossing experience heavy traffic jam during peak office hours. The roads around the community centres where wedding

receptions and other functions are held remain overcrowded at noon as well as at night. At some places, bricks, sands and other building materials are piled up obstructing easy movement of vehicular traffic and pedestrians. Youngsters assemble in groups on the pavements around mobile food and drink vendors. And on top everything, there are scores of dustbins and garbage dumps vitiating the environment of this once serene residential area.

Of late though, some renovation work has been done to reclaim the Danmandi. It has of course improved the condition of the lake and beautified the area. But after the sunset, the lakeside and adjoining areas are reportedly taken over by drug addicts and anti-social elements. The rate of hijacking and dacoity in the streets of Dhanmondi has also reportedly gone up. The population of the area has also increased several times. Ten years ago, the population density in Dhanmondi was only 327 persons per square mile; it has now increased to several thousands per square mile. While hundreds of high-rise apartments have been constructed, civic amenities like water supply, power supply, etc have not been increased proportionately. Such services like sewerage, telecom and disposal of domestic wastes have not been upgraded to keep up with rising population and commercial activities in the area.

Before 1950, the entire Dhanmondi area was paddy field. Dr. Muntasir Mamun, a Dhaka University professor of history and a researcher on Dhaka city wrote: "During the Mughal rule, an Eidgah was built in Dhanmondi near Satgambuj Mosque. Paddy and other crops were sold at the weekly market place there. Since those days the area took its name as Dhanmondi." It was later, during the Pakistan time, the government of East Pakistan decided to develop Dhanmondi as the capital's first residential area.



White-winged duck ditched forever?



Photo: Dr. Ali Reza Khan



White-winged duck ditched forever?

Dr. Reza Khan

White-winged duck or white-winged wood duck, popularly known in our hilly region as Bhadi Hansh, lives in lush evergreen and semi-evergreen forests, termed high forest in the papers of Bangladesh Forest Department. This was entirely confined to the erstwhile Chittagong Hill Tracts District that is currently Rangamati, Khagrachari and Bandarban hill districts. It did not occupy the whole of the forest but patches like Pablakhali and its neighbourhood.

About half a century back it was a hay day for Bhadi Hansh as it enjoyed a kind of protection from the tribal Chakmas and a handful of forest personnel who lived there. It had very few enemies that included sunken fishing nets and collection of a few ducklings by the tribal people. Other than these, Bhadi Hansh had a wonderful time with plenty of huge tall trees. These were dominated by Civil Swintonia floribunda, Chundul Tetrameles nodiflora, Uriam Mangifera longipes, Garzan Dipterocarpus turbinatus, Chaplish Artocarpus chaplasha, Dhaki Jam Eugenia grandis, Shimool Bombax ceiba, Shil Kori Albizzia procera, Chakua Koroï Albizzia Chinensis, and Bandarholla Duabhangia sonneratia. Also there were plenty of water bodies that included Kassalong River, many ox-bow lakes and innumerable chars or feebly flowing streams that formed the life line for the forest.

The hay day for the Bhadi Hansh did not last long. With the commission of Kaptai Hydro-electric Project, several thousand square kilometers of Kassalong valley from Marishsha and Massalong to Rangamati and Kaptai in the CHT district were inundated. As a result, Bhadi Hansh had to change its strategy for survival. The most common problem that it encountered was an increase in the vast quantity of water that flooded their favorite feeding places in charas. However, in two decades,

Bhadi Hansh was able to adjust itself to the changed condition and seemed faring well in the late 1970s and early 1980s. At that time there were about 20 pairs of Bhadi Hansh in the country.

International status

The Bhadi Hansh currently lives in parts of Assam in India, parts of Myanmar, Indonesia and Thailand. Its total world population is about 2000 specimens. It is in the critically endangered species list of World Conservation Union. Also, it's in high priority list for protection as per the National Red Data Book of Bangladesh, that is in the final stage of printing.

Now let's see what happened to 40 or so Bhadi Hansh that lived in Kassalong Valley forest during the early 1980s - Around 1980, the then Bangladesh government decided to settle the plain-dwelling Bengali-speaking Bangladeshis in many parts of CHT and Bandarban districts. These areas included both reserved and unclassed state forests. The settlers were allotted an area of 5 acres of forest land per family. Although only 20,000 families were settled, we have lost 1,00,000 acres of forest. The settlers not only removed plants from the forest areas allotted to them but also started felling trees and clearing jungle from the neighbourhood of their settlements. As a result, forests were being cleared of plants at an alarming rate. Pablakhali Wildlife Sanctuary had an area of about 42,000 hectares. Out of is, nearly 10,000 hectares had been reserved to settle the plain-dwellers.

Prior to 1971, the tribal people, 80% of whom were Chakmas, inhabited the entire CHT district. The remaining were Pankhus, Kukis, Mizos and Nagas. Almost all the tribes practiced slash and burn, shifting or Jhum cultivation. As per an old report of the Forest Department dating back to the 1960s, there used to be 60,000 Jhumias in the CHT. Each Jhumia used to clear trees and burn vegetation of at least three acres for Jhum cultivation. This rotated on a 3- year cycle. Thus the annual destruction of forest amounted to roughly 60,000 acres. Ultimately many such areas had been included under the Unclassed State Forest (USF). Tribals and their Jhum practice are ages-old. The Forest Department (FD) of British era started forestry activities as early as late 1870s. They practiced clear-felling of all timber and commercially important trees and then allowed the Jhumias or

forest villagers to remove the unwanted vegetation and burn the whole area to get ash as manure for the Jhum plants. FD first started working with a programme under prescription from the working plan division. The process of clear-felling was and is still the most detrimental forestry practice in the world.

To add fuel to the fire, certain sector corporations were given the right to develop roads or timber extraction routes and trails from deep forest to the collection centres. All the above processes of forest destruction were in place prior to the settlement of the plain-dwellers in the early 1980s. It seems that the settlers have destroyed more forests in the past 20 years than what the Jhumias and FD did during the past decade or so.

The process of forest destruction reached its all-time peak during the tribal insurgency in the entire forest areas of former CHT from 1980 up to January 1998. It seems that all quarters involved in the conflict took part in the wholesale destruction of forest and killing of wild animals.

