

Introduction

The Oslo Workshop on the linkages between Environment and Security in 1986 emphasized that "theorist must move beyond the traditional thinking about security concepts and begin considering a series of environmental factors underpinning the material welfare. These factors include such natural resources as soil, water, forests, grassland and fisheries, all prime components of a nation's natural resource base. They also include climatic patterns and physio-biotic cycles that maintain the life support system of all nations. If a nation's environmental foundations are depleted, the idea goes, its economy may well decline, its social fabric may deteriorate and its political structure may become destabilized. The outcome all too likely is conflict whether in the form of disorder and insurrection within the nation or tension and hostilities with other nations."¹

Bangladesh presents a stark illustration of this environment-security relationship as well as its resultant syndrome. With a land area of only 144'000 km² and a population of 110.8 million, Bangladesh is subjected to environmental degradation on the national, on the regional as well as on the global levels. While poverty and decreasing land-man as well as resource ratio are causing the environment to degrade at a faster rate, eco-geographic setting and various physiological and morphological characteristics have made the country extremely vulnerable to natural disaster. Recurring floods, cyclones, tornadoes, storm surges etc. are frequent occurrences which contribute to further degradation of environment in Bangladesh. At the regional level, the country faces environmental degradation due to imbalances in the shared ecosystem, i.e., the Himalayan drainage ecosystem. Bangladesh, the lower riparian, is geographically situated in such a position that it is affected by most of the adverse consequences of any disruption of this unified ecosystem caused by various indiscriminate and uncoordinated economic activities of the upper riparians. At the global level also, Bangladesh faces "nightmarish" dangers emanating from global warming and sea level rise. Due to the flat nature of terrain, the country is much vulnerable to inundation in case of even a little rise in the sea level together with the series of catastrophes that are related to the warming atmosphere and the rising sea.

Degraded environment is a concern for the country not only in terms of shrinking resource base but also in terms of destabilizing effect on the country's ecosystem that arises out of various man made factors at the global, regional and national levels. In other words environment as a 'bank of resources', as a space of living and as a 'sink for wastes and products of human activities' is facing degradation in such a short period of time that the entire socio-politico and economic system of the country fails to adapt to such changes. The central question, which is also the main thesis of the paper, is whether such

¹ Norman Myers, Linking Environment and Security, Bulletin of Atomic Scientists, June 1987, p.46.

man made disturbances to environment (regarding its normal regeneration rate) in the country and its impact on the society are of such magnitudes and dimension that it would be the cause of conflict in Bangladesh or/and between Bangladesh and neighboring states.

In order to obtain the answer to this question, a number of steps would be followed in the paper, viz.:

- A.1. What are the main areas of environmental concern in terms of its degradation in the country?
- A.2. What are its magnitudes and dimensions in terms of its economical effects?
- A.3. What are the characteristics of the environmental problems in terms of its dimension of time, i.e. its reversibility or irreversibility as well as the dimension of its scope i.e., whether confined within the country or of transboundary character?

These ecological changes alone do not lead directly to conflict. Only when they produce a series of casually interrelated social effects, then these may cause a specific type of acute or violent conflict. The search for this would be done through answering the following questions:

- B.1. What are the social effects of such degradation in terms of its economic problem, population displacement, various differences in the society like ethnic divides, social cleavages etc.?
- B.2. Do these social effects have a destabilizing power on the social structure and social institutions?
- B.3. What are the social effects of such degradation in terms of its scope?

The combination of these two steps shall lead us to the existing as well as potential sources of 'conflict', either purely environmental or environmental together with traditional factors. After arriving at this stage the onward search of the paper would be for the dimension of the scope of such a conflict, i.e. whether it would turn into a full scale war, armed insurrection or just low intensity insurgency? The answer to this question would again be searched for a number of factors viz., the attitude of the parties involved in the problem; the extent to which the parties are responsible for and are affected by the environmental problems; the perception of the party affected as to the problem; the economic, military or other capabilities of the parties involved to fight out the conflict; various alternative methods that are tried by the parties involved to fight out the conflict; the potentiality of turning the conflict into either a war or insurgency etc.

Finally approaches to peaceful conflict management and conflict resolution would be explored. This again would be done by answering three question of 'how' to the previous three levels viz.:

- A. How can the social effects of ecological degradation be solved or managed?

B. How can the social effects of ecological degradation be solved or managed?

C. How can the specific conflict be solved or managed?

I. ECO-GEOGRAPHICAL SETTING AND PHYSIO-MORPHOLOGICAL FEATURES

Now before we proceed further it is important that there is made an introduction to the eco-geographical setting of the country/region we are about to deal with. What happens to Bangladesh's ecology has a lot to do with this setting as well as its physiological conditions.

Ganges-Brahmaputra-Meghna drainage basin

Broadly speaking, from a ecological point of view Bangladesh belongs to the Ganges-Brahmaputra-Meghna drainage basin of which Bangladesh forms only a fraction. The basin spreads over five countries, i.e. Bhutan, Nepal, India, Bangladesh and China and covers a huge area of 1'758'000 km² roughly 2400 km east to west and 800 km north to south. Bangladesh covers only 8% of this area but occupies a very vital part of it. It lies at the confluence of three of the mightiest rivers of the world which merge almost in the center of Bangladesh. The combined flow of the Ganges, the Brahmaputra and the Meghna in the last hundred kilometers of their run to the sea form a river two and half times the size of the Mississippi. Although the total area of the South Asian Watershed is slightly less than one half the area of central basin of the United States it receives four times the Mississippi basin's total annual rainfall, 85% of it in one third of the year. A huge quantity of silts are also transported to the sea by these rivers. Much of the silts carried downstream is in fact, responsible for the largest deltaic formation in Bangladesh. In a 1968 marine seismic expedition estimated that undersea sediments brought down from the Himalaya by the Ganges and the Brahmaputra rivers and deposited in the bay were 1000 km wide, 12 km deep and 3000 km long and extended even south of Sri Lanka. Indeed, Bangladesh is the result of this unrelenting southward silt flow over the past 10,000 years.²

Himalayan ecosystem

The eco-region under discussion is sometimes referred to also as Himalayan ecosystem because much of the behavior of the river systems forming this basin and the ecological features of the basin itself are profoundly influenced by conditions prevailing in the Himalaya. For example the monsoon rainfall in the region is largely the function of the Himalayan barrier. Moreover the Himalayan forest or its absence has a great deal to do

² Shaukat Hassan, *Environmental Issues and Security in South Asia*, Adelphi Paper 262, p.16.

with the quality of the water flowing down as well as flood conditions down stream. The Himalaya being the youngest mountain range of the world is still subjected to continuing tectonic movements. Consequently there are land slides and a lot of soil erosion. That partly explains why so many silts are carried by the rivers flowing down from the Himalaya. Nevertheless, to a great extent the deltaic Bangladesh is a result of the phenomenon.

Major rivers

The Ganges river rises from the lake Manaswarabor in the West of Nanda Devi range in the Himalaya. It traverses first north south, then south east through India and reaches Bangladesh near 'Rajshahi' town. It then joins Brahmaputra flows at 'Gualunda' and the combined flows travel further south east till they join the Meghna flows at 'Sureshwar'. In the middle valley in India the Ganges is joined by as many as nine tributaries. Likewise, the Ganges also sends a number of distributaries-mostly in Bangladesh-which may now be classed as decaying rivers. A twenty year peak discharge in the Ganges at Hardinge Bridge is 71'400 m³/s.

The Brahmaputra is one of the world's most turbulent and dynamic rivers. It originates by the name 'Tsangpo' from the Himalaya from a source close to that of the Ganges. The Brahmaputra-Jamuna system gathers drainage water of eastern Himalaya and Assam Hill ranges - areas of exceedingly heavy rainfall. Two hundred years ago the main Brahmaputra flowed east of Dhaka and entered the Bay of Bengal through a mouth separate from that of the Ganges. It is interesting to note that this river was divided into two channels following the great flood of 1787. One channel, the Jamuna flowing south became the main channel while the old course of Brahmaputra became a left bank distributary joining finally the Meghna flows in its final run. A twenty year peak discharge in the Brahmaputra at 'Bahadurabad' is 80'800 m³/s.

The Meghna originates from the name of 'Barak' from the southern slopes of the Naga-Manipur watershed in the Assam state of India. The Barak divides into two branches - the northern branch by the name 'Surma' flows downstream like the Meghna and discharges to the Bay of Bengal. The twenty year peak discharge of the Meghna at 'Sureshwar' is about 18'000 m³/s.

Some characteristics of the river system

The deltaic plain constituting Bangladesh which is rather young continually undergoes changes. The major rivers are officially classified as either 'unstable'(Meghna) or 'very unstable' (e.g. the Jamuna and the final run of the Ganges). This is also evident from the coastal areas which are sinking up to 2 cm a year. Both the Ganges and Jamuna show a high rate of lateral migration. Both have changed their courses significantly within the past 200 years. Long-term patterns of river migration are controlled by major faults or

fractures in the earth's crust, many short term factors also affect such migration, i.e. the rate of rise and fall of the river, the number and position of major channels which are active during the flood conditions, formations and movement of large bed forms, cohesion and variability in the compositions of bank materials, intensity of bank slumping, etc. In Bangladesh, every monsoon period brings changes in the course of main channels of the Ganges and Jamuna. Sand bars in the Jamuna, for example, can migrate up to 1500 m downstream in a year and 3 m of sediments can be deposited over a distance of one km.

Such river instability causes rapid deterioration of the river system through massive siltation. While such a process is a natural phenomenon, there is considerable evidence that the processes are accelerating in the rivers of Bangladesh and may already have assumed unmanageable proportions. Within about a decade, many important routes once open to mechanized vessels had to be abandoned. The siltation is not limited to a few rivers but it has turned into a natural problem suggesting a rapidly growing worse and worse situation.

Physiological features

Deltas and estuaries are generally known as areas of net deposition of sediments either carried by the river or supplied from the sea. This is also true about Bangladesh. The growth of the delta and the accretion of land in the estuaries is a continuous and generally a very gradual natural process interfered by the dynamics of the ever changing courses of their channels. In present times the Ganges, Brahmaputra and Meghna carry a huge amount of annual sediment supply to one of the world's largest deltas keeping the expansion of the delta in progress. A comparison of the 1982 map with the 1798 map of J. Renal shows a completely changed system of channel and river courses but a more or less stable coast line. However, at present, only a small part of suspended sediment settles on the low lying lands in the delta. Each year during flood season water inundates about 30% of the total area of Bangladesh where a large quantity of suspended sediments are deposited. It is believed that a delicate equilibrium exists between the up building of the flood plains and flood plain deposits and relative sea level rise caused by eustatic sea level rise (at present some 10 cm per century) compaction of the clay deposits and tectonic subsidence of the area. The experience of two Meghna crossdams which were constructed in 1957 and 1964 in the old course of lower Meghna indicates that it is possible to stimulate the natural sedimentation and land accretion processes with appropriate intervention. On the other hand large scale flood control and drainage schemes or river diversion will interrupt sediment supply.

Subsidence is a common earth movement in Bangladesh, but there may also be some uplift. Major areas of subsidence are the Surma basin, Faridpur trough, Chalan beel, Dhaka depression, and the Khulna- Sundarban area. Calculated values of subsidence range from 0.6 mm/year to 5.5 mm/year but may exceed 20 mm/year in the central part of

Surma basin. Evidence of recent uplift is difficult to find in Bangladesh, but geodetic leveling over the Shillong Plateau shows a rise of 25 mm over the period 1910-1977.

Hydrological cycle

The complexity of the subcontinent's hydrological cycle has a great deal to do with the environmental peculiarities in the region particularly in relation to flooding in the eastern part of the region. The flow in the Brahmaputra usually peaks in June and reaches a higher peak in August because of the heavy monsoon rains. The Ganges starts rising in June-July and peaks in late August or early September. The Meghna usually reaches its annual peak in August-September. The combined annual flood wave from the Ganges, Brahmaputra and Meghna river passes through a single outlet—the lower Meghna river and empties into the sea. The peaking of these rivers at various times causes 'normal' flood to occur in various regions of the basin, but severe flood results when the peak flows in the Ganges and Brahmaputra coincide. Flooding is exacerbated as the South West monsoon winds raise the mean tide levels in the Bay of Bengal reducing the slope and therefore the discharge capacity of lower Meghna.

Such a hydrological cycle plays a major role in flood creation and its consequences on environments in Bangladesh. With the advent of summer low pressure systems develop over central India drawing dense rain bearing clouds which strikes the South Asian land mass including Bangladesh, triggering the onset of the four month monsoon (June-September) providing for 85% of the annual rainfall. During the rest of the year particularly between November and April rainfall is rare and the surface water in the region is indeed scarce. This highly skewed rainfall distribution is another peculiarity of hydrological cycle having profound impact on environments. Because seasonal variations in rainfall contribute both to devastating flood (inundating as much as 60% of net cultivable area) and serious drought preceded by excessive exploitation of ground water resources. Both conditions cause in turn ecological degradation. This is also one of the reasons of the paradox of water in Bangladesh: There is excess water, at times in devastating magnitude when the country does not need that much and there is too little, when it needs much more than is available.

Climatic and topographical factors

Situated in the tropical monsoon region, the climate in Bangladesh is characterized by heavy rainfall during monsoon and little or no rainfall during the dry winter months. The distribution of rainfall is highly skewed both spatially and seasonally. The mean annual rainfall increases towards north east of the country and reaches to about 5690 mm at the extreme north-east corner of Sylhet. Rainfall starts decreasing towards west and reduces

to about 1'110 mm.³ The seasonal variation shows that about 80% of the rainfall occurs during a 5 months period of monsoon starting usually in June and ending in October. During this period water surplus is experienced all over the country. The dry season which extends over seven months, is heavily deficient of water and soil moisture. The average annual water deficiency is over 15 cm in the extreme west to about 5 cm in the east.⁴ The situation is further aggravated by the fact that the deficiency of soil moisture exists for about eight months (October-May) in the western part and for five to six months (November - April) in the east. Therefore, the country is desperately dependent on the surface water flow to provide a stable source of water supply. The country is criss crossed by major river systems, the Ganges, the Brahmaputra and the Meghna and their innumerable tributaries and distributories. These rivers which cover 9.7% of the total area of the country originate from outside the country. There are about 54 common shared rivers including the Ganges, Brahmaputra and Meghna and Bangladesh, being a lower riparian, has hardly any control over them. River flows are also seasonally variable. The total flow through the major rivers varies from 6967 m³/s in February to 101'091 m³/s in August,⁵ which means the maximum monthly flow in August is at least 15 times more than the minimum flow in February.⁶ During the dry winter months the flows in the major rivers fall down drastically and most of the small rivers dry up. Moreover, these rivers are not all perennial (except the Ganges, Brahmaputra, Meghna, Teesta and Karnaphuli) and flows during some part of the year.

The regional variation in the topography as discussed earlier together with temperature and rainfall etc., are also causes of environmental degradation. The north-west region of the country with an elevation from about 12 meters to 90 meters above sea level is prone to low water rainfall and high water deficiency in the driest month (February) On the average 361 m³/s of water are available through stream flows in the region of which 349m³/s flow from India. The major contributors of water flows in this region are the 'Teesta' (33%), the 'Dudhkumer' (30%), and the Dharla (18%).⁷ The north-east region, known as 'Meghna dominated Sylhet basin' with an elevation of 3 to 6 meters above sea level, is influenced by the backwater effect of the Ganges. The mean monthly inflow is 45m³/s (in February) to 16'800m³/s (in July).⁸ The smaller river of this region along the north-eastern and eastern border frequently carries flash floods during the monsoon and early monsoon. Most of the rivers of this region originate from the areas of greater rainfall intensity like the hills of Assam, Tripura and Meghalaya.⁹ The south west region is

3 Nurul Islam Nazem and Md. Humayun Kabir, 'Indo-Bangladesh Common Rivers and Water Diplomacy, BIISS Paper, No. 5, Dec. 1986. p. 4.

4 Ibid.

5 M. Shahjahan, Surface and Ground Water Assessment, Development and Utilization in Bangladesh. A Memograph, 1985, p. 43.

6 Nurul Islam Nazem and Md. Humayun Kabir, BIISS Paper, No. 5, Dec 1986, op. cit., p. 5.

7 Ibid.

8 Ibid.

largely dominated by the Ganges and its tributaries and distributaries and any shortage of water in the Ganges affects the whole region. The mean monthly flows vary from 190 m³/s (in March) to 7650 m³/s (in August) in the region.¹⁰ Intrusion of salinity through estuaries and seepage is a problem in this region. The south central region on the other hand, receives an enormous volume of water from the combined flow of the Ganges, Brahmaputra and Meghna, hence the salinity level is low in this area. The South east region is geographically different from the rest of the country having generally elevated relief and being independent in terms of hydrological response from the major rivers. The rivers, viz., Karnaphuli, Muhuri, Feni etc., here are non-deltaic.

Hence it is apparent that while the physiology and soil character provide various types of agro-ecological regime, regional variation in rainfall, surface water availability, topography, etc. have made the country subjected either to flood or to drought during various times of the year.

While the average height of the country i.e. 7.6 meters has made her an easy prey to the "greenhouse monster", location in the Bay of Bengal has made the country a favorite spot for cyclones and tornadoes. Generally cyclones develop in the southern Bay of Bengal where depressions develop and move north to the coast of India, Bangladesh and Burma mainly during April-June and October- November. In comparison with the neighboring countries, cyclones approaching the coast of Bangladesh are more harmful. The reason for this is the funnel shape of the Bay with Bangladesh at the bottom of the funnel where the waters are piling up. In addition to this the sea level in the eastern estuary increases during the monsoon by about 1 meter as a result of upland discharge, strong wind from the south-west and a low barometric pressure.

II. ENVIRONMENTAL DEGRADATION (I.1., I.2.)⁹

2.1. Environmental problems

The ecology of Bangladesh has been nourished and conditioned through the ages and its equilibrium maintained by the Himalayan drainage system. Today as the civilizational development progresses clearly there is a rupture in the system due not only to tampering through human activities but also to a complex web of natural and morphological factors both on local and global level. A certain strain is clearly visible on the natural support base in the country making any developmental effort unsustainable till such time the nature's resources can be made renewable. As a matter of fact, in Bangladesh the ecological degradation which has since then started and an enormous pollution pressure

⁹ The figures in brackets refer to the levels and dimensions of an analytical framework proposed by Volker Böge to examine environmental conflicts. See Böge, Volker: Proposal for an Analytical Framework to Grasp "Environmental Conflict" (ENCOP Occasional Paper No.1), Bern, Zurich 1992.

with a chronic state of poverty reinforce each other. In the following chapter we shall show an overview of our natural resources and the extent of degradation they have suffered.

2.1.1. Fresh water

Bangladesh lies across the delta of three major rivers, the Ganges-Padma, the Brahmaputra-Jamuna and the Meghna. These rivers and their distributories discharge about 142'000 m³/s into the Bay of Bengal at peak periods. The annual sediment load of the rivers has been estimated at 2.4 billion tons. The rivers and other surface water bodies like 'haors' 'beel's, lakes and ponds all make a major contribution to the agriculture and general economy of the country by providing navigation, fish, water for irrigation and fresh alluvial sediments to replenish the soil. However, the river systems also give rise to a number of problems causing sufferings and miseries to lives, livestock, property and crops. The general flatness of the terrain neither allows harnessing of the river flows for hydroelectric power generation and there is only one hydro power plant in the country located in the Chittagong Hill region.

Ground water is also an important resource of Bangladesh. It is extensively used for both domestic and agricultural water needs. There is a fairly extensive aquifer at a very shallow depth of 6-12 m below ground level. This aquifer is generally tapped by hand tubewells of 3.75 cm diameter with a hand operated pump and the water is used for domestic as well as agricultural purposes. A deeper aquifer at about 60-120 m depth has also been identified in large parts of the country, particularly in the north, west and eastern regions. Although the ground water aquifer is substantial there are concerns that the limit of exploitation of the ground water reserves may be approaching soon.

"Water is part of our environment and in that respect everything we do by way of managing or exploiting water resources has an impact on the environment." Degradation of fresh water resource of Bangladesh occurs mainly as a result of both its overuse and pollution. Besides, it can also take the form of salinity, siltation, lowering down of ground water level, flood etc. Apart from some inherent physiological factors, various man made factors contribute to such degradations. In the following we have attempted to analyze these factors in some details.

2.1.1.1. Industrial and agro-chemical pollution

Though the country has a small number of industries, they are situated mostly by the banks of the rivers. These industries dispose their wastes in the water bodies in an untreated form, since none of the industries have waste treatment plant. Among the pollutants known to be discharged are mainly mercury, lead, chromium, arsenic and iron. Even at a relatively low concentration these are very much harmful to human health as well as to the aquatic resources.

In Bangladesh industrial toxic wastes are affecting the health of the people living along the Karnaphuli, Sitalakhya and Bhairab rivers. There are about 47 industrial units on the bank of the river Karnaphuli in the suburbs of Chittagong. Of them, two, viz., Karnaphuli Paper Mill and Rayon Complex discharge about 45-55 million liters of untreated waste almost daily. This results in mortality of fish in a stretch of 8 km downstream and 1.5 km upstream from the mill¹⁰. The Tongi Industrial area located 24 km north of Dhaka city, consists of a mixture of production, viz. textile, batteries, detergents, paints, steels, rubber, and pharmaceuticals. Of these the pharmaceutical industry is found to be a grave threat to aquatic environment of the surrounding areas into which the toxic wastes are being discharged. Any accidental leakages into the river water out of the process unit operation were found to seriously contaminate the water into which it was channeled. Among the industries situated by the side of the river Shitalakhya the Urea Fertilizer Factory of Ghorashal discharges the principal polluting agents. A maximum of about 200 ppm (parts per million) of ammonia concentration was even detected by EPC (Environmental Pollution Control) technicians¹¹. The Hazaribagh tanneries along the Buriganga river in Dhaka dispose off such hazardous toxic pollutants both in the air as well as in the water bodies that the case was dealt with at length in the WPCP yearbook (1973- 1975)¹². The dumping of the waste of Khulna industrial area is done in the Bhairab/Rupsha river does not receive a continuous flow from its parent river and the Bahirab being subject to reducing purification capacity due to back water effects, Khulna industrial zone has been polluting the river Bhairab/Rupsha to a significant degree.

Agro-chemical pollution is also widespread. Since the land area for agricultural expansion is limited, there is an emphasis on increasing acreage under "High Yielding Varieties" (HYV) of rice displacing in most cases traditionally adapted and resistant varieties. The bias towards HYV rice increases agrochemical use including both fertilizer and pesticides. Currently 4-5'000 tons of commercial pesticides are used per year, primarily in the cultivation of rice, tea, jute and sugarcane. Though banned for import, DDT and other highly toxic and environmentally persistent organochlorins are still formulated and used locally. Farmers who are mostly illiterate are incapable to follow the directions given on the label of the pesticide container. The result is the pollution of water bodies (through rain, irrigation channel as well as by ground water aquifer which suck water from the polluted soil) to the grave detriment of human and aquatic health. Fish productions have been reported to decrease around the agricultural land where pesticides are used. Fertilizers and pesticides washed away from the lands by flood waters have been on

¹⁰ Ainun Nishat and Shahjahan Kabir Choudhury, Water Quality: Problems and Needs for Integrated Control in Bangladesh, paper presented at a Regional Seminar on Water Resources Policy in Agro-Socio-Economic Development, August 4-8 1985, Dhaka.

¹¹ Ibid.

¹² Ibid.

occasions linked to various sicknesses in fish which supply 80% of the country's animal proteins.

2.1.1.2. Water diversion for irrigation

For generations the people of Bangladesh have practiced irrigation using various traditional devices such as dons, swing baskets, dug wells and even earthen jugs. An estimated 0.49 million ha (mha) are now irrigated by these traditional devices.¹³ They however presuppose the use of surface water. In 1985 about 66500 ha were irrigated by low Lift Centrifugal pump. Due to limited availability of surface water in some areas in the country particularly in the north-west region, ground water is used exclusively for irrigation. Both shallow and deep tubewells (DTW) are used to tap the ground water for irrigation. Approximately 620'000 ha (1985) are irrigated by tubewells. In addition about 150'000 ha are irrigated by large scale irrigation project which are implemented mainly by Bangladesh Water Development Board (BWDB). Of the 9.03 mha cultivable land, 7.6 mha is suitable for irrigation. According to the Master Plan Organization MPO, 2.6 mha were irrigated in 1989-90 leaving 5 mha of potentially suitable land for irrigation development subject to availability of water and economic feasibilities.

However, ground water planning and management in Bangladesh is at a critical stage. The period of rapid exploitation started in 1972 and since then the number of irrigation wells has increased from 1800 to 399'000.¹⁴ The annual increase in irrigation well numbers has not been constant but has grown at a compound rate in excess of 40% annually. The consequence of such rapid growth are now apparent. In Rajshahi district irrigation tubewells equipped with STWS were reported back in 1982 to be incapable of pumping due to the increased seasonal decline of ground water levels. In 1983 suction lift pumps in both irrigation wells and portable water supply hand tubewells were running dry in some areas in both the north-west and north-east. The situation was regarded as being so serious in the Rajshahi district that agricultural credit of STWS under the IDA Agricultural Credit 7 - Project was stopped for eight upazilas regarded by the World Bank as being seriously over exploited in November 1983.¹⁵ The Bangladesh Bank recognized a similar problem in the Borga district, in the south west region of Bangladesh and stopped STW credit in an additional six sub-districts in December 1983. The situation worsened far more since then indicating that the limits of ground water resource in some areas have already been reached.

Reduction of the ground water level to a specific depth and desperate attempt to extract water in these areas have resulted in a number of ecological effects, viz.:

¹³ Dr. Hamidur Rahman Khan, Water Resources Development in Bangladesh: Problems and Prospects, paper presented at a Regional Seminar on Water Resources Policy in Agro-Socio-Economic Development, August 4-8 1985, Dhaka.

¹⁴ Master Plan Organisation, Second Interim Report June 1984, p.3.

¹⁵ Ibid.

1. Desertification: The roots of the natural vegetation in these areas were adapted to a ground water level of a particular depth. Because of the lowering down of the water level the vegetation fail to adapt to the new level. The result is the top dying of the natural vegetation there.

2. Salinization in the irrigated areas as well as in the coastal areas: The decreasing ground water allows the saline water to intrude inland in the coastal areas whereby the salinity front penetrates into the mainland. But ground water reduction alone does not cause soil salinity. Reduction of surface water also contributes to it.

Salinity due to surface water irrigation is not so pronounced due to its exploitation within the country. It is more significant due to the diversion of water by the upper riparian state, India in order to irrigate the agricultural land in the drought prone areas of Bihar and Uttar Pradesh. Bangladesh and India share 54 common rivers. Various flood control and irrigation projects undertaken by India in the upstream seriously affect the ecosystem downstream. The areas ecologically dominated by the Ganges, i.e. the south-western region in Bangladesh is the major victim of such development programs in the upstream. The only agreement that existed for the sharing of Ganges water (whereby Bangladesh was to receive 34'500 m³/s of the 55'000 m³/s water available in the Farakka and India was to receive 20'500 m³/s) also expired in 1986. In absence of any more agreement India is now withdrawing any amount of water she wants through Farakka Barrage. Due to upstream withdrawal in the dry season flow of the Ganges, Gorai-Modhumati, the tributaries of the Ganges, receive very insignificant flow to check salinity. In 1968 the minimum discharge of water at the Hardinge Bridge (a railway bridge over the Ganges) was 58'800 m³/s and the salinity of the Passur (a river in the Coastal area) river was 1000 micro mhos per centimeter. In 1976 the water level of the Bridge came down to 23'200 m³/s whereas the salinity of the river increased to 136'000 micro mhos/cm. In 1982 the water discharge was 31'400 m³/s and the salinity decreased to 11'500 micro mhos/cm.¹⁶ This shows the relationship between the flow of water from the Ganges and the level of salinity. To keep salinity to a permissible limit (below 500 micro mhos/cm), the minimum Ganges flow at Hardinge Bridge (the point where the Ganges flow is measured) should be about 2200 m³/s which is very close to the prediversion average minimum flow in the Ganges.¹⁷ Salinity in the Sibsa and Passur estuary reaches the maximum during the months of April and May. The 500 micro mhos line engulfed an area of about 27'600 km² during 1983 which has surpassed all the lines of the same concentration in other years.¹⁸ In 1983 the 500 micro mhos line reached about 13 km north of Kamarkhali and

¹⁶ Z. Karim, S.M. Shaheed et al., Coastal Saline Soils and their Management in Bangladesh, Bangladesh Agricultural Research Council, p.2.