The process of forest destruction climbed a second peak after the insurgents, Shanti Bahini, surrendered their arms in February as per the Peace Agreement. I reached the Pablakhali area on 18th February for a 4-day survey of Bhadi Hansh and other wildlife, as I could not visit the area after 1981. I was horrified by the way government forests were being cut and burnt by all factions of Chakmas and settlers. There was a total lawlessness in the area. No law-enforcing authorities were visible in the forest areas and there were none to see what was happening inside the wildlife sanctuary. I spent four days in the sanctuary area and went as far deep as 5 km east of Amtoli area where all law-enforcing units and FD personnel were stationed. During this period, I talked to many Chakmas and settlers but none could give me any clue to the presence of Bhadi Hansh. As it was winter, I thought of visiting the area again in summer so that I can check whether this duck exists in the area.

With assistance from the Forum for Environmental Journalists of Bangladesh and Centre for Advanced Studies at Dhaka, I paid a 6-day visit to Pablakhali Wildlife Sanctuary and its neighbourhood that included areas between Myni Mukh and Shishak Mukh. I was assisted by a wildlife researcher with a postgraduate degree. During 50 hours of intensive fieldwork covering both daytime and twilight hours, we did direct

observation, both with naked eyes and with the aid of binoculars. We interviewed chakma villagers, headman and korobaris, Bengali settlers, forest personnel and fishermen, both in the field and in market places.

Our result

The prospect of the presence of Bhadi Hansh in Pablakhali area is bleak. Out of two dozen people interviewed none but one said they had seen this duck during the past decade or so. One chakma boatman at Dhoopchari Bazar said he had seen a pair of this duck in a low-lying marshy area at the mouth of Shishak River. That sighting is two years old.

We checked the reported spot but saw no Bhadi Hansh. Although there was a good population of Lesser Whistling Duck and a few Pygmy Goose or Cotton Teal, it should be noted that people often confuse this duck with the Bhadi Hansh.

● We saw nearly 80 species of birds, 12 species of mammals, 8-9 species of reptiles and 9-10 species of amphibians during our field trip.

The sad thing is that birds that we encountered are the species that are very common in the neighbourhood of human beings. There was a super abundance of Go Shalik/Pied Myna, Bhat Shalik/Common Myna, Jhuti Shalik/Jungle Myna, Shuichoora/Small Green Bee-eater, Nil-lej Shuichoora, Fingey/Black Drongo and Chorui Pakhi/House Sparrow.

The presence of these species in greater abundance indicated that the forest has been denuded and the population of human being increased in an unprecedented number providing food and shelter to these opportunistic species of birds that flourish in disturbed habitats.

Another trend I noted is that in the late seventies, during day trip in the forest, we would encounter nearly 80 species of birds. Now in a day, we saw just a little over 40 species of birds.

In earlier times, we used to see many specimens of Roktochusha, Anchil or Anjan along our trails. During the present trip of six days we saw less than half a dozen specimens of these two species. On the other hand, the number of house

geckos has increased manifold, as there are more household units and shops with electric supply. Many insects are attracted by the florescent light, that in turn attracts geckos and allows them to breed in profusion.

No typically forest-dwelling amphibian was found during the trip.

The worst was the total disappearance of tall, natural as well as planted trees. As far as the eyes go, a range of 5 km and above, I could not see any good tree that was over 15m in height. A civit tree grows to a height of 35 m, Uriam and Garjan up to 25m and Kroroi up to 20m. It seemed FD raised monoculture of Teak, Koori and Gamari. Gamari and Garjan have not withstood the wholesale lumber poaching.

Another phenomenon that seemed terribly disturbing was the way Jhumias were cutting down reserved forests, burning the vegetation and converting forest areas into Jhum rice fields.

As there is literally no commercially significant timber in the forest within a few kilometres of concrete road or waterways, the lumber poachers and firewood collectors, - both tribal and settlers, have turned their attention to the teakwood trees. It was a common sight to see people carrying head loads of teak. Others have stacked the teak logs by the side of road with a view to transporting those to nearby business centres. It appeared that no officials are ready to move beyond their place of work considering that there is lack of social security. The tribal on one side and settlers on the other are exploiting this situation. Thus there appears no way of stopping the wholesale destruction of forest. However, in a few cases, forest officials were able to confiscate logs worth 17,000 cubic feet of teakwood in one station and more than that in a neighbouring Forest Beat office.

What should we do now?

- All efforts must be made to locate a spot that still holds virgin or natural forest within the Kassalong Valley. I understand there are some good forests still left in Sajek Valley. Such a natural forest must be saved at all costs. Reasons are simple. Such a forest will be able to supply all the seeds /saplings of forest trees and other plants that are needed for regeneration, recreating and raising new forests.

This will work as a reservoir for wild plants and animals. It will definitely be a unique place so far as our biodiversity is concerned.

- Stop practicing monoculture of teak or other commercially viable species but start recreating forests with indigenous species in areas still under possession of FD.
- A dialogue must be initiated with the local tribal headman and korobaris on one hand and other parties dependent on the forest produce. The sooner it is done the better.
- Any Bhadi Hansh found should be protected. Attention must be paid to locate the roosting and nesting area of such a pair of Bhadi Hansh. If successful, attempts must be made to collect eggs or chicks of Bhadi Hansh to hand rear (incubate) the eggs/chicks. This must be done within the sanctuary area and in any other suitable captive breeding centre in the country. Even international cooperation might be sought for this.
- FD must ensure the stopping of all legal and illegal forestry activities within the area of forests controlled by them in the region.
- Sale of wild animals, live or dead, and their parts in local market should be stopped.
- All settlement activities in the forest areas must be stopped at the earliest opportunity.
- Jhumias need to be provided with alternative technology of rice cultivation.
- Food subsidies to them need to be considered.