¹⁷ A. Hannan, Ganges Flow and Salinity Problem, Bangladesh Journal of Water Resources, Vol. 2, No.1, December 1981, pp. 19-27.

¹⁸ Ainun Nishat and Shahjahan Kabir Chowdhury op. cit.

penetrated up to 300 km inside from the Passur mouth.¹⁹ Salinity observed at Khulna topped all past records reaching 17'100 micro mhos in April 1983.²⁰ In the recent years the diversion of water has increased much more making the surface water level at the Hardinge to only 4 to 4,25m compared to the historical height of 6,7m.

Salinity in the Meghna estuary is not a problem at the moment but it is anticipated that the salinity limit may advance further inland if the fresh water supply is reduced. The headwaters of the Meghna receive their water from the Sylhet and Mymensingh Districts. Presently about 38% of the country's territory and 33% of the population is affected by salinity in the water supply.²¹ Most seriously affected of this salinity is the south western region of the country as well as the coastal mangrove forest. Salinization in the coastal areas has hampered the generation process of the forest as well as the habitat of hundreds of aquatic species through to the destruction of the natural food chain.

Beside the upstream diversion of water for agriculture various flood control, drainage and irrigation projects undertaken by the Ministry of Irrigation, Water Development and Flood Control under the name of FCD and FCDI have contributed to salinization of 20% of the net cultivable area. In many projects under these programs internal drainage is reported to be poor. In many areas of the project it remains perennially water logged. It is because of excessive seepage losses from neighboring irrigation channels. Sulfur and Zinc deficiencies are reported in these areas. Moreover the obstruction caused by these FCD's and FCD's hampers the normal outflow of the river water in many places further contributing to saline intrusion in the coastal areas.

2.1.1.3. Reduced water flow and increased evaporation through dams irrigation etc.

Reduced water flow in Bangladesh occurs either because of seasonal fluctuation or because of the withdrawal of water through numerous dams and barrages by the upper riparian state, India. The country has not yet achieved the capacity to exploit surface water for mass scale irrigation through dams and barrages to the extent of reducing its flow.

All the rivers in Bangladesh have their origin outside the country except for one small river. Main diversion of the river water by India is done from the Ganges through the Farakka Barrage. Although India started operating the barrage without arriving an agreement with Bangladesh (as normally required in case of common rivers), such an agreement was concluded at a later stage, i.e. in 1977. The agreement, which was valid for five years, expired in November 1982. Although it was extended by two memoranda of understanding, but there was no agreement from 1987 onward at all and in its absence India became free to divert as much water as she wants. The water level registered at Hardinge Bridge fell below the minimum ever recorded, i.e. 23'000 m³/s compared to a

¹⁹ Ibid.

²⁰ Ibid.

²¹ ESCAP, ECU/MCEA/PM/4.

historical average of 64'430 m³/s.²² The water level at Hardinge which was 6,7m came down to 5,2m in the mid eighties while in the 1992 dry season, it came down to about 4,3m. Experts feared that the pumping station at the Ganges Kobadak irrigation project would be inoperative in case the water level fell lower than this. When the surface water level was 5,2m, the ground water level fell by 1,5m. In case of 4,3m water level the lowering of ground water level can easily be assumed.

Besides the Ganges water is being diverted by India through dams from various other rivers which include rivers like Brahmaputra, Teesta and numerous other smaller rivers. India has adopted flood control schemes on the Brahmaputra to reduce the flood hazards and damages. Such schemes involves 3850 km of embankments along the main river tributaries, 770 km of drainage channels and 44 town protection projects. Various river training programs and channel improvement schemes have also been executed. In the field of irrigation development of the Brahmaputra basin India is still going on with other minor irrigation works. According to decade old data 600'000 ha of area were already under irrigation. Another 1,7 million ha were considered as potential area for future irrigation out of 3.1 million ha of cultivable areas in the Brahmaputra basin in India.²³ The irrigated area has definitely expanded after such a long time to cover almost the entire cultivable area. In the backdrop of such water use the total withdrawal of water from the river by India will be about 50'000 to 60'000 m³/s.²⁴

Large volumes of water are also being withdrawn from the river Teesta. Considering the importance of the river for irrigation of the northern districts, the then government of East Pakistan undertook the Teesta Barrage Project in 1958-59, which was completed by the Bangladesh government in 1990. But the objective of the project, i.e., to irrigate 566'000 ha of land and to protect 769'000 ha from flood and other natural hazards, could not be accomplished completely because of the 'Gajaldopa Project' undertaken by India. Moreover, the only agreement existing between the two countries (whereby 36% of water was allotted for Bangladesh and 39% for India, the rest of 25% to be apportioned further under a future final water sharing agreement) has also expired. Although several attempts have been made by the Bangladesh government to renew or enter into a new agreement, no success has so far been achieved. In absence of any agreement India is indiscriminately withdrawing water also from the Teesta to the grave detriment of the lower riparian's ecological equilibrium.

Of the smaller common rivers, which total 51 and contributes 15% of the total surface flow, most of them are facing ecological and morphological problems due to reduced water flow caused by the upstream blockage and diversion.

22 Khurshida Begum, *Tension over the Farakka Barrage: A Techno-political Tangle in South Asia*, University Publishers Ltd., Dhaka 1987, p. 137.

23 Amjad H. Khan and Shahjahan Miah, *The Brahmaputra River Basin Development*, in: Munir Zaman et al. (eds.), *River Basin Development*, Dublin 1983, p.94.

24 Ibid.

The impact of such diversions is disastrous on the balance of the riverine ecosystem of Bangladesh, particularly in the south-west region of the country which is totally dependent on the Ganges river system. Following are a series of consequences Bangladesh is going to be confronted with:

i) Flood: Although there is deforestation in the Himalayan region, the melting of the Himalayan ice cap as well as the various obstructions created within the country are the main reasons for flooding the Farakka as well as other barrages and dams over the common rivers in India contribute greatly to its intensity and frequency. Diversion of the silt free water into the upstream pushes a large volume of silt into the river downstream and thereby decreases the carrying capacity of the rivers. It has been shown in a study that 30% of the country is subjected to flood due to the spillover from major rivers while the flood from small rivers cover about 40% area of the country.²⁵ More than 80% of the flood run off is brought from outside the country of which 90% is contributed by the major rivers.²⁶

ii) Desertification: The reduced water flow have resulted in the desertification of some regions in the country, particularly in areas of south and south western region dominated by the Ganges largely by depleting soil moisture and increasing salinity. It has increased the soil salinity in 21 districts of the country by 40% as has been discussed earlier.²⁷ The lowering moisture context of soil is a sure sign of desertification. The critical point of moisture (lowest percentage of moisture in the soil), usually recorded in April and the month May before 1975 has come forward over the last few years to of February.²⁸

iii) Decreasing ground water level: It is also a major ecological effect of reduced surface water flow in addition to excessive withdrawal of ground water for irrigation. This in turn contributes to the desertification process as well as soil salinity in the coastal area.

iv) Degradation of the coastal ecosystem: This is a direct consequence of reduced water-flow. Regeneration of the mangrove forest has decreased significantly due to increase of salinity in the coastal areas. The wild life, aquatic habitats, various species of plants and trees-in short the precious biodiversity is facing extinction.

v) Decreasing river depth and land formation: Parallel with the decreasing river depth land formation in the coastal areas has increased largely due to the absence of strong water flow that pushes the sediment far away in the sea from the coast. Formation of the Talpatti/New Moore island is partly due to this reason and the question of control over it has been instantly disputed between Bangladesh and India.

25 Md. N. Huda and J.U. Chowdhury, Floods and Erosion, paper presented at a regional conference on Floods and Erosion, Dhaka, September 7-10, 1989, p.9.

26 Amjad H.Khan, Flood, Problems and Prospects - A Regional Overview, keynote address on a regional conference on Flood and Erosion, Dhaka, September 7-10, 1989.

27 Bangladesh Observer, November 7, 1989.

28 Ibid.

Apart from these ecological effects the small bordering rivers face the problem like flood in the monsoon, drought in the dry season and shifting river courses due to erosion in the Bangladesh side as well as new land formation on the Indian side of the rivers. The result of such shifting courses of rivers (apart from the loss of agricultural land and human settlement) is also the shifting of the mid channel which is considered as the international boundary line between India and Bangladesh. Erosion of the river bank of the Bangladesh side expands the claim of India to a great extent within the territory of Bangladesh, as the mid channel shifts towards Bangladesh. This applies in case of the bordering rivers, i.e. Kushiara, Muhuri Khowai, Feni, Ichamati, Gumti, etc. They also constitute bone of contention between Bangladesh and India.

2.1.1.4. Industrial accidents in plants situated on river banks

Data on this aspect of water pollution is just now non-existent. However it can be generally said that no such industrial accident took place in the country whereby a massive water pollution occurred. But the general practice of disposing off the everyday industrial wastes in an untreated form directly into the water bodies are not any less dangerous or harmful than a number of industrial accidents.

2.1.1.5. Siltation

The reduced water flow due to upstream diversion, fluctuating rainfall, long period of dry season, meandering river courses etc. as well as frequent tectonic movements in the Himalaya have increased the siltation rate in the country. The problem has become so serious in the recent years that major rivers like Padma, Jamuna, Teesta, Mahananda, Punarbhaba and many others are becoming clogged up due to shoals.

Deforestation and consequent soil erosion in the Himalayan region as well as in the watershed areas in the upstream are the most significant of all the reasons of siltation downstream. Available data suggest that by 1950 the Himalayan forest has been halved and from one half to three fourths of the middle mountain range in Nepal has been deforested in the last 40 years. According to a survey made in 1961 it was revealed that in Nepal there was about 83'000 km² of land which was under forest. By 1982 the forest area in Nepal was reduced to the size of about 32'000 km².

The situation is just as bad right across the border in India. According to the Center for Science and the Environment in New Delhi India has lost 40% of forest cover in the last 30 years. The apparent fallout is that the flood prone areas in India have almost tripled in the last 25 years despite an enormous increase in flood control measures. Recent data shows that in less than a decade forest coverage within 100 km of India's major cities dropped by 15% or more.

Stripped off forest cover the Himalayas are no longer able to buffer the powerful monsoon because the sponge effect of the soil to absorb a certain amount of water is lost.

Hard rain flows more quickly off mountain sides taking with them soils that are left unprotected. Furthermore, the increased erosion compromises the soils' ability to retain water. Narrow mountain rivers and streams that receive huge volume of rain water over a short period of time swell beyond their banks sending torrents of water full of silt to the low lands. An amount of 2.4 billion tons of silt load are being carried in the country by the major river systems and these upland silts eventually settle on the beds of shallow deltaic river. Because of the flat terrain of the country strong upland flow is required to push the silt load to the sea.

In absence of such flow only 25% of that enormous silt load reaches the ocean and the rest settles on the rivers' beds decreasing their depth and increasing the frequency and intensity of flood.

2.1.1.6. Flood

Although flood is a regular phenomena in Bangladesh, its intensity has increased in the recent time. Normally 25'960 km² of the country is flooded every year with a flooding depth of 1 to 3 meters. During severe flood years, the affected area can be 52'000 km², i.e. 36% of the country and nearly 60% of the net cultivable area²⁹ can be submerged. The riverine ecosystem has adapted itself to this annual flood and rather reversal of this phenomenon can cause degradation of the environment. But problems arise when flood comes with added intensity and without giving the time gap required to be ready to receive the next surge of flooding.

Besides destruction and damage to human life and various sectors of economy the ecological degradation due to flood are as follows: destruction of the fertile agricultural land by deposition of new flood alluvium which requires to acquire the fertility afresh to produce crop spread of pollutant materials in the entire inundated area to the grave detriment of human and aquatic health. During the 1988 flood the major rivers reached to a record height washing away the toxic chemicals from large numbers of industries. Explaining the magnitude of the 1988 chemical pollution problem an environmentalist said that each of the three distillery units (producing rectified spirit at Rangpur, Panchagarh and Darshana) used over 315'000 liters of toxic chemicals per day and effluents from which one such distillery units was enough to pollute the entire region³⁰. The biochemical oxygen demand of the chemicals released by these was as high as 60'000 milligrams per liter against the allowable limit of 50% per liter according to a survey carried out earlier by the Department of Environmental Pollution and Control.³¹ After the flood the Ghorashal and Palash fertilizer factories caused ammonia and chromium effluents to be mixed with the water of the Lakhya river which is already known not to have any fish

²⁹ Shaukat Hassan, *Environmental Issues and Security in South Asia*, Adelphi Papers No.262 1991, p.18.

³⁰ Mustafa Kamal Mojumar, *Holiday*, September 30, 1988.

³¹ *Ibid.*

habitat near the Ghorashal area. Same was the case with the Fenchugang fertilizer factory. The problem arising out of the lack of sanitation in the rural areas as well as in the slums in the urban areas become very acute during flood through the spread of water born diseases, specially diarrhea.