Wilderness in the woods

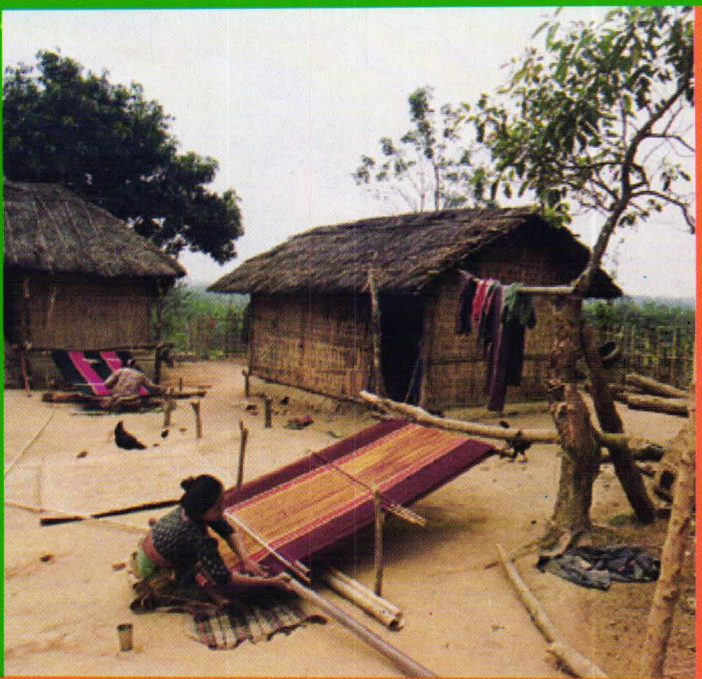


Photo: Azizur Rahim Peu, FEJB



Wilderness in the woods

Quamrul Islam Chowdhury

All 14 grassroots, three district and one regional workshops completed charting the sustainable future of hill districts of Bangladesh. Will the face of the CHT change? Is it an epic in the making like the globally acclaimed NEMAP or will it be lost in the deep woods?

Grassroots-level people seized the opportunity. They took the lead. Consultants took a back seat. The eyes of the hilly people were bright with eagerness. Getting an opportunity at last to pass on their views to the enablers, they enthusiastically pinpointed different sets of problems of different eco-specific zones of the three different hilly districts. They also came up with different sets of solutions. And in addition to that, they also pointed out the government bodies and other agencies, including those of the donors, who would be most effective in implementing the solutions. They argued with each other over different strategies to shape a sustainable future. This was a sort of revolution that came about through a series of some 14 workshops held in three months, allowing the audience to have the floor, with officials and consultants taking the back seat. The wave of audience participation went from Thanchi in Bandarban to Panchhari in Khagrachhari. Their recommendations were published in three district level workshops and finalized at the regional workshop. It took more than a year from launching workshop to final workshop both held in Rangamati.

These people were far more vocal than those who had participated in the 26 grassroots-level workshops held across the rest of the country during the formulation of the National Environment Management Action Plan (NEMAP). The hilly people were so conscious of the dependence of their future on the health of the environment that they vigorously called for

the rapid implementation of the people's participatory environment management action plan for the Chittagong Hill Tracts (CHT) to help restore and maintain the region's ecological balance.

Participants at the four grassroots-level workshops in Bandarban identified some problems that were not aired at the six workshops in Rangamati district. Some of those were not identified at the four grassroots-level workshops in Khagrachhari district. But there were some common problems shared by the hill districts.

"The face of Chittagong Hill Tracts will change," said K. S. Prue, a member of the royal family of Bandarban, adding that once the ball starts rolling, things will take a different shape and environmental problems will be resolved easily. "Preserve our forests, our heritage, our culture of conservation. The Hill Tracts is the finest jewel in the crown of Bangladesh," he said.

Daw Nai Marma at Thanchi, the first grassroots-level workshop on November 18, 1999, fully agreed with him. She, along with about 100 participants at that workshop, demanded early execution of the CHT-NEMAP. To them it meant an end to the encroachment into the deep forests of the most remote south-eastern hilly area of Thanchi, which can be reached after a 15-hour journey by a motorised boat from Bandarban district town. From Thanchi to Panchhari people came up with their own environment plans. They participated in an unprecedented manner. Everywhere 100 to 150 participants from seven different professional groups took part in the crafting of the CHT-NEMAP. "It's a unique experience for me to actively participate in such a workshop to help formulate our plans," said Purbah Marma, headman of Manikchhari. Dipali Chakma, a farmhand of Matiranga, echoed Purbah. Chang Khisa, former headmaster of Khagrachhari Government High School, warned, "Please don't play with us. Implement this environment plan without delay. Our hopes are high. Don't dash them."

The beauty of the formulation process attracted numerous participants. The marvel of the consultation centred on the voice of the grassroots-level people. The participants in all the workshops identified over 30 issues of concern, out of which

10 were common to all of them. Among the common issues identified were forest depletion, depletion of fisheries, scarcity of drinking water and irrigation water, health and sanitation, river-bank erosion, lack of environmental education and awareness of the malaria menace.

They further suggested extensive afforestation, strict enforcement of laws, scientific cultivation on the hills, installation of ringwells, tubewells and deep tubewells, re-excavation of ponds and rivers, water conservation, use of alternative sources of energy and creation of mass awareness.

The participants identified the main problems as lack of electricity and communication facilities, unemployment, poor marketing facilities for agricultural and other produce, lack of cattle, attack by wild elephants, pigs and rats, killing of migratory birds, pollution of river water, jhum cultivation, and lack of mother and child healthcare.

The last workshop of the series held at the Khagrachhari Government High School was jointly organised by the Environment Ministry, the Chittagong Hill Tracts Affairs Ministry, the Regional Council and UNDP on February 26, 2000. The inaugural session was addressed by the Director General of the Department of Environment A.R. Khan, editor of The Independent Mahbubul Alam, Environment Ministry's Dr. Mahfuzul Haque, chairman of the Forum of Environmental Journalists of Bangladesh Quamrul Islam Chowdhury, Deputy Commissioner of Khagrachhari Ashraf Makbul, the Environment Ministry's Omar Ali and Sunil Kanti Bose and the NEMAP-CHT Consultant Jana Bikash Chakma.

The process of framing an Environment Management Action Plan for the three districts of the Chittagong Hill Tracts was kicked off at Rangamati on October 26, 1999. The chairman of the Chittagong Hill Tracts Regional Council (CHTRC), Jyotirindra Bodhipriya Larma (Santu Larma), who presided over the preliminary workshop, emphasised the need for evolving a pragmatic environmental management action plan to maintain ecological balance in the country's hilly region.

The participants present at the launching workshop also filled

in the questionnaires [around 300] and submitted them to the facilitators. They were given more copies of the questionnaires with a request to get them filled them up by their friends, colleagues, neighbours and then mail them to the Programme Management Unit, SEMP.

It was observed that people of these places responded very warmly and expressed deep appreciation for having been consulted prior to the preparation of the NEMAP-CHT. The active participation of women, headmen and karbaris, who appeared to be very keen to shape their future in an eco-friendly manner, made each of the workshops interesting and significant and offered ample grounds for hoping that environmental issues would be given due importance by the people of the CHT.