Existence of various unplanned flood control programs particularly the one under the funding of World Bank, viz. Flood Action Plan (FAP) causes flood damages to become more acute because of poor drainage of flood water. This results in the water logged condition and the consequently degrades the quality of land. Major damages caused by these programs is the reduction of fish production because these projects hamper the natural movement of fish from spawning ground to open water.

2.1.1.7. River bank erosion

River bank erosion is a very natural phenomena of deltaic country where silts and silty clays predominate the top layer of the soil and clay and sandy silts and sands dominate the deeper layer. Thus the soil of Bangladesh is very much vulnerable to erosion and scouring. A network of 250 rivers in this alluvial plain and differing flows of these rivers at different location cause erosion of river banks and river beds. The rivers can rapidly shift laterally cutting out old sand bar deposits, forming new ones, and changing the flow alignment and channel geometry within several miles wide flood plains. Hence, this is the occurrence of extensive erosion. While these are the characteristics of the delta, man-made factors like deforestation together with soil erosion, siltation, flood etc. contribute to the river bank erosion and shifting river courses at a rate of a number of times greater than the normal rate. While deforestation in the Himalayan watershed as well as in the upstream areas has resulted in the increased rate of erosion and thereby siltation of the rivers reduced water flow due to diversion of water in the upstream for irrigation has further contributed to the siltation and decreased river depth in the dry season in Bangladesh. These shallow rivers can not contain the huge volume of monsoon water, both from the rivers as well as from the heavy rainfall and erode the river banks simultaneously with the flood. The river Ganges eroded about 5,5 km of its right bank Southeast of Sujanager between 1965 and 1975.³² The Brahmaputra river is braided and has multiple channels and large shoals over a flood plain which varies from 8 to 16 km wide. The right bank has eroded westward as much as 0.8 km or more in one year at certain points and average shifting has been about 0.08 km per year since 1936.³³ Of the 24'000 km of total length, 1200 km of river bank are subjected to erosion of which more than 380 km face severe erosion problems.³⁴

³² Md. Huda and J.U. Chowdhury, op. cit., p.16.

³³ Ibid.

³⁴ Ibid.

During 1984-85 an investigation was made to find out the extent of erosion of river banks and cities which revealed that at 283 places of river banks and 85 towns and villages are subjected to severe erosion. River wise bank erosion is shown in the following table:

Table 1: Length of bank erosion in various rivers

Rivers	No. of location of bank erosion	length of erosion in km
a) Brahmaputra-Jamuna	30	160 (Total of two banks)
b) Ganges-Padma	30	94.4
c) Meghna	6	12.8
d) Teesta	8	35.2
e) Minor rivers	18	31.2
f) Flosy and other rivers	165	77.6
g) Tidal Rivers	118	83.2
Total(a-g)	283	494.4
h) Cities	85	

Source: M.N. Huda and J.U. Chowdhury, *Floods and Erosion, country paper presented at a Regional Conference on Floods and Erosion, Dhaka, 7-10 September, 1989, p. 9.*

Average annual suspended sediment discharge were estimated in the same study at seven locations in six rivers. These are:

a) Brahmaputra at Bahadurabad	387	million tons
b) Ganges at Hardinge Bridge	212	m tons
c) Padma at Barua	563	m tons
d) Old Brahmaputra at Mymensingh	2,3	m tons
e) Dhaleswari at Jagir	40	m tons
f) Gorai at Gorai Railway Bridge	30	m tons
g) Gorai at Kamarkhali	43	m tons

Ecological effect of such erosion is wide ranging. This not only destroys the agricultural land but also changes the morphological characteristics with changed river course, closer of some areas of the river, destruction of the forest areas, and the fishing grounds etc.

2.1.2. Soil

Total area of Bangladesh is approximately 14.4 million ha (mha) of which 13.46 mha are land surface and 0.94 mha are rivers and other inland water bodies. Agriculture is the mainstay of the economy of Bangladesh contributing 39.39% of the GDP.³⁵ Therefore, the soil quality of the land is of enormous value. The soil of Bangladesh in general is reasonably fertile, well drained and stone free.

Flood plain soil constitute 80% of the total area formed by the sediments deposited by three major rivers and their streams and distributories. Four main types of flood plains are recognized and they are piedmont alluvial plains, Meander flood plains, Tidal flood plains formed under the impact of tidal flooding and Estuarine flood plains locally known as 'Char'. Then there are terrace areas which include Madhupur and Barind Tract in the north and north west occupying about 8% of the country's land area. These two tracts appear to have been suddenly uplifted as a block 3-6 meters high from the surrounding flood plains area. Hill areas account for about 12% land resource and the feature occurs in the north east and eastern part of the country with highest elevation of 600 meter above the mean sea level.

However, various natural causes together with population pressure, decreasing land man ratio, faulty cultivation practices, unplanned drainage, irrigation and flood control projects as well as various impractical communication and transport systems are fast causing deterioration to the soil quality in the country. In addition to these, there are the adverse effects of the factors like erosion, salination, deforestation and loss to urbanization etc.

Forest plays a vital role in the preservation of climatic and natural condition of the country. It checks the soil to erode. The present 2.3 million ha of land under forests are not in a good shape. About one mha of depleted land in the state forest of Chittagong Hill Tracts (CHT) is completely denuded due to repeated shifting cultivation. Slash and burn agriculture is practiced by the tribals in the CHT. But the long time required between the cultivations to allow the forest to regenerate is no longer possible with the growing population pressure and need for land. The result is that 87% of the total land has been classified as having severe limitation to crop cultivation and are subjected to heavy erosion due to steep slopes. In the sloping areas of Modhupur, Barind Tracts and the Northern Piedmont plain, degradation of soil has occurred and is continuing due to faulty cultivation practices. Soils are subjected to erosion in these areas during monsoon rain when soils are loosened by ploughing. In many places heavy compact-clay has appeared

³⁵ Bangladesh Bureau of Statistics, 1989.

in the surface. In this region a monsoon season rainfall of 1244-1320 mm does not seem to have any beneficial impact on the land. The soil has lost its capacity to retain moisture and much of the rainfall runs off the land, contributing little to ground water recharge. Numerous deep tubewells are being sunk in an attempt to ensure year round irrigation for agricultural production. This further lowers the ground water level during dry season and contributes to desertification. Clearing of natural vegetation and cultivation of pineapple in rows are often practiced in the hills of Rangamati district and in the Moulavibazar district. Such practice exposes the hill soils to a very high degree of erosion.

Imprudence in the use of pesticide contaminates soil. It not only destroys harmful insects but also benevolent microbes of the top soil which in turn retards biological nutrient replacement of the soil.

Mining of sand and shingles from agricultural land also causes the top soil to erode because after mining the depressions are abandoned and left fallow.

Irrigation is one of the major reasons for degradation of soil quality. Irrigation is being used to grow High Yield Varieties (HYV) 'Boro'/'Aus' followed by transplanted 'Aman' crops on the same field. In such case the land remains water logged round the year. This practice yields good harvest initially but degrades the soil by continuous submersion for a prolonged period. The causes of soil degradation due to continuous submersion are :³⁶

- Continued absence of oxygen in the subsoil,
- Chemical changes of soil materials by forming compounds toxic to plants,
- Constant loss of soil nutrients by percolation,
- Incidence of pests or diseases associated with water logged environment.

Over exploitation of biomass as well as agricultural residues for fuel, fodder and thatching are causing sulfur deficiency in the soil in many places as well as the decreasing capacity of the soil to retain moisture. The critical area in this respect are the areas where 'Aus' crops followed by transplanted 'Aman' are grown. Another critical area is the Barind tract, the western part of which now shows symptoms of aridity during the dry months, i.e. March-April.³⁷ Increasing landlessness and fragmentation of land not only reduce effective crop area but also cause soil erosion. According to the statistics of 1989 persons per hectare is calculated to be 9.6 for all cropped land including forests and plantation crops and 12.4 for land under agricultural crops only.³⁸

³⁶Toward Sustainable Development: The National Conservation Strategy of Bangladesh, First Draft, Ministry of Environment and Forest (Government of Bangladesh) and International Union for Conservation of Nature and Natural Resources 1991, p.73.

³⁷ Ibid.

³⁸ Ibid., p.68.

In addition to these man-made factors causing the soil quality to degrade there are certain natural causes of degradation which have intensified in recent time. By a satellite study made in 1987 it is found that between 1973 and 1982, an area of about 302 km² has been accreted in the coastal region. Out of the about 60% have been accreted from the Bay of Bengal and 40% by the reduction of estuarine areas. This reduction in the area is an aggravatory factor of flood hazard.³⁹ Coastal areas which are most vulnerable to erosion are Hatia, Bhola and Sandwip.

River bank erosion is the worst cause of land loss and degradation which have increased further due to decreased river depth. Every year large areas along river banks erode mainly during the monsoon taking away good agricultural land, vegetation and human settlement and also creating acute socio-economic problems.

Deposition of sandy material on agricultural land is a natural process of soil degradation and has increased greatly due to deforestation and faulty cultivation practices. This phenomena is present in the Piedmont areas of the hilly terrain in Sylhet and in the CHT districts.

The general idea, though is that flood revitalizes the land through alluvium deposition. In fact, flood deposited alluvium does not readily provide the quality land to produce crop and it takes quite some time to attain the required degree of fertility so until that time the land is useless.

Salinity is another major factor responsible for soil degradation. Salinity in soil occurs mainly in the Meghna estuary flood plain and in the southern part of the Ganges tidal flood plain. A FAO study in 1988 estimated that 0.82 mha of land were affected by salinity. Upstream withdrawal of water and excessive ground water withdrawal for irrigation in certain areas of the country have allowed the saline front to penetrate further in the mainland.

Unplanned human settlement in the urban areas is also a major reason for loss of land and soil degradation. At the beginning of the century 3% of the total population was urban. During the 1950's Bangladesh experienced a 45% increase in its urban population, 137% in the 1970s and 115% during the 1980s. With a present growth rate of 6.5% per annum urban population will be between 35-40 million in the year 2000.

Providing space for the newly emerging urban centers has already put pressure on valuable agricultural land. This means less area for food production for an ever growing population which puts further pressure on end bads to over exploitation of urbanization the remaining land. The increased demand for construction material, has led to the conversion of nearby agricultural land to brick fields. Forest resources and fisheries in the

³⁹ Ibid., p.74.

vicinity of urban centers are becoming overexploited as a result of the pressure of urban requirements.

2.1.3. Forest

Forest resources in Bangladesh are indeed of environmental concern both because of their overuse and destruction. The total forested area, according to official figures, has been reduced from over 20% in the 1960's to less than 9% at present. Unofficially it is estimated that only 6-7% remains forested today. Need for agricultural land and domestic energy consumption have resulted in such reduction. In the country 73% of the total domestic energy consumption is met by the non-commercial energy like fuel wood and biomass.

There are three types of forests under the jurisdiction of the forest department:

1. Tropical evergreen/semi-evergreen forests located in the eastern district of Sylhet, Chittagong Hill Tracts and Cox's Bazar and consists of 8925 km².⁴⁰
2. Mangrove forest along the coast consisting of 5992 km² the 'Sundarbans' in the Southwest in one of the largest mangrove ecosystem in the World. The Chakaria Mangrove forest is a small patch in the Southeast near Cox's Bazar.⁴¹
3. Moist/dry deciduous forest located in the central plain north of Dhaka and between the present and old main channel of the Brahmaputra, consists of 1197 km².⁴²

Besides these there is a small area of unclassed state forest under the control of local district administration, it consists of 6328 km².⁴³ These forests have been long subjected to shifting cultivation and are badly degraded. There are some village forests also surrounding most of the rural settlements. They consist mainly of fruit bearing trees and their exploitation is faster than regeneration. In the decade from 1976-1986 the output of firewood rose by 25%, while timber extraction increased by 100%. About 60% of the wood harvested is for fuel and 35% is for timber. The coastal mangrove forests constitute about 60% of the commercial productive forests, including plantation. The Hill forests provide the remaining commercial timber production. The 'Sal' forest has degraded to 405 ha which was over 8100 ha in 1970.

The hill forests have also degraded over the years to provide raw materials for pulp and paper industries, timber for construction as well as firewood and other materials. The Kaptai hydro power project in the CHT has opened the area to outside settlers whereby the villagers were forced to move up the hill sides. Over the years the forest areas have

40 Bangladesh Bureau of Statistics, Yearbook 1987.

41 Ibid.

42 Ibid.

43 Ibid.

been shrinking and degrading due to shifting cultivation, encroachment, land alienation, fire and logging.

The Chakaria 'Sundarbans' is extensively lost to human settlement and the demand for poles, posts, fuelwood, grazing, etc. further denuded the forest. A large part of it has also been cleared for shrimp cultivation. These factors are leading the mangrove forest to its fast depletion. The Khulna Sundarban, which has been a managed forest for over 100 years, is also subjected to depletion. 'Sundari' and 'Gewa' have declined by 40% and 45% respectively since the last inventory was made 20 years ago.⁴⁴ The reduction is due to over harvesting by over 100% in the case of fuelwood species. Also the increase of salinity in the coastal region due to upstream withdrawal of the Ganges water has also contributed to the decrease of regeneration rate of these species of trees⁴⁵. About 50'000 to 60'000 people are directly dependent on the 'Sundarbans' for their livelihood. In an average day 45'000 people work in the Sundarban forests. In a whole year the figure comes to about 300'000 based on Forest Department's license and permit record. The unofficial figure is much higher.

Together with the forest the habitat of the various species of animals and plants an area of which Bangladesh provides a wide range of diversity are also depleting. Some of the animals and plants are endangered and are already listed in the IUCN Red Data Book. The most famous, of course, is the Royal Bengal Tiger (*Panther tigris*) along with other cats (e.g. Panther, *Pardus*), primates (e.g. Rhesus, Macaque, Languor etc.) bears, civets, mangoes, reptiles, snakes and elephants as well as birds and aquatic animals.