As the groups differed in their professions and livelihoods, their identification of problems naturally had some professional bias. For example, farmers focused more on problems of agriculture, such as water, pesticides, polythene bags and stampedes by wild elephants, while the women put priority on drinking water and health/sanitation issues. The teachers focused on lack of education and environmental awareness, while the government officials identified absence of officials from duty stations, lack of communications and infrastructure and the land question as major problems. People's representatives and headmen/karbaris put priority on afforestation and alleviation of poverty, while the social workers identified poverty, deforestation, illiteracy and drug addiction as the major problems. Identification of priority problems was also influenced by the varied topography of the six thanas. For example, participants from Jurachari and Longadu valley areas were concerned more with the water level at Kaptai lake and irrigation problems, while participants of steep and hilly Barkal were concerned more with drinking water and livestock breeding. The solutions offered by the participants also reflect their educational levels. For example, tribals and local communities offered solutions based mostly on local resources and indigenous knowledge, while the government officials offered structural solutions like building of larger dams across the streams.

In all the areas, participants focused on issues that concerned their immediate neighbourhoods, livelihood and security. Naturally, the problems were mainly concerned with the economic and physical survival of the local communities. Obviously the issues of deforestation, jhum tillage, agriculture, fishing and health/sanitation were common to all the seven groups. The government initiative of expanding the Reserve Forest did not find favour with the participants. Instead, they suggested social forestry and community management. The hill people also put emphasis on settling the land disputes for sustainable environmental management of the area. As most of the local people were very poor and illiterate, they put the blame for environmental degradation mainly on poverty and lack of education. Instead of outright banning of the age-old jhum cultivation, the participants suggested alternative options of employment and eco-friendly jhum cultivation, if there is any such thing.

Participants from all the six thanas surrounding the Kaptai lake alleged that the Power Development Board was not following the "Rule Curve" in maintaining the water level at Kaptai lake. Instead of 99 ft. MSL [mean sea level], 103 ft. MSL was maintained on 18 January, 2000. Due to the high water level, farmers could not cultivate their rice fields. They suggested that the water level be kept at 60 ft. MSL, allowing them to cultivate the fringe land.

The participants in all the places suggested the option of storing rain and fountain water for satisfying the need of drinking water. Death due to malaria was identified as a major issue of concern everywhere. Headmen and karbaris raised the issue of poor agricultural production, lack of electricity and land erosion. They suggested that instead of MPs, their representatives should be included in the Forest Committee for issuing permits, and the Forest Department should be put under the Regional Council.

The social workers suggested that the mother tongue of each tribe be made compulsory from grade three. They also opined that local tribal teachers should be recruited for primary and secondary schools. The teachers raised issues like flash floods, drought, difficulties in ploughing hillocks, etc. Government

servants and the journalists mentioned issues like hill fires, unplanned agriculture and invasion of agro-chemicals. They also said that the unwillingness of the government servants to work in the CHT has created obstacles in the implementation of development projects.

The ultimate solution for environmental degradation in the CHT districts lies in the easing of heavy biotic pressure on natural resources. This has to be done through alleviation of poverty, creation of employment opportunities, provision of health services and educational opportunities, and, above all, through settling the land question.

The major environmental issues identified by the participants of these grassroots-level workshops are the following:

- **Deforestation, denudation of hills and slaughter of wildlife:** The participants alleged that as the hills are khas land, people indiscriminately fell trees to meet their daily need for fuel or other purposes. They also blamed corrupt forest officials, traders, and persons involved in illegal cutting and trading of timber for denuding the hills.

- **Adverse effects of Jhum cultivation:** They pointed out that Jhum is practised mainly by the tribal community on the upper ridges of the hills. It is a traditional method of agriculture. Tribal people and a good number of participants were against banning Jhum cultivation. They suggested that other practices like terracing and use of Jhum land for horticulture and cultivation of spices should be explored. The point that they underlined was that alternative means of livelihood for the Jhumiya people should be provided before taking any action against Jhum tillage.

- **Poor communication system:** At Thanchi, and also at Lama, people were very concerned about the poor communication system of the area, particularly the absence of a viable link with the district town. Some groups identified it as their first priority. The Shangu river is navigable only for five months a year. It takes 15 hours to reach the district town by motorised boats and two days by road. The roads being built by the Bangladesh army are expected to be completed by 2002.

The terrain is difficult and hills have to be cut for the roads. Some local people suggested the building of ropeways, if possible.

- **Scarcity of drinking water:** Very few tubewells were seen in the three hilly districts. Ringwells do work occasionally. People mostly drink Jhiri [rivulets from the hills] water. They suggested that water could be conserved in the Jhiris by putting up dams -- a very costly proposition, and far from environment-friendly. Others suggested facilities for year-round storage of rainwater.
- **Malaria and water-borne diseases:** At Thanchi, workshop participants witnessed the death of a child due to cerebral malaria. They suggested compulsory use of mosquito nets and introduction of health education among the local people. A Malaria Research Centre at Bandarban has been long overdue.
- **Health and sanitation:** General malnutrition and poor sanitation were identified as the main problems in the health sector. The participants suggested health education and curriculum development, to begin with.
- **Hill cutting and extraction of stones:** Participants blamed the faulty permit system introduced by the district administration and corrupt practices and called for strict enforcement of laws.
- **Flash floods and natural disasters:** It was observed that hilly rivers passing through V-shaped gorges could inundate the banks. Thanchi and Lama bazaars are regularly deluged by flash floods from the Shangu and Matamuhri rivers. Panchhari is flooded by Chengi river. The affected areas remain waterlogged for a few days after every flood and thus sustain severe damage. The areas are often lashed by cyclones. Landslides are a common occurrence during the monsoon. People blamed increasing siltation of the rivers due to soil erosion, deforestation, faulty agricultural practices, etc., for the landslides. At Lama, participants suggested digging a river loop to prevent regular flooding.
- **Soil erosion:** Participants pointed out that soil erosion was mainly due to faulty agricultural practices and deforestation.

- **Ignorance of environmental issues:** All the groups suggested that environmental education should be introduced in the region. They also stressed that more and better schools should be set up. In the hills, there are a good number of one-teacher schools.

- **Excessive drinking:** Alcoholic addiction is prevalent among the tribal community, and participants at the Thanchi workshop identified it as a major social problem having adverse impact on the environment. This is because such addictions cause poverty, which leads to over-exploitation of natural resources.

- **Attacks by wild elephants:** Farmers at Lama complained about the on-again off-again incursions by wild elephants. They demanded that the local administration take effective measures to protect the villagers against such attacks.

- **Invasion of polythene:** At Bandarban, Nakhongchhari, Panchhari, Khagrachhari and Matiranga, some participants identified the large-scale use of polythene as an environmental menace.

- **Tobacco cultivation on the Matamuhri and Maini banks:** Participants at Lama and Dhiginala complained about the adverse effects of tobacco cultivation by the multi-national companies. A considerable acreage of woodland is lost to tobacco cultivation each year, they pointed out, alleging that tobacco, being a mono-crop, was adversely affecting horticulture and vegetable production. Women's groups, in particular, were against tobacco cultivation. Others said that instead of totally banning tobacco cultivation, which generates employment, the authorities should find out methods of eco-friendly production of tobacco in the region.

At the Khagrachhari grassroots-level workshops some of the participants identified cluster villages as a problem. This opinion was not aired in the other two districts.

After the completion of all 14 grassroots-level workshops, three district-level workshops held in mid-April and the regional-level workshop held in June to finalise the CHT-NEMAP

environment plan. That is the silver lining for the hilly people. But the 'grassroots voice' might get lost in the deep woods of the hills. The marvel of the consultative process should be sharpened. The entire CHT-NEMAP mosaic should be built upon the foundation laid by the grassroots people. District-level workshops maintained the same participatory planning methodology practiced in all 14 workshops. At the district level, project identification received the higher priority rather than mere concentration of problems alone. Validation work completed at the three district-level workshops. Then, at the regional workshop, the draft action plan for CHT has been finalised by the people.

The grassroots-level people have outlined some of the doable programmes for their sustainable development. These programmes have been fleshed out at the district and regional workshops so that they can be implemented fast. Any delay in execution will only add to the deep frustration of the people of the CHT.

Hope in the hills

Shamima Chowdhury

Resentment was brewing up in their hearts for a long time. Tobacco was being cultivated in their paddy fields, their forests were being destroyed, the green hills were being burnt for Jhum cultivation, soil from cut hills was being used to fill up the hill rivers. And their children were dying of malaria in front of their eyes and they could do nothing about these.

While they faced such numerous problems, none came forward to show them a way out. After signing of the peace accord between the government and a section of separatists hill people, the Ministry of Environment and Forest (MoEF), with assistance from the United Nations Environment Programme (UNEP), came up with an environmental management programme to solve the problems of the people of the three hill districts. A series of nineteen workshops were held in the three hill districts of Rangamati, Bandarban and Khagrachari from 1999 to 2000. These workshops virtually opened up the eyes of the hill people.

People from seven professions and classes took part in these workshops. They included the teachers, government officers and employees, journalists, farmers, housewives, social workers, tribal headmen, businessmen and public representatives. In each of the workshops, 100 to 150 people on average took part and explained their problems and asked for their solutions. They identified 20 to 25 problems that were posing hindrances to their development. These problems are: poverty, illiteracy, lack of employment, deforestation, hill cutting, killing of wild animals, adverse effects of Jhum cultivation, primitive communication system, scarcity of drinking water, malaria, diarrhea and other health problems, flood and natural disasters, attacks of wild elephants, polythene, tobacco cultivation, etc. There are differences of problems among hill-surrounded Bandarban, comparatively plain land of Khagrachari and the

monsoon-wet Rangamati. But their core problem is same: the hill people want a structural change in the light of their traditional knowledge and availability of local resources.

Gazendra Chandra Tripura, a farmer from Matiranga Thana of Khagrachari, came to attend one of those workshops of Sustainable Environment Management Project (SEMP). His main occupation is Jhum cultivation. He is aware of the fact that Jhum cultivation destroys the hills. But despite that, he has to depend on Jhum cultivation. He does not know any other skill. Thana Agriculture Officer of Manikchhari, Tapan Chowdhury, said it is the abject poverty that is responsible for degradation of natural environment of the hill area. Without cutting and selling wood from the hill forests and without Jhum cultivation, the hill people cannot earn their livelihood. The Jhum Cultivation Act of 1962 has not been updated till today. As per this law, there should be an interval of 26 years between two Jhum cultivations. During this interval, the soil gets back its fertility lost in one crop season. Even 15 years back, this gap was of 10 years. Now it has come to three years. For Jhum cultivation, hill forests are burnt and seeds of paddy, wheat and other vegetables are sown together in small holes over the hills. But excessive and unplanned cultivation is reducing the soil fertility of the hill areas. Land degradation is increasing, causing desertification of the hill areas.

Crabai Marma, a 60-year-old female farmer from the village Guimari of Matiranga Thana of Rangamati, said her long experience of farming brought home the fact that Jhum cultivation did not bring any good for them. Due to moving from hills to hills and one village to another for Jhum cultivation, they could not give attention to the education of their children. Rather, they have destroyed government forests and trees planted by their forefathers. Birendra Tripura, an 80-year-old farmer from Pancchari Moratila, also echoed the same view. He told stories of the deep forests to his grandchildren. Crabai Marma, Birendra Tripura, Gazendra Chandra Tripura and other farmers participating in the workshop said that they would not do Jhum cultivation if they were provided with alternative occupation.

But for deforestation, poverty and Jhum cultivation are not

responsible. Some dishonest forest officials are also cutting valuable trees like Segun, Garzan, Gamar, and Chapalish. Poor people cannot take action against them, they said in the workshop. Shatish Chakma, Chairman of Logang UP of Pancchari, observed that hill people would never destroy natural resources if there were alternative ways for poverty alleviation and employment. He also informed that the past government did not create employment opportunities in the cluster villages set up for the Bangali settlers in the hill areas. Although several years have passed since the signing of the peace accord, property rights over land of the tribal people were not recognised. That is why the hill people do not have any attachment to land. Similar views were echoed by other local people as well.

One remarkable feature of these workshops was the spontaneous presence and participation of the hill women. Some 30 to 40 per cent of the participants were female. President of Lakshmicchari Thana Female Wealthless Cooperative, Saleha Begum, said that although she had been working in the locality as a development worker for a long time, she could not express their real problems. Previously, the local authorities could not understand the importance of participation of women in such development workshops. Water crisis is acute in hill area. The rivers Chengi, Matamuhuri, Mainee and Banshkhali dry up during the dry season. Female members of the family have to go out in search of water for drinking and irrigation purposes. They have to help their male counterparts in cultivation and irrigation works. They also have to procure wood from the forests and sell those in the market, besides looking after their families. But their views are never taken into consideration in local development planning process.