The ecological effect of such deforestation has wide ramification. These are:

- Soil erosion and silting up of river beds, lakes, 'beels', 'haors' etc.;
- Decreased river depth leading to flood, river bank erosion shifting river course;
- Deforestation in the coastal areas leading to erosion in the coastal areas;
- Soil erosion and decreasing soil fertility leading to desertification;
- Decreased evapotranspiration (the evaporation of water from plants by way of holes of leaf surface) and decreased cooling effect of the atmosphere, decreased rainfall;
- Increased intensity of cyclones and storm surges in the coastal area as forest acts as first protection line in the coast against such natural hazards;
- Loosening of the soil in the coastal areas and easy intrusion of saline water in the mangrove forest which further destroys the rest of the forest and aquatic habitats.

⁴⁴ The Environment and Development in Bangladesh: An Overview and Strategy for the Future, prepared by Canadian International Development Agency for Bangladesh Programme, Asia Branch, October 1989, p.17.

⁴⁵ ESCAP, ST/ESCAP/618 cited in: The Environment and Development in Bangladesh: An Overview of Strategy for the Future, op. cit.

2.1.4. Atmosphere

Although Bangladesh's contribution to greenhouse effect and global warming is very insignificant, the country is going to be the worst victim of such environmental degradation. According to the Report of the World Resources Institute 1990-91, the net CO₂ emission by Bangladesh among the South Asian states is only 1.61% compared to 90.72% by India. South Asia's contribution to the global total green house gas (GHG) emission is 4.7% of which Bangladesh's share is 0.4% only. Emission of CO₂ and other pollutants in the atmosphere in Bangladesh is localized in the small industrial areas in the urban centers.

There are some densely populated and industrialized pockets, e.g. Dhaka, Chittagong, Khulna cities where number and size of units are large enough to generate significant air-pollutant loads probably beyond the assimilation capacities of the surrounding environment.⁴⁶ The size and number of such pockets are expanding. Thus while the situation in respect of air quality may not be critical because of prevailing meteorological conditions (which are usually favorable to provide adequate ventilation to disperse air emission from industrial and other activities) due to flat terrain and relatively high wind speeds most of the year complacency can not be affordable.⁴⁷ Among the industries that emit pollutants are pulp and paper (toxic and chemicals like mercaptants, chlorine, and dust from lime kiln), urea plant (ammonia and ureadust and when production stops, large volume of CO₂), triple super phosphate plant (dust), etc.

Apart from the industrial units increasing number of motor vehicles in the urban areas are another source of atmospheric pollution. The department of environment in January 1990 carried out monitoring of certain parameters of Dhaka ambient air like 'suspended particulate matter' (SPM) SO₂ and N. It was revealed that SO₂ and NO_x concentrations were low enough to cause alarm while the situation in respect of SPM is rather bad primarily due to large emission of smoke from vehicles⁴⁸ SPM/TSP concentration in Dhaka was highest at Motijheel Commercial Area, in January (570 microgram/m³) to lowest at Tejgaon area in May (178 microgram/m³). Similarly SO₂ concentration recorded was highest at Motijheel in January (312 microgram/m³) to lowest at Motijheel and Tejgaon in June (4 microgram/m³). Nitrogen oxide concentration was highest at Motijheel in January (54.7 microgram/m³) to lowest at Tejgaon in April (4 microgram/m³). The result from the samples only gave a general picture of the air quality situation which are not very serious.⁴⁹

⁴⁶ Environmental Policy, Report of the Task Force on Bangladesh Development Strategies for the 1990's, Vol. 4, Dhaka 1991, p.157.

⁴⁷ Ibid.

⁴⁸ Ibid., p.158.

⁴⁹ Ibid.

CFC production in the country is nil and the amount emitted from the imported air conditioner and refrigerator is very negligible to exert effect on the ozone layer.

While Bangladesh's contribution to atmospheric change is very insignificant, the country would be amongst the first and worst victim of global warming and sea level rise. An increase of 1.5 to 4.5 degrees Celsius can be expected as early as 2030.⁵⁰ A warming of this magnitude would cause a rise of sea level from 40 to 120 cm.⁵¹ The average height of Bangladesh is estimated to be only 7.6 meters above the present sea level. One meter rise in sea level would inundate 17% of the countries land area, i.e. over 25,000 km² The entire 401,600 ha of mangrove forest in the Sundarbans as well as 36,000 ha of mangrove forest along the coast will be gradually destroyed.⁵² Extensive river diversions markedly decreased the amount of freshwater discharge into this coastal environment while higher sea levels would increase saltwater intrusion reducing forest cover to aquatic habitats and biodiversity. Reduction in river outflow may also accelerate the intrusion of brackish waters into aquifers, a problem that already extends 240 km inland.⁵³ A very rough assessment indicates that with a one meter sea-level-rise, an area of high salinity intrusion will increase from existing area of 13% of Bangladesh land area to a 32%.⁵⁴ In fact the entire south and south western part of Ganges-Padma-Lower Meghna river system will be affected by high salinity penetration.⁵⁵

Another important effect of climate change would be change in spatial and temporal distribution of temperature and precipitation. In a recent study made in 1989 more than 85 years of rainfall data for six different station including the driest area viz. Rajshahi and Kushtia as well as the heavy rainfall area, viz. Sylhet, were analyzed. When the rainfall data was analyzed season wise, it was found that during the monsoon rainfall period all stations except Kushtia indicate increasing trends; whereas for dry and pre-monsoon seasons, two out of six stations indicate decreasing trend. The analysis of rainfall variation indicates that the co-efficient of variation is more in the drier areas as well as during pre- and post-monsoon periods.⁵⁶

In the same study the magnitude and frequency of heavy rainfall were also analyzed assuming 43 mm or more rain in 24 hours to be heavy rainfall and the amount of rain is considered as the magnitude of the heavy rainfall. The result of analysis indicates that for Bangladesh both frequency and magnitude (mean monthly) are maximum during the

50 Changing Climate, Report of the Carbon Dioxide Warming Projection from US. National Academy of Science, Assessment Committee, Washington DC. 1983.

51 Irving Mintzer, A Warming World: Challenges for Policy Analysis, Economic Impact No.65 1988/89, p.6.

52 Environmental Policy, op.cit., p. 179.

53 John D. Milliman, Environmental and Economic Impact, cited in: Jodi .L. Jacobson, Environmental Refugees: A Yardstick of Habitability, World Watch Paper No.86 1988, p.35.

54 Environmental Policy, op.cit., p. 180.

55 Ibid.

56 Mahtab, 1989, cited in: Environmental Policy, op.cit.

months of June and July. The results of linear regression analysis indicate that the annual frequency of heavy rainfall for Dhaka, Sylhet and Rangpur (wetter area) depict an increasing trend, whereas for Rajshahi and Barisal (relatively drier area) it indicates a decreasing trend.⁵⁷

Decrease in rainfall, higher co-efficient of variation of rainfall and shorter monsoon period in the already drought prone western part of Bangladesh is likely to increase both frequency and intensity of drought stress. The drought prone areas would also extend towards south and south central region of Bangladesh.⁵⁸

On the other hand, the frequency of flood will increase. Accretion and subsidence is the dynamics of the delta. Over time these sediments accumulate. But regional and local tectonic effects along with compaction cause the land created to subside. Local subsidence alone can be as 10 cm per year. Local rate of sea level rise then depends on the sum of global sea level rise and local subsidence.⁵⁹

Overpopulation and decreased river flows have increased the rate of ground water withdrawal almost six times in Bangladesh over the last two decades which has affected subsidence rates. Sediment sample suggest that ground water withdrawal may have raised the subsidence rate to at least twice the natural rate.⁶⁰

Thus the local rate of subsidence, increased rainfall, rising sea as well as the vast volume of Himalayan water (melted due to a warming world) would result into intrusion of so much water that the entire country would be subject to massive flooding. The area affected by the major floods during the last 33 years has increased from 50'500 km² in 1955 to 90'000 km² in 1988.⁶¹ In the past, massive floods used to hit Bangladesh only once in every 50 years and so. Since mid of the present century, the number and severity of large scale flood has increased markedly. In the seventies there has been a flood in every four years. Since 1980 there have been five floods, each one worse in terms of unprecedented damage. In the 1988 flood 80% of the country was submerged.⁶²

Sea level rise will enhance the process of shoreline erosion. Per Braun of Technical University of Norway in a study showed that shoreline erosions were of the order of 0.3 meter per year. If sea level rises 1.5 meter by the year 2000, shoreline recession will be about 150 meters.⁶³ Vast areas of the coast of Bangladesh will be flooded. This will add to the existing process of erosion due to tidal action which is the general reason of erosion in the coastal region of Bangladesh.

57 Ibid.

58 Ibid.

59 John D. Milliman, *Environmental and Economic Impact*, cited in: Jodi .L. Jacobson, *op.cit.*, p.31.

60 Ibid., p.33.

61 *Environmental Policy*, *op.cit.*, p. 183.

62 Jodi L. Jacobson, *Flood: An Unnatural Disaster*, *Bangladesh Observer*, December 8, 1990.

63 Mohiuddin Ahmed, *Holiday*, May 31, 1991, p.5.

Warmer climate and rising sea would increase the frequency and intensity of tropical cyclone, tornadoes and storm surge. The average annual frequency of tropical cyclones in the Bay of Bengal ranges between 12 and 13 out of which 5 attain cyclonic strength (wind 35 knots). A comparative study of monthly frequency of tropical cyclones in the Bay of Bengal for the period 1891 to 1960 against subsequent 14 year period (1961 to 74) clearly indicate that monthly frequency of tropical cyclone during later period (1961 to 1974) is significantly greater than that of 1891 to 1960 period.⁶⁴ It is opined by the experts that the reason behind the cyclone of 1991 in Bangladesh to take such catastrophic turn is the rising sea and warmer climate. Usually storm surges as much as 6 meters higher than normal can reach as far as 200 km inland. But the height of the surge was 15 to 20 meters in the 1991 cyclone.

Thus, the intrusion of salinity increased rainfall in some areas, drought in others, flood in the entire country, shoreline erosion, destruction of the mangrove forest as well as aquatic habitats and the increased cyclones, tornadoes and storm surges etc., would totally change the ecological equilibrium to such an extent that the existence of the country will be at stake.

2.1.5. Ocean and seas

As far as the adjoining sea is concerned Bangladesh, mainly because of the underdeveloped state of the country, enjoys a relatively pure and unpolluted status of the marine environment. However, the ocean nearer to land is more polluted than the EEZ. The agrochemical, industrial as well as the solid wastes and sewage pollutants are all disposed off in the water bodies in an untreated form, which through numerous rivers, and their tributaries and distributories, ultimately reach the ocean. This destroys the balance of the marine environment to grave detriment of the aquatic resources. This factor depletes the fish production much more than the overuse or over exploitation because the country lacks the facilities to conduct deep sea fishery and the people are not yet accustomed to have salt water fish in their regular protein intake. Due to lack of police patrolling facilities a number of foreign trawlers (mainly Thai) fish within the territorial water illegally. Same is also liable for allowing illegal disposal of toxic waste in the Bay of Bengal and adjacent Indian ocean by the industrialized countries. Besides, the Chittagong and Mongla port do not possess facilities to dump the bilge water or burnt oil and their disposal is also polluting the coastal areas seriously. Nearly 1000 ships, including 50 oil tankers ply the water of Chittagong harbor every year, not to mention countless small crafts.

⁶⁴ Environmental Policy, op.cit., p. 183.

2.2. Causes of the environmental problems (I.3)

2.2.1. Available renewable resources

Availability of freshwater: Fresh water resource in the country consists of rainwater, surface water and ground water. Rainwater availability is limited in the monsoon period of which 90% of the rainfall occurs in the 4 months period of the monsoon (June to September), while there is minimum rainfall during dry season (October to March). Rainwater is more available in the north east and less in the south west.

As regards surface water on an average approximately 2.98 billion m³ of stream flow are discharged in the Bay every day. However, the total stream flows (under 1990 water use condition) in the entire country as indicated by the total outflow of the Bay of Bengal varies sharply from about 89'000 m³/s in August to only 5714 m³/s in February.⁶⁵ The average annual surface water inflow into the country is 1080 km³. With a gross area of 144'000 km², the country receives about 9,14 m of water per hectare per year. The average annual evaporation is about 114,3 cm or 162,64 km³ over the gross area.⁶⁶ Only a little more than 12% of the total volume of water entering Bangladesh can be used for agriculture and virtually all the rest flows to the sea.

However, this annual picture conceals some of the important fluctuations during the course of a year. The average rainfall over most of Bangladesh amounts to only 7-11 mm during November to March (the minimum rainfall is zero during this period) which is insufficient to sustain crops. In addition the flows in the rivers are significantly reduced during the period of low rainfall. Water supplies are needed between November and May for agriculture, domestic and industrial purposes maintaining adequate river depth to allow adequate navigation, avoiding damage to fisheries and limiting the inland penetration of sea water. These are conflicting demands and the optimal division of scarce winter water among them is the crux of the planning task associated with the 'low-flow' problem. Upstream uses have an important effect on water availability and ecology of the coastal areas.

Ground water is the principal dry season flow of water available in many areas of Bangladesh. It is generally utilized where irrigation from surface water is difficult or impossible and water demand is high. The safe seasonal volume of ground water available for use in each locality is highly variable from place to place because of the recharge of the ground water depends on the surface flow and rainwater. Ground water levels are highest from August to October and lowest in April and May. Actual recharge in the country is considerably less than potential recharge. Highest potential recharge occurs in

⁶⁵ Ibid., p.45.

⁶⁶ Ibid.

the south west, south, south east, north east. The lowest potential recharge occurs in the western region, i.e. in Rajshahi, Kushtia and Pabna.

Soil resources used for agriculture and pasture, etc.: Of the 14.4 million ha of total area of the country 13.46 million ha is land surface and 0.94 million ha are rivers and water bodies. Out of this 13.46 million ha, agricultural land is 9.25 million ha and the rest is covered either by forests, housing and settlement or other uses. Again this entire 9.25 million ha of agricultural land cannot be used equally because of the variations in their quality. The FAO/UNDP project BGD/78/014 for the land resources appraisal of Bangladesh categorized 37.5% of the agricultural land as very good and good, 39.3% as moderate agricultural land, 16.0% as poor and 9.0% as very poor.⁶⁷ Land quality has definitely deteriorated much more since then with the fast rate of environmental degradation. Tendency towards high yield variety of crops and various flood control and irrigation projects have degraded the land quality. Increased intensity and duration of flood have also caused loss of agricultural land.

The time gap required for the flood plain to regain the fertility is becoming scarce gradually. Absence of the food grain gap is resulting into sulfur and zinc deficiencies in the soil.

Forest: Bangladesh has 2.46 mha of forest land covering about 17% area of the country including Forest Department controlled forest, unclassed and village forest.⁶⁸ Inventories show that there has been an overall depletion in forest resources in all the major forests. The growing stock in the 'Sundarbans' has depleted from 20.3 million m³ in 1960 to 13.2 million m³ in 1984, i.e. 35% depletion of resources over the past 25 years. In the reserved forests of CHT the growing stock has depleted from 23.8 million m³ in 1964 to less than 19.8 million m³ in 1985.⁶⁹ Although various programs of afforestation are undertaken by different organizations at the governmental as well as non-governmental level, but the widening gap between demand and supply are ruining all these attempts. There will be a net deficit of 5.96 million m³ of logs by the year 2000.⁷⁰ According to a FAO/UNDP study the annual per capita fuelwood availability in rural areas will decline to 0.02 m³, from a current per capita fuelwood consumption estimated at 0.8 m³, if trees continue to be depleted at current rates⁷¹ The consequence is clearly the unauthorized felling (70% of the snail forest has been cleared illegally over the last 70 years), overcutting of village forest (growing stock in village forests will be reduced from the level of 1981 by 35% by the year 2000), increased use of non-traditional energy source (viz. agricultural residues, biomass etc.) and raw material scarcity for wood based industry.

⁶⁷ Towards Sustainable Development, op.cit., p.70.

⁶⁸ Ibid., p.83.

⁶⁹ Ibid.

⁷⁰ Ibid.

⁷¹ Ibid.

2.2.2. Population size and growth

According to the census of 1991, the population of Bangladesh is 110.8 million with a growth rate of 2.16%. During the period from 1951 to 1989 population has increased by more than 70 million.

Given the trend of crude birth rate and crude death rate, it appears that demographic transition is still too remote. According to a projection of the planning commission, the population of Bangladesh is projected to increase to about 141 million by the year 2000. In an estimate in January 1990 of the World Resources Institute (WRI), Washington, population of Bangladesh may not stabilize before reaching 340 million although measures for population control are being implemented successfully.⁷²

With a population of this size and a land area of 144,000 km² Bangladesh at present ranks as the world's eighth and Asia's fifth most populous country. The density of population is 793 persons per km² which is one of the highest in the world. If the population continues to grow at the present rate, it will double in another thirty years. Such a growth rate is rather alarming for a country like Bangladesh, as the national production has to grow by at least 2.4% per annum only to keep the per capita income at a constant level.⁷³

Apart from the size of population, there is a tremendous growth potential built into its age structure. Population below the age of 15 years is around 46% of the total population and 48.4% of the female population are within the reproduction age.⁷⁴

Population growth rate has reduced the land-man ratio to 0.117 ha in 1990 from 0.134 ha in 1981. This resulted in an increased landlessness, decreased land quality and other resources due to over exploitation and increased migration to the urban areas. Since 1951 the urban population has increased from 1.8 million to 13.2 million in 1981.⁷⁵

Another aspect of the on the problem of population growth in Bangladesh is the lack of complementary resources with which the growing labor force could be productively utilized. The present rate of unemployment is around 35-40% of the total labor force. Population under the age of 15 is 46% who will attain the working age within a few years whereby the unemployment problem would intensify further.

2.2.4. State of agricultural and industrial production

Agriculture is the most important sector of the country's economy. It contributes 48% to the GDP during 1988/90⁷⁶ and employs 55% of the civilian labor force. Agriculture includes:

⁷² Ibid., p.65.

⁷³ Environmental Policy, op.cit., p.15.

⁷⁴ Ibid.

⁷⁵ Ibid., p.16.

⁷⁶ Bangladesh Bureau of Statistics, Yearbook 1991.

- crop agriculture
- crop agriculture in the coastal region
- fisheries
- livestock
- forest
- biodiversity.

From the mid 1990's to date the rate of growth of food grain output averaged about 3% but for the 1980's the trend of growth rate was no more than 2.2%.⁷⁷ A large part of the growth since the middle of the 70's is the result of irrigation and expanded use of high yield varieties (HYV) of rice and what during the dry season. Performance of non cereal crops was poorer, about 2% per annum.⁷⁸ There has been stagnation in the wet season production; the better performance of the 'Aman' crop could do no more than just offset the decline in 'Aus'. Furthermore, the rapid growth rates of dry season crops of the late 70's were not sustained in the 1980's when irrigation growth rate slowed down. Finally north west regions which had shown remarkably high rates have stabilized at a lower level while others with low growth rates have not picked up.⁷⁹ Various factors discussed earlier have contributed to such a decline. Over 13% of the net cultivable area is in the coast. Out of 2.85 million ha of coastal and off shore areas about 0.9828 million ha are arable but affected by varying degrees of soil salinity. Agricultural land use in these areas is very poor, which is much lower than the country's average cropping intensity (159%) ranging from 62% in the Chittagong Coastal region to 114% in the Patuakhali coastal region.⁸⁰

Fishery provide the main protein intake of the people in the country. It consists of open inland water fisheries (in rivers, estuarine areas, 'beels' inundable flood plains and lakes), inland culture fisheries, marine industrial and marine artisanal. Nature has made Bangladesh a leading producer in fresh fish production producing annually 4000 kg per km against 411 in China and 301 in India. Fisheries sector accounts for 3% of GDP 8% of the gross value added of agricultural products, 71% of the animal protein intake, 11% of export earning and employs 1.1 million people. Annual production is 830,000 metric tons. However, there a trend of decreased production in the recent time. From 1983-84 to 1987-88 inland capture fishery declined by 2.7% a year, inland culture fishery 10.7% and marine industrial fishery 8.0%. Marine artisanal fishery, however, shows a tendency of increase by 9.6% a year.

Forest resources have already been discussed earlier. Biodiversity including terrestrial ecosystem, aquatic ecosystem, species diversity, genetic diversity etc. have all shown a

⁷⁷ Environmental Policy, op.cit., p.77.

⁷⁸ Bangladesh Agricultural Sector Review, Bangladesh Agriculture Performance, Resources, Politics and Institutions, Final Draft Report, UNDP, Dhaka 1988.

⁷⁹ Environmental Policy, op.cit., p. 78.

⁸⁰ Ibid., p.86.

gradual degradation because of population exploitation and increased human necessities. Degradation in every sector of agriculture compared to population have pushed the people to exploit the resources to the non-renewable limit even though such practice would contribute to long-term depletion or degradation of resources. An underdeveloped state of industry can not provide the people with an alternative source of living.

Table 2: Growth rates of agriculture by sub-sectors 1973-1987

Sub-sector	73-76	77-81	82-87	73-87
Crops	7.6	2.6	2.0	3.0
Livestock	1.4	9.3	2.6	6.2
Fisheries	3.0	8.0	2.8	2.2
All agriculture	6.0	2.6	2.2	2.9

Source: Internal World Bank Document, Cited from *Development Strategies For the 1990's, Report of the Task Forces, Vol. II 1991, p. 103.*

State of industrial production: The manufacturing sector of Bangladesh accounted for about 7.8% of GDP in 1969-70. The sector's share rose to a peak level of 10.8% in 1979-80 and then gradually declined to 8.49% in 1988-89. Industries are mainly agro-based viz., jute, cotton, sugar, paper, match pulp, leather etc. Other industries include engineering, chemical and pharmaceutical, fertilizer, steel, aluminum, soap etc. Private investment from 1978-1981 was overachieved by 59% while in the first and second five year plans it fell short of targets by only 13% and 19% respectively.⁸¹ Private investment during the first 4 years of the third five years plan reached only 48% of the target indicating a worsening of performance.⁸² Financial performance analysis indicated that the public sector corporations continued to incur substantial losses. As a result the overall growth of industrial production has been significantly lower in the 1980's (about 2.5% per year since 1980- 81) than in the 1970's (4.3% per year during 1975-76 through 1979-80).⁸³ Sickness of industries now about 50% according to certain studies, continue unabated. Unrecovered loan resulted into credit squeeze for the genuine industries. Smuggling has become more rewarding than trading and trading more rewarding than

81 Managing the Development Process, Report of the Task Force on Bangladesh Development Strategies for the 1990's, Vol. II (UPL Dhaka 1991), p.2.

82 Ibid.

83 Ibid.

manufacturing.⁸⁴ Resources have shifted from manufacturing to trading and other activities thus rendering the hope of long term industrialization an elusive one.⁸⁵ On the export front, however, turn out appears to be less spectacular when one looks at the value added content of these exports. Overall exports constituted a meager 7% of GDP in 1988-89 as against 6% in 1969- 70.⁸⁶

2.2.4. Position in world economy

Bangladesh is enlisted in the United Nation's categorized 'Least Developed Countries'. With an average annual per capita income of \$160 80% of the people live below the poverty line. GDP growth is 3.3%, export in the 1991 was of \$1.7 billion, deficit in trade, is \$306 million, foreign debt is \$11.9 billion and inflation in consumer price index in current account is 7.4%.⁸⁷ Exchange rate is 32.9 Taka per dollar and the annual rate of depreciation is 2.5%. Hence, the position of the country in world economy is very insignificant. Development work in the country is poverty alleviation-oriented and trade, etc. is undertaken as response to fulfill the domestic shortage. Need for foreign exchange, i.e. hard convertible currencies (both to meet the government expenditure on public goods for fueling economy and the international financial obligations like debt servicing, interest payment, etc.) push the country to export raw materials from primary sectors like agriculture. Moreover the country has to sell the export items under priced because of competition in the world market as well as for the unfinished state of export items. Such drop in price results into an accelerated claim on natural resource base and the growing tendency of the producer to shift a large share of the social and environmental cost of production on to others, viz. low wage, inadequate fertilizer use, too little reforestation, etc. This leads to further depletion of natural resource base.

2.2.5. Pattern of consumption, reproduction

Freshwater: The predominantly agrarian society evolved in the country over the centuries with full dependence on the climate and weather. Except for lifting water from ponds and streams to provide supplementary irrigation with swing basket, etc., done by farmers themselves at a very small level, no major efforts were taken in water development until 1959 when the Pakistan water and power development authority was established. In 1961 a limited number of low lift pumps and tube wells, both shallow and deep, were distributed. But the rapid expansion started after 1962 and the easy to use water resources went at a maximum level of utilization. Other sectors of water use did not receive that much importance as they did in case of agricultural production, protection of

84 Ibid.

85 Ibid.

86 Ibid.

87 World Almanach 1992.

land from flood irrigation, etc. Result is the degradation or interruption of other sectors dependent on water, viz. fisheries, forestry, etc.

Soil: Energy consumption pattern in the country has largely degraded the soil fertility. Energy consumption pattern in Bangladesh is characterized by heavy dependence on traditional biomass fuel which accounts for 73.1% of the total energy use. At the moment even in the industrial sector 70% of the energy used is biomass, 82% of the biomass energy consumed in the industrial sector is provided by agricultural crop residues and only a few industries use fuel wood. In the domestic sector which consumes 65% of the total energy, 91.5% of the energy is provided by biomass fuel almost all of which is used for domestic cooking. Of the total biomass fuel used for rural cooking, crop residues, wood fuel and animal dung contributes 65.9%, 12.4% and 21.7% respectively. In case of urban cooking 65.3% of the biomass fuel is provided by fuel wood and the rest of the biomass fuel comes from crop residues. The consequence of such a heavy dependence on the biomass resulted in the extremely low level of nutrient presence in the soil, since this biomass provides the basic supply of soil nutrition in absence of fertilizers, etc. which the poor farmers can hardly afford.

Population pressure and limited arable land have also produced the trend of consumption of land without any gap required for the land to revitalize.

Forest: Consumption of forest is greater than reproduction. While fuelwood provides a major portion of the domestic energy consumption, it provides raw material for the industries like paper, match, pulp, etc. Per capita consumption of fuelwood and timber is estimated at 0.07 m³ and 0.01 m³ respectively, which are very low compared to the neighboring countries. Village forests constitute 89% and 80% of the country's total fuel wood and saw or ply logs supply respectively and village forests are exploited at a rate of 10% of standing volume which is double the rate of extraction that these forests could apparently sustain.⁸⁸ Same applies to the mangrove, the Sal and forests in the hilly areas. Afforestation programs have also been taken. During 1973 to 1990 plantation programs covered a total area of 2,37,260 ha of land.⁸⁹ However, such afforestation cannot maintain balance with deforestation because planted trees take some time to mature. Besides energy and industry, forest resources are depleting due to need to expand agricultural land and human settlement. The brick burning sector consume a vital share of the forest resources.

2.2.6. Social land cultural peculiarities

Traditionally people of Bangladesh together with the people of the South Asian region had been living in harmony with nature. Natural resources were utilized according to

⁸⁸ Towards Sustainable Development, op.cit., p.85.

⁸⁹ Ibid.

certain well defined principles that indicate a deep and rational understanding of ecological processes. With lesser population pressure mass use of resources then was not so much geared to market oriented economy. Colonial exploitation over the last two centuries seriously disrupted the harmonious balance of nature. This period witnessed the switch from food crop to cash crop with a view to feeding the lucrative industries of the west. For instance, jute was extensively cultivated for earning ready cash while British colonialists also tended to encourage it so that their jute industries at Dundee could be profitably run.