Some of the workshop participants--Rupashi Chakma (19) of Pancchari, Ilora Chakma (20) of Ugalcchari, Manukh Chakma (30), a teacher of government primary school in Lama, Rina Barua (30), UP member of Gazalia Union of Lama--were all educated. They all are aware of the fact that women and children are the worst victims of environmental damages in the hill areas. They cannot take rest from household work even during their pregnancy or other illness. They have to take the sick family members to remote health complexes where

physicians are not always available for women and children. Excessive work is the main reason for regular abortion of the hill women. Fishes have depleted from the hill rivers. And if any fish is at all available, the male family members and children get preference in eating the fish. Most of the illiterate men in the hill area are alcoholic, spending a major portion of their earnings for alcohol. In such cases, the family burden often falls on the women family members.

The workshops have provided them an opportunity to ventilate their views, share their sufferings as poverty and unemployment continued to destroy their lives. Saleha Begum, a participant in one of these workshops, commented that the hill women who worked so hard for their families, mostly did not know about their rights in the society.

Dr. Mahfuzul Haque, the coordinator of the SEMP, said, "Participation of women in the SEMP has been given due importance. Due to spontaneous participation of women in 19 workshops, it can be unequivocally said that massive changes will take place in the environment and development of the hill area in the near future."

Teachers' representatives participating in the workshop gave emphasis on development of education. The main demand of the people's representatives was increasing allocation for construction of roads. Due to lack of communication infrastructures, farmers are deprived of proper prices of their agricultural products. Scarcity of drinking water, hill flood, river siltation, hill cutting, lack of healthcare and education facilities, unplanned use of pesticides, use of polythine are the other problems of the hill area. They also gave emphasis on removing discrepancies in the land tenure system. But on top of these, lack of employment opportunities and poverty are the biggest problems.

The new environmental development programmes have brought a new hope for the hill people. Earlier, these people were never involved in such policy-making process. Due to long political unrest of the hill area, development activities also hampered in the hill districts. The plain living hill people only knew that natural environment is their friend--but none told them the way to protect this environment in a sustainable way.



Fixing a framework



Photo: FEJB

Bangladesh
State of Environment Report 2001



Fixing a framework

Jesmul Hasan

The legal system of Bangladesh is the legacy of British colonial era. Most of the laws formulated by the British rulers were aimed at protecting their interest in the colonised India. Although those laws and the legal system worked as the foundation of the neo-legal system in the newly-independent India and Pakistan and, subsequently, Bangladesh, in course of time they failed to meet the demands of the changed reality and circumstances. So a wave of amendments, modifications and repeals took place in the de-colonised states of the region.

The age of Bangladesh and the age of modern international environmentalism are almost the same. Bangladesh achieved independence in 1971 while the era of modern international environmentalism began in 1972 from the UN's Stockholm Conference on Human Environment. Bangladesh inherited a good number of sectoral legislation from the colonial legal system. These, together with a few legislation promulgated during the post-independence period form the core environmental jurisprudence of Bangladesh.

Environmental jurisprudence in Bangladesh

A research in the regulatory regime shows that there are about 185 statutes in Bangladesh which deal with environmental issues directly, indirectly or casually. The statutory laws and by-laws based on common law principles are the primary source of environmental legislation. There are case laws which have enumerated judicial interpretation and operate as mandatory precedents. A good number of customs, uses and practices are also available which act as corollary to the core environmental legislation. These laws provide measures for environmental conservation, offer protection against various environmental damage and offences and lay down rights and duties of the citizens by prescribing or prohibiting certain activities. A great

bulk of these environmental legislation were existent in the country from the 19th century although they remained unenforced to a large extent due to several factors or were vaguely known to the responsible public agencies. The traditional practices prevailing in the legal regime are not much conducive to reading the law with new ideas like environmental protection or conservation of resources. Lack of consciousness among the executing agencies and the common people about the very existence and scope of these laws has rendered them ineffective functionally. Some laws have also become redundant since the situation under which they were enacted do not exist anymore.

Present environmental scenario and future of Bangladesh

Bangladesh is a developing country. To ensure a minimum living standard for its 130 million inhabitants, Bangladesh has to fight incessantly with its limited resources. Despite the recent success in reducing the rate of population growth, the reality is that population is increasing and available limited resources cannot always be managed and used in a sustainable way. Accumulation of resources in the hands of a privileged section of society is causing intra-generational deprivation and discrimination.

Due to improper and inadequate policies, limited natural resources are not efficiently managed. As a result, the only adequate mineral resource, the natural gas, may be extinct before the stipulated period of its depletion. Side by side with the afforestation drive through social forestation and awareness campaign, the rate of deforestation is also high. Various species of animals and plants are on the verge of extinction causing imbalance in bio-diversity. The air of major cities is being polluted by industrial and vehicular smoke emission. Water of the major rivers are being polluted by hazardous wastes. Over extraction of underground water and rapid use of chemical fertilizers and pesticides are causing arsenic problem and loss of soil fertility. Land degradation is being caused by hill cutting, river erosion and desertification. Despite increase in agricultural output, unplanned human settlements are decreasing the area of cultivable land and forest resources. Bangladesh is located in a disaster prone area and is regularly hit by flood, cyclone, drought and other natural disasters. Due to the vulnerable geographical position of the country, it will continue to be hit

by such natural calamities.

Besides internal environmental threats, Bangladesh has also to take the burnt of regional and global environmental fall-outs. A weak legal regime on marine resources is causing depletion of valuable marine resources. Global green house gas emission is causing sea level rise which may devour a significant portion of the southwestern territory of Bangladesh. Occasional influx of refugees from neighbouring countries cause pressure on the limited natural resources.

Although the above scenario projects a grim picture of Bangladesh, the future is not that much bleak, provided the country can adopts and implements a well-planned sustainable development policy integrating optimum use of limited natural resources without destroying the ecological balance. Sustainable development is the development that meets the needs of the present generation without compromising the ability of the future generation to meet their own needs. Thus, if the natural resource base meets the basic needs of the present generation, including the raw materials for secondary products, such resource-base should be used and conserved in such a way that it can maintain its capacity to meet the needs of the future generation. Preservation of a natural resource-base, improvement of resource base and protection of environment can thus ensure sustainable development. Environmental legislation can be an effective instrument in the sustainable development initiative.

Basis of future environmental legislation

For a comprehensive sustainable development drive, Bangladesh requires basically two types of environmental legislation, viz.

- Resource management and conservation laws
- Damage prevention laws

Resource management and conservation laws

Although there are a good number of sectoral legislation on various natural resources (such as Embankment and Drainage Act, 1952 or Groundwater Management Ordinance, 1985 for water resources, Protection and Conservation of Fish Act, 1950 for fisheries resources, Mines Act, 1923 or Petroleum Act, 1934 for mineral resources), those need to be amended and updated

for ensuring conservation and sustainable use of those resources. Need assessment study for at least 50 years should be done before adopting any resource management and conservation legislation

In formulating new sectoral resource management and conservation legislation or amending the existing laws, the principles of environmental economics or green accounting should be applied. For achieving economic growth and a better standard of life, natural resources have to be used. But they should be used judiciously after proper cost-benefit analysis and taking into account the ecological aspects. This is green accounting and if this is applied to various sectoral resource management and conservation legislation, it will ensure sustainable use of natural resources.

The conflict of public-private ownership in resource management, prevalent anomalies in private ownership of properties, juridical perception and interpretation of private titles and liability, ages-old concepts of rights, duties, interests and obligations in practice in Bangladesh are not favourable to sustainable resource use. They should be reoriented according to the need of the time for establishing a suitable resource regulatory regime for future.

Environmental damage prevention laws

Bangladesh has a good number of environmental damage prevention laws of which the Environment Conservation Act, 1995 and the Environment Conservation Rules, 1997 are the main and important ones. But the titles are misleading in the sense that they are focussed more on environmental protection than on conservation. Moreover they have failed to define the term 'environment' in its widest possible scope.

The existing environment damage prevention laws need to be reoriented on a right-based approach to environment and development. The latest international human rights laws recognise both the right to environment and the right to development as human rights. These rights are popularly known as solidarity rights and are collective in nature. Necessary amendments or formulation of new environmental damage prevention legislation must be based on environmental rights

which entail corresponding duty of restraining one from causing damage of pollution to environment and protecting it. On the other hand, if such legislation is based on developmental rights, it will consequently cause a link to be established with resource management and conservation norms.

Environmental common law principles

To make environmental legislation more effective in future, some environmental common law principles are required to be incorporated in the environmental legislation of Bangladesh.

Intergenerational equity and public trust doctrine

This principle assures each generation of the right to receive the planet in no worse a condition than received by the previous generation. This implies that environment and natural resource-base are held by the present generation in trust for the future generation, which is known as public trust. This further implies a responsibility for the present generation to protect and improve the environment for both the present and the future generations. Within a generation, it implies fairness groups of people in a society in terms of access to common resources and a clean environment.

Precautionary principle

This principle provides that sufficient precautionary measures are taken in formulating and applying the environmental laws if there is any scientific uncertainty about the implications of resource-use. The underlying goal of this principle is that policy-makers remain cautious and consider probable harmful effects if they adopt any environmentally sensitive development plan. A good number of environmental legislation of Bangladesh have incorporated this principle as a guiding one. But this principle should be made binding in future environmental legislation.

Polluter pays principle

This principle requires that the potential and actual costs of pollution should be borne by the person or organisation responsible for causing environmental pollution. Although the Environment Conservation Act, 1995 is based on this principle, there is lack of broad-based standards about the potential and

actual damage. So these standards are required to be set.

Principle of common but differentiated responsibility

The principle of common but differentiated responsibility includes two elements. The first concerns the common responsibility of all citizens of the country for the protection of environment. The second concerns the need to take account of differing circumstances particularly in relation to the contribution of various segments/communities/localities of the country to the creation of a particular environmental problem and their ability to prevent, reduce and control the threat.

Principle of preventive action

The preventive principle requires action to be taken at an early stage and, if possible, before the damage is caused. It requires an activity, which does or will cause damage to the environment in violation of standards established by environmental rules to be prohibited. It also allows action to be taken to protect the environment at an early stage. It does not consider repairing damage after it has occurred. Access to environmental information, environmental impact assessment (EIA) and pre-authorisation procedures are some of the tools to apply this principle.

Principle of good neighbourliness and international cooperation

In signing bilateral and multilateral cooperation treaties, Bangladesh should try to incorporate this principle in respect of environmental management and cooperation. Good neighbourliness is expected from the neighbouring countries by getting early information on natural disasters, notification on environmental effects of any development project, consultation on trans-boundary enforcement of environmental standards etc. This principle is particularly important for time to come when new development projects may be initiated in neighbouring countries that might have environmental implications in Bangladesh.

Sovereignty over natural resources and not to cause environmental damage A State has the sovereign right to exploit its own resources pursuant to its environmental policies. It also has the responsibility to ensure that activities within its

jurisdiction or control do not cause damage to the environment of other states or states beyond the national jurisdiction. The sovereign right to exploit natural resources include the right to be free from external interference over their exploitation. This principle is important for Bangladesh in the sense that it has potentials for exploring huge mineral resources, which may be common resources for two countries beneath the territory but separate resources on the surface over political boundary. In tapping the marine resources, Bangladesh has to suffer from the damage caused by other states. Moreover in future, the question of extra-territorial application of national environmental standards between the neighbouring countries may arise in which case this principle may help Bangladesh in getting reciprocity.

Some issues to be considered in future environmental legislation

Agenda 21, the UN's basic plan of action on environment and development for the new century, has prescribed several actions for developing a legal and regulatory framework for environmental protection and conservation. These include:

- Making laws and regulations more effective in practice
- Establishing relevant judicial and administrative procedures
- Providing legal reference and support services
- Providing training for application and progressive improvement of laws
- Developing effective national programmes for reviewing and enforcing compliance with laws
- Strengthening legal and institutional capacity
- National monitoring of legal follow-up to international instrument

The Government of Bangladesh adopted a National Environmental Policy in 1992, which provides general guiding statements and sectoral environmental policies including a legal framework on environment. This framework has suggested following actions:

- Amend all laws and regulations related to protection of environment, conservation of natural resources and control of environmental pollution and degradation to suit the needs of the present time.
- Frame new laws in all necessary sectors to control activities

- related to environmental pollution and degradation.
- Ensure observance of all clauses of relevant laws/regulations and create widespread mass awareness in this regard.
- Ratify all environment-related international conventions/protocols that Bangladesh considers ratifiable and amend/modify the existing laws/regulations in line with the ratified conventions/protocols

The Constitution of Bangladesh does not include the issue of environment in any of its provisions. The fundamental rights enumerated in the Constitution of Bangladesh (Part III) are civil and political in nature, which are individual rights and can be protected by judicial enforcement and judicial review. On the other hand, the fundamental principles of state policy of the Constitution (Part II) has incorporated the economic, social and cultural rights which cannot be protected by any legal measures but are applied as guiding principles for development initiatives. So it is a matter of constitutional debate in which part of the Bangladesh Constitution, the issue of the environment should be included.