This trend of ruthless exploitation of resources did not change even after independence. Population pressure and a decreasing land man ration pushed for over exploitation of existing natural resources even at the risk of creating disequilibrium in the ecosystem. Agro-based economy, absence of minerals etc., backward industry and the country's adverse position in the world economy provide further incentive to exploit the limited natural resources. With a very low rate of per capita income and unemployment the country, is trapped in the vicious circle known as 'under developed spiral'.

Lack of education and very low rate of literacy also contributed a great deal toward environment degradation. The literacy rate in the country is only 29.2%. Education is regarded as something forbidden for the village women. Literacy rate for the male is 39.7% and for female 18.8%⁹⁰ although the female constitutes about half of the total population.

Moreover the traditions of inheritance and succession laws have fragmented the land into innumerable divisions and this phenomenon also contributes much toward landlessness, soil erosion, declining soil fertility, low productivity, etc.

2.3. Time dimension of ecological degradation (I.4.)

a) Freshwater:

Industrial and agro-chemical pollution: It is not a temporary phenomenon produced by any ecological catastrophe but took place over the years due to ignorance of our people. The inability of our entrepreneurs to install proper gadgets for waste treatment has also been responsible for such pollution. Our drainage system also is, to an extent, responsible. However, it is reversible in the midterm at a relatively low cost.

Salination: This problem is of long standing character. It is reversible in the long term and at extraordinarily high cost. It would require year round surface water flow as well as increased level of ground water to push the saline front on to the sea. Adequate Ganges

⁹⁰ Cited in: Nahid Islam, Environmental Challenges to Bangladesh, BISS Paper No. 13, July 1990, p.39.

water flow is an imperative in this regard. Ground water extraction practice shall also have to be changed, i.e. the use of deep tubewells instead of shallow one.

Ecological degradation caused by reduced water flow: It is reversible in the long term and at an extraordinary high cost because it involves problems like augmentation of both ground and surface water particularly during the lean seasons when the water is indeed scarce even across the border. Yet justice and fairplay are the only basis on which the scarce water will have to be shared to augment our stream flows.

Siltation: It is reversible in the long term and at an extraordinarily high cost because it involves dredging of the channels inland as well as the check of sediment from the rivers coming from across the border.

Flood Although flood occurs during a definite period of the year, it is a regular phenomenon and connected with many factors permanent in character. Nature-made flood is irreversible, however, man-made flood is reversible but at a high cost because it involves the removal of problems like siltation, various obstruction in the water ways, viz. flood control drainage, irrigation roads and highways, etc.

b) Soil

Environmental concerns emanating from overuse and depletion of the soil resources is reversible in the long term and at an extraordinarily high cost. Because it involves measures like afforestation, change in cultivation practices, provision of alternate energy for fuel to check deforestation as well as consumption of biomass, etc. Excessive and upland ground water withdrawal in particular regions are also to be controlled. Water development and irrigation projects causing damage to the soil quality need to be abandoned. All these are indeed gigantic tasks and are both expensive and time consuming.

c) Forest

Environmental concerns growing out of overuse and destruction of the forest resources are even reversible in the mid term. The cost involved is also not likely to be exorbitant as it involves only the preservation of our existing forest and undertaking an afforestation to ensure required forest coverage.

d) Atmosphere

Ecological effects of atmospheric change occurred over the years mainly because of the profligate consumption pattern of the rich industrialised countries. Management of the problem involves measures like drastic change in the consumption pattern and entire life style, which appear difficult indeed. But there are a few ways out. However, given the growing urge and new awakening on the issue as exhibited at RIO conference the problem can be categorized as a reversible one but at a high cost and still worse it will require an excessively long time for a return to an acceptable global environment. Because it will involve switching to an alternate consumption pattern, innovation and implementation of

such a pattern which may take generations to adapt to. Moreover, the flow of technology in case of developing countries, etc. seem to be an Herculean task.

e) Ocean and seas

The environmental concerns arising out of pollution of the oceans and seas is not a major problem at the moment and reversible in the mid term and at a relatively low cost.

2.4. Scope of the degradation (I.5.)

a) Freshwater

The problem of pollution is confined mainly to this country except for the pollution of the Ganges water when the river water flows into Bangladesh in a polluted form.

The problem of salinization is confined within Bangladesh only as far as its effects are concerned but involves both India and Bangladesh as far as the causes are concerned. The environmental problem of reduced water flow involves Bangladesh only so far as its effects are concerned. But the source of such a problem includes both Bangladesh to a limited scale and India to a greater scale.

The problem of siltation is of transboundary nature so far as the ecological causes are concerned but of the lower riparian, Bangladesh is its worst victim, though siltation occurs more or less throughout the region.

Flood involves all three countries, viz. Nepal, India and Bangladesh so far as the causes are concerned but compared to Nepal and India Bangladesh's contribution is rather in significant. However, the ecological effect of flood is confined to Bangladesh only. Same applies to river bank erosion where the ecological effect is confined to Bangladesh only but the cause is of transboundary character involving also India and Nepal.

b) Soil

Environmental problem relating to overuse or pollution of soil is confined to Bangladesh only so far as the ecological effects are concerned.

As regards ecological causes, Bangladesh itself is more responsible for its degradation. However, India and Nepal can be blamed to the extent the sedimentation, flood and river bank erosion, etc. affect the soil quality.

c) Forest

The environmental problem relating to the forest is confined mainly to Bangladesh so far as ecological effects are concerned. It can again be of transboundary character in the sense that the depletion of forest affects the overall weather and climate pattern of the region. So far as the causes are concerned it is confined only to the country.

d) Atmosphere

The environmental problem relating to an atmospheric change is of global scope so far as the ecological causes and effects are concerned. However, within the region Maldives and Bangladesh are going to be the worst affected countries. India also will bear the brunt of it to an extent.

e) Ocean and Seas:

So far as the ecological effects are concerned it is confined to Bangladesh only but its causes are of global nature because the tankers, ships, etc. come in the Bay of Bengal from various parts of the world.

III. THE SOCIAL EFFECTS OF ENVIRONMENTAL DEGRADATION

3.1 Economic problems/Economic decline (II.1)

3.1.1. Decrease in agricultural production

Agriculture is the backbone of the country's economy. Contribution of agriculture to it is about 50% of the GDP and it employs 60.3% of the total labor force. In terms of the recent growth trend the performance of agriculture seems to be disappointing with a continuing decline in the growth rates over the years. The reasons behind such decline is the environmental degradation in various sectors, viz. freshwater, soil, forest and atmosphere. The food grain output, which was 3% per annum in the mid 70's declined to 2.2% in the 1980's. Due to reduced water flow, both for the Ganges water diversion in the upstream as well as excessive general water withdrawal and reduced rainfall, agriculture of a vast area in the south, south west and north west have suffered a decline. Of the total net cropped area of 2.77 million ha, 0.635 million ha are partially or fully affected. This amounts to 22.92% of the net cropped area.⁹¹ During the dry season of 1976 alone large acreage of land were affected due to soil moisture deficiency and increase of salinity and approximately 33% of the irrigation facilities could not operate because of the decreased availability of water. Rice production alone fell short by 236'000 tons or 20% of Bangladesh's food import.⁹² Irrigated crops usually suffer more from shortage of water. The area damaged due to water shortage in the year 1988-89 was 38'449 hectares as against 11'215 hectares of the year 1987-88.⁹³ The total area affected due to moisture depletion was 59'129 ha, which was 13'216 ha more than the previous year. 'Aus' variety

⁹¹ A. Hannan, Impact of Reduced Flow of the Ganges, paper presented at a seminar organized by the Department of Water Resources Engineering, BUET, August 23, 1980, p.11.

⁹² Government of Bangladesh, White Paper on the Ganges Dispute, September 1976, p.8.

⁹³ Information received from a concerned office under the Bangladesh Water Development Board (BWDB).

of rice was the worst affected crop and sustained yield loss was about 37%.⁹⁴ Intrusion of salinity in the soil imposes limitation on the cultivation of crops. Vast areas remain fallow during dry season. The area affected in the year 1988-89 due to salinity was 43'254 ha against 8218 ha of the previous year.⁹⁵ The value of the total production loss of the Ganges dependent area has been estimated at Taka 2895 million or US \$85 million in the year 1988-89.⁹⁶ Due to salinity in the coastal areas the cropping intensity is from 62% to 144% compared to the country's average of 159%.

Drought of different intensity occurs in both dry and wet seasons and in various parts of the country but the north west and south west are severely affected. During 'Kharif' or perennial dry season crops about 0.574 mha of 'T. Aman' crops (main rice crop) are severely affected and more than 1.748 mha of 'T. Aman' crops are severely affected by drought.⁹⁷

Flood damage is also severe in agricultural production. Normally each year 18% of the country is flooded. But in 1987 35% of the land area were inundated.⁹⁸ In the 1988 flood 122'000 km² or 84% of the country's land area were submerged. 'Aman', the main rice crop planted in the summer season suffered most from the flood as 22% of the area under 'Aman' was affected. As the flood damage of 1988 coincided with a cyclone in the early December, the total crop loss was estimated at about 2 million tons or 17% below the year 1989 target for 'Aman' or 'Aus' crops or about 18% below the (flood damaged) actual production of the year before.⁹⁹ Damage to other crops and livestock were also severe. Ten percent of the jute harvest was damaged. In the forestry sector both public and private nurseries suffered extensively. Livestock losses are estimated to be close to 200'000 large and small ruminants and 420'000 poultry, with shortages of animal feed adding to malnutrition and weakening of drought animals.¹⁰⁰ Various flood control projects also cause decline in agricultural production through declining soil fertility resulting from prolonged water logged condition.

Forest and fisheries have also suffered decline due to salinity, water diversion and various flood control projects. Present production of fishery is 0.85 million tons of which inland fisheries constitute 73% and marine fisheries 27%. The total fish production increased only marginally from 0.81 million tons in 1968-69 to 0.85 million tons in 1989-90, which could not keep pace with the growing population.¹⁰¹ Data generated by the

94 Ibid.

95 Ibid.

96 Ibid.

97 Environmental Policy, op.cit., p. 64.

98 Bangladesh - Recent Economic Development and Short Term Prospects, Document of the World Bank, Report No. 7596-BD, March 13, 1989, p.35.

99 Ibid.

100 Ibid.

101 Managing the Development Process, Report of the Task Force on Bangladesh Development Strategies for the 1990's, Vol. II (UPL Dhaka 1991), p.137.

Department of Fisheries shows that the total production of inland capture fisheries has declined from 0.47 million tons in 1983-84 to 0.42 million tons in 1988-89. If this trend continues, there is an apprehension that the total fish production will fall by 0.25 million tons in the year 2000.¹⁰² Due to upstream water diversion, fish landing in the upstream (hilsa specially) was reduced more than 90%¹⁰³ because of the destruction of historical food chain. Moreover embankment, road construction, drainage channel, etc. have all changed the normal flow pattern of the rivers affecting fish production. Because of this the direct loss of fish harvest has been estimated about 37 kg/ha.¹⁰⁴ Through the construction of various flood protection projects in 1990, 3.36 million hectares of inundable flood plains have been made floodfree, whereby open water fisheries had decline to 51.3% in 1987-88 from a 62.70% contribution of open water fisheries in the total fish production in 1983-84. A decline of 11.4% is evident due to this factor.¹⁰⁵

Cyclone and storm surges also cause the agricultural production to decrease. In the cyclone of 1970 the loss of crops was of the value of \$63 million, the loss of cattle was of the number of 280'000 and poultry 500'000.¹⁰⁶ In the 1991 cyclone 100% of the standing crops in the coastal areas were destroyed, the loss of cattle was 110'000, freshwater fisheries were damaged totally together with heavy damage of the shrimp cultivation.

Hence, the overall trend of production in agricultural sector exhibits a decline in concert with the decline in environment. Parallel to the slow process of environmental decline and agricultural decline sudden catastrophes like the cyclones and tornadoes (which have also intensified due to man made atmosphere change) cause the agricultural production to decline sharply.

3.1.2. Insufficient supplies of basic goods for the population

Basic goods for the population includes items like food, water, shelter, clothing, energy, sanitation, health, education, etc. Social effect arising out of economic decline in food and water has already been discussed in the above section. However, water for domestic consumption merit a separate discussion.

In the urban areas 38% of the people has access to water of reasonably reliable quality and the rest 62% is using water from polluted sources as ponds and surface water for drinking purposes.¹⁰⁷ In Dhaka, with a population of about 8 million people, the demand of water for domestic consumption is estimated at 431 million liters per day, whereas the

102 Ibid.

103 UN. ESCAP, ST/ESCAP 618: Coastal Environment Management Plan for Bangladesh, Vol. 2, Final Report, Bangkok.

104 Ibid.

105 Environmental Policy, op.cit., p.101.

106 Mahtab, Effects of Climate Change and Sea Level Rise on Bangladesh (Commonwealth Secretary), London 1989, p.1-10.

107 Environmental Policy, op.cit., p.160.

supply is only 281 million liter.¹⁰⁸ In Chittagong the demand is also much higher than the supply. In rural areas the supply of drinking water from tubewells is 53% and the rest is from ponds, river, canals, etc. The water quality is far below the drinking standard.¹⁰⁹

Per capita energy consumption in Bangladesh is very low, i.e. 140 kg oil equivalent (OE) according to the 1990 energy balance sheet of which 73% comes from traditional biomass fuel. Of the total biomass fuel agricultural residues supply 63.5%, fuelwood 22.5% and animal dung 14% respectively. Per capita demand of fuelwood according to a 1981 study was 0.076 m³. Even at this low rate of energy consumption the supply falls far short of demand. The rate of growth of firewood from 1973 to 1983 was 4.7%.¹¹⁰ But it can not keep pace with the fast rate of the population growth. The total forest cover has declined from 20% in the 1960's to less than 9% at present (while the unofficial estimate is at 6.7%). The total extraction of firewood increased from about 152'000 metric tons in 1973 to about 318'000 metric tons in 1983.¹¹¹ If the present trend continues, annual fuelwood availability in rural areas will decline to 0.02 m³ per capita by the year 2000.¹¹²

3.1.3. Problems regarding the industrial production, the transportation system, the traffic, etc.

During the Third Five Year Plan (TFYP) i.e., from 1985-90, the industrial sector grew at an average rate of 4.32% against the target rate of 10.1% per year.¹¹³ Environmental degradation is a major contributor towards such slow rate of growth. Most of the industries in the country are agro-based. Hence, any disturbance in the agricultural production hampers industrial production. Evaluating the factors responsible for non-realization of targets set for industrial production during the TFYP the following can be cited:

- Infrastructural problem,
- Shortage of adequate fund for investment,
- Low productivity and low capacity utilization,
- Raw material scarcity,
- Low managerial efficiency, skill and labor problem,
- High cost of production,
- Demand constraints and world wide recession.