As the Constitution is the supreme law of the land and all laws must be in conformity with the Constitution, so for future environmental legislation, the doctrine of intergenerational and intra-generational equity, public trust doctrine and the concept of sustainable development should be incorporated as a guiding policy in the fundamental principles of state policy (Part II) of the Constitution. It will help facilitate the formulation of future environmental legislation. Constitutions of many countries of the world, including those of the neighboring countries of South Asia, have incorporated the right to environment as a fundamental right of their citizens. The supreme judiciary of Bangladesh, in several public interest environmental litigation, has in its judgements implicitly recognised that environmental right is a human right and although the Constitution does not mention this right, there are other basic principles and essential spirits which can be used to cover the environmental aspects. So, the right to environment can be included in the Constitution as a fundamental right.

Like development planning, legislation in Bangladesh is done in

a top-to-bottom approach i.e. laws are imposed on people by bureaucrats and legislators. Since such laws do not have people's ownership, people become apathetic in following laws and problems surface during enforcement. So, in environment legislation, a bottom-up approach should be adopted and grassroots people and the civil society should be consulted in law making. This will cause formulation of pro-people environmental legislation, ensure spontaneous support of people in enforcement and result in less damage to environment and more conservation.

In cross-sectoral resource management/conservation laws, steps should to be taken to avoid overlapping and incompatibilities. In this respect substantive legal provisions and statutory institutional framework should be combined together to reduce the number of statutes and facilitate enforcement of laws as well as smooth functioning of statutory agencies.

A good number of environmental legislation are either not applied due to ignorance about them by enforcing agencies and people or are applied in a way incompatible to their conservation or sustainability spirit. Before making any new legislation, a stock of account should be taken in this regard. Regular publicity of environmental legislation among people can be an effective tool for their enforcement.

Environmental legislation must be in conformity with relevant policy and institutional set up. Otherwise, it will lose effectiveness. Moreover, new environmental legislation must take into account practices, customs and values existent among the people for making them more pro-community and indigenous. New and regular environmental legislation should be made for fulfilling obligations under the international environmental treaties and conventions

Resource management and conservation legislation must adopt a government-people joint approach in which people's ownership will be ensured. Social forestation can be an example of success in this regard. Such approach will also reduce excessive authority of statutory agencies over resource management. Decentralisation of decision making should be

included in environmental legislation which will strengthen the role of statutory agencies.

Bangladesh has developed a good reputation in public interest environmental litigation. Particularly in terms of allowing access to judicial process and granting injunctive relief, the top judiciary of Bangladesh has taken a liberal position. But except a few cases, the judiciary is still cautious and conservative in exercising its suo moto authority and in flexible interpretation of the statutory provisions. In India, courts have made several directions on unconditional closure of tanneries and their relocation, on payment of compensation for reversing the damage, to create expert committee in environmental cases, to pay the costs required for remedial measures, on necessary measures to be adopted by the relevant ministry/agency to disseminate environmental information in media and to set up a committee to monitor the directions of the court. In Bangladesh, judiciary can also come forward for such environmental activism which will strengthen future environmental legislation and environmental jurisprudence.

Provision of an environmental public interest litigation fund should be incorporated in environmental legislation to ensure people's access to funding for petition. This is important particularly for people who are in a financially weak position due to which they cannot initiate legal measures against unauthorized encroachment. The cost of litigation includes the initial expenses of the applicant, overall cost of the case, etc. At the moment, most of the funding comes from private foundations and foreign assistance. The unreliable nature of the source of the fund has made it more important to develop a statutory fund for environmental litigation. Creation of such a fund will help facilitate in developing environmental case laws in Bangladesh.

Cost order of the case is another cause of concern. Although in most of the environmental cases in India, the cost is decided on case by case basis, in Bangladesh, the court disposed of two environmental cases without any order regarding the cost. 'No win, no fee' can be an option to encourage environmental litigation. This would allow the lawyers to take on cases initially without charging the clients. In a successful case, the other party

is usually ordered to pay most of the lawyer's fee. The client or the lawyer can also take out insurance to cover the risk of losing or having to pay the other side's cost. This system can reduce the number of unnecessary litigation but it requires special fund for cases perceived as public interest litigation which can help examine environmental test cases with complex points of law and to establish precedents.

Although the Environment Court Act, 2000 has been passed, courts are yet to be set up in six divisional cities. The judges to be appointed in these courts need to be imparted with special training in environmental jurisprudence. These specialised judges are going to be the first generation of 'green judges' and upon their acumen, knowledge and training will depend the development of future environmental jurisprudence in Bangladesh.

The NGOs involved in environmental protection and public interest litigation can build a database of lawyers who are ready to provide free legal assistance, at least for the first consultation, to people suffering from environmental problems. Thus, it will make people aware of their environmental rights and the options available to them. It will also help the lawyers to participate in environmental protection. The court can ask the environmental lawyers/NGOs as amicus curie to provide them with supporting legal documents which will help them in doing legal research. Thus the environmental lawyers/NGOs would be able to give their own views for the knowledge of the court.

Alternative dispute resolution methods can also be applied in solving environmental disputes and protecting environment. These methods have advantage in the sense that they are less time consuming, free from procrastination and other vices of established court system and people and custom oriented. Future environmental legislation should incorporate provisions for alternative dispute resolution in environmental disputes.

Conclusion : The Law Commission of Bangladesh should take a proactive and central role in examining all environmental legislation of Bangladesh. These laws need to be modified, updated and amended in compliance with the changed circumstances. A comprehensive code of environmental

legislation or a comprehensive environmental regulatory framework can be a good source for environmental judicial activism and environmental jurisprudence. The non-government organizations should actively take part in developing such environmental legislation/jurisprudence which will make it more participatory and all encompassing. Thus the future generation of Bangladesh will live in a healthy environment protected by a good regulatory framework.

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