In addition another important factor that deserves to be mentioned is uncertainty in the supply of raw material and uncertain communication and transportation resulting from

¹⁰⁸ Ibid.

¹⁰⁹ Bangladesh Environment and Natural Resources Assessment, Final Report, prepared for the US. Agency for International Development by the World Resource Institute, Center for International Development and Environment, Washington DC. 1992, p.22.

¹¹⁰ Coastal Environmental Management Plan for Bangladesh, ESCAP, 1988.

¹¹¹ Environmental Policy, op.cit., p.23.

¹¹² Ibid., p.126.

¹¹³ Managing the Development Process, op.cit., p.9.

national hazards like floods, cyclones etc. While overuse of forest resources causes the wood based industries to face raw material scarcity, the same happens in the case of reduced water flow and consequent salinity which led the forests to regenerate at a slow pace. It also applies in the case of jute, textile, paper, pulp and food based industries. Reduced water flow and increased salinity affect the industrial production in the Ganges dominated areas. After the commissioning of the barrage the Goalpara thermal power station and the paper mills situated in the south west region suffered severe damage. The Goalpara thermal power station had to be closed for some time. Though it became operative at a later stage the cost of running the station became exorbitant because sweet water had to be carried by barges from long distance. According to a concerned office under the Bangladesh Water Development Board, the financial loss of power generation due to a reduced water level and increased salinity is about Tk 30 million for the year 1989 alone. The Khulna Newsprint Mill is operated at half the capacity as the chloride content of the water used for the Mill increased by more than 20%.¹¹⁴

Reduced water flow and flood also disrupt transportation and communication. There are about 6000 km of water ways under Inland Water Transport Authority (BIWTA) of which 3600 km. are seasonal. Ganges is one of the perennial rivers, but due to reduced water flow vessels found it difficult to move in the dry season. Immediately after the commissioning of the Farakka barrage 145 km navigation routes on the Ganges went out of commission¹¹⁵ The routes in the Ganges-Jamuna confluence have deteriorated in particular and caused difficulties in the operation of ferry services linking the east and west zone of Bangladesh due to extra fall in water levels and consequent development of shoals. For maintenance of ferry services BIWTA had to carry out extensive dredging and request construction of ferry terminals involving a huge cost. In 1988-89 BIWTA incurred expenses of \$ 0.94 million for dredging 1519 km² area of river way and about \$ 0.81 million for maintenance of ferry terminals for the same year due to constant shifting of terminals.¹¹⁶

Flood causes the road and railways to submerge creating total disruption in communication as it happened after the 1987 and 1988 flood. In 1988 3000 km out of 12'960 km of road under the Roads and High Ways Department (RHD) as well as roads in the villages and rural areas up to 10'000 km were damaged. In the same year 898 bridges and culverts, 1300 km railway and 1300 rail bridges were also damaged by the flood. The flood of 1987 damaged 1523 km of road under RHD, 1102 culverts and bridges, 698 km railway and 166 rail bridges.

114 Government of Bangladesh, *Deadlock on the Ganges*, cited in Khurshida Begum, *Tension over the Farakka Barrage: A Techno-Political Tangle in South Asia* (UPL), Dhaka 1987, p.143.

115 White Paper on the Ganges Dispute, op.cit. p.3.

116 BWDB Source.

3.1.4. Decline of production for world market and associated effect

Bangladesh exports a meager amount of manufactured good, most of which are agro-based. jute, tea, leather are the main traditional export items except in recent times non-traditional items like garments and shrimp have firmly established their position in the country's export list. Production decline in the traditional export items have seriously affected the trade balance of the country as import in the last few years have increased greatly to meet the food requirements of the country following the destruction of crop agriculture by two severe floods and the cyclone of 1991. In 1988 the merchandise export was \$1231 million, while the merchandise import was \$1756 million. In 1988 the deficit rose to \$1850 million. The consequence of such deficit is negative on the overall development of the country. Lowered export means decrease of foreign currency reserves, decreased rate of domestic resource mobilization, increased dependence on aid and loan. Bangladesh's external debt at the end of 1988 stood at \$8.96 billion, equivalent to 47% of the GDP. Aid dependence and debt burden have made the country very much vulnerable to foreign dominance and dictation. Gradually the country is being trapped in the various circle of environmental degradation, poverty and vulnerability whereby the policy-making of the country in every sector is becoming accountable to the donor countries.

3.1.5. Large scale negative effects on human health

Since there is a small number of industries industrial accident is rare in the country. However, these industries pollute the soil, water and atmosphere in absence of a waste treatment plant. Pollution caused by industries have been discussed in the earlier chapter. These wastes cause pollution of aquatic environment resulting in fish kills and the alteration of the ecological balance in the waters. Very often many of the toxic chemicals ingredients are re-circulated back into human bodies via plants, meat and fish, which most often are damaging to human physiology and health. The immediate economic impact is the depletion of fish production but the long term economic decline would result from the depletion in the health of children, the most vulnerable group in population because they are going to build the future labor force. The infant mortality rate in the country is 140 per 1000 live births while the child mortality is 29 per 1,000 children and 39% of all deaths are due to infant mortality. 80% of all illnesses is linked to water born diseases and there are associated with 20% of all child mortality.¹¹⁷ Cholera, diarrhea, malaria, skin diseases, etc. are the most common among the people who use the water from the river, ponds etc. Even water supplied by the Water and Sewage Authority (WASA) contains a high level of chlorine, which is not safe for health. Absence of sanitation and water supplies in the slum areas of the urban centers as well as in the rural areas cause

¹¹⁷ A. Atiq Rahman, Salimul Haque and Gordon R. Conway, *Environmental Aspect of Surface Water System of Bangladesh (UPL)*, Dhaka 1990, p.180.

widespread diseases. Infant mortality rate is higher in the slums than in other areas of the country.

3.2. Population displacement/migration (II.2)

Migration of people from the disaster prone areas to other areas is one of the major social impact of environmental degradation. But there is lack of data, both official and unofficial, to assess how much migration has taken place from the disaster-prone areas to the places where there are some job opportunities. However, the trend of rural poverty and the rate of migration in the urban areas would project the environmental degradation all over the country and its social effect. According to one estimate, 50.8% of the rural population in Bangladesh fell under the poverty line in 1964.¹¹⁸ The war of independence in 1971 and subsequent flood and famine of 1974, have worsened the poverty situation and the percentage falling below the poverty line was 57.8.¹¹⁹ It further worsened and the figure rose to 77.8% in 1982 after which various rural poverty alleviation programs were undertaken by the governments and the NGOs. The situation was improved. In 1984, 57.6% of the population were found to be under the poverty line.¹²⁰ However, according to the recent estimates of the World Bank, Asian Bank of Development (ABD) etc., poverty situation has again worsened. In rural areas 51% of the people lived under the poverty line income in 1986.¹²¹ The figure is probably somewhat more than 51% at present hence, the absolute size of the rural poor today is approximately 50 million.¹²² In rural Bangladesh the pattern of distribution of land ownership is an important factor determining income distribution because the economy in rural areas centers around land. Nearly 50% of the households in the rural areas are without land and it is estimated that the proportion of landlessness has grown faster than population.

Table 3: Land-less families by category

Category	No. in million	% of rural households
1. Absolute land-less	1.20	8.7
2. Possession only homestead, but no cultivable land	2.71	19.6
3. Cultivable land up to 0.2 ha	3.89	28.2
Total	7.80	56.5

Source: *Towards Sustainable Development: National Conservation Strategy of Bangladesh*. Ministry of Environment and Forest Government of Bangladesh/IUCN, 1991, p. 69.

¹¹⁸ Atiq Rahman, Semeen Mahmud and Trina Haque, Bangladesh Institute of Development Studies 1988, based on the Statistical Bulletin of Bangladesh Bureau of Statistics.

¹¹⁹ Ibid.

¹²⁰ Ibid.

¹²¹ ADB in Bangladesh Observer (English Daily), June 7, 1990.

¹²² Developing the Infrastructure, Report of the Task Force on Bangladesh Development Strategy for the 1990's (UPL), Vol.3, Dhaka 1991, p.426.

Parallel to landlessness, fragmentation of land would also illustrate the supporting capacity of the land.

Table 4: Fragmentation of land

<u>Year</u>	<u>average farm size (ha)</u>
1960	1.4
1967	1.3
1977	1.4
1983	0.9

Source: BARC/IUCN, 1987.

From the above scenario it is apparent that land which is the main source of sustenance can no longer support the huge population. In addition to this natural hazards like flood, drought, cyclone, river bank erosion, etc. push the unemployed landless rural poor out of their land of origin to the urban centers where various real or perceived opportunities act as pull factors.

Various surveys made on the migrant population of Dhaka revealed that 57.3% migrated due to economic reasons, viz. landlessness, poverty, unemployment, economic crisis, business reasons, seeking a job, etc., while 25.0% migrated for environmental reasons, 8.9% for personal or family reasons, 1.0% for socio-political reasons, 7.6% for other reasons and 0.1% for reasons not stated.¹²³

The process of desertification is acute in the north west and south-west region of the country. However, migration in a massive scale from these regions to the urban centers of Dhaka, Chittagong, Khulna or Rajshahi is not visible. In a survey made on a total of 10858 poor migrants in the Dhaka city in 1990 it appears that only 706 persons (constituting 6.5%) have migrated from that region. Since Khulna is the business center of the west, maybe the environmental refugees tend to move there from the drought-prone areas of Rajshahi, Kushtia, Rangpur, etc. rather than cross the river Padma and move to Dhaka. The number of urban centers in Khulna was 437 in 1974 which became 652 in 1981, i.e. a 5.19% annual growth rate, while in Rajshahi the growth rate is 3.72% per annum.¹²⁴

Flood and hurricanes are two major factors behind population displacement in the country. The normal range of inundation, i.e. 18% of the total area of the country do not cause displacement of people, but in case of severe floods like the flood of 1989 and 1988 the rate of population displacement was huge. The flood of 1987 submerged 57'000

¹²³ Ibid., p.418.

¹²⁴ Ibid., p.419-423.

km², i.e. 39.58% of the area of the country. It killed 1657 people and destroyed (totally or partially) 2.5 million houses.¹²⁵ 30 million people were displaced due to this flood.¹²⁶

In the flood of 1988 82'000 km² was totally submerged and 122,000 km² was the overall submersion area including both total and partial submersion which cover 84% of the land area of the country.¹²⁷ It displaced an estimated 45 million people or 40% of the population and led to the death of 1600 directly by the flood and another 735 subsequently by diarrhea diseases.¹²⁸ Losses of assets including housing, personal effects, agricultural stocks and livestock (which is an important source of income generation for rural women) were severe. Bangladesh Bureau of Statistics (estimates on a basis of a sample survey) indicated that 3 million rural housing structures were damaged in the 1988 flood, most of which belonged to the poor. It also extensively damaged more than 2 million ha of crops.¹²⁹ Hence, the range of inundation, the record period duration of inundation from 40 to 60 days, the loss of crops and income generating sectors caused disaster for the rural poor. The loss of industrial assets up to 80% including plants, machineries, raw materials, etc. produced immediately half a million unemployed people. Initially people had to move to the flood relief camps where the incidence of diarrheal diseases peaked at around 80,000 cases per day in September 1988. All these were added up to make the government declare "Emergency" in the country. All these people moved particularly from Faridpur, Dhaka, Comilla, Barisal, Noakhali, Mymensing and Potuakhali to the urban centers especially in Dhaka City.

The cyclones of 1970 and 1991 are the two most severe cyclones that totally destroyed the coastal areas of the country. In the 1970 storm tidal surges were of the height of 4.5 to 9.0 meters which killed 500'000 people, destroyed 4'000'000 houses and 3800 educational institutes. Standing crops of the entire coastal areas were destroyed and the rate of agricultural growth in the following years were very low due to intrusion of saline water into the agricultural field.¹³⁰ The tidal surge height of the 1991 cyclone was from 6 to 10 meters. It killed 138'000 people, destroyed agriculture of 110'965 ha area of land, houses of the number of 642'552 totally and 56'371 partially.¹³¹ People of these coastal areas usually migrate or are rehabilitated in the Chittagong Hill Tracts.¹³²

Another reason for population displacement, due to environmental degradation, is river bank erosion. The rivers Padma, Jamuna, Meghna, etc. are more prone to erosion. The

125 BWDB, Flood in Bangladesh 1987, Ministry of Irrigation, Water Development and Flood Control, National Flood Protection Programme (2 vols.), Dhaka 1988.

126 World Bank Document No. 7597/BD, op.cit., p.19.

127 Ibid.

128 Ibid., p.35.

129 Ibid., p.19.

130 Monirul Qader Mirza and Subroto Pal, *Prakit Durjog O Bangladesh Paribesh*, Centre for Environment Studies and Research, Dhaka February 1992, p.104.

131 Ibid.

132 Shaukat Hassan, op.cit.

river Jamuna is shifting towards the right and in some places it has even shifted up to 19 km. The most affected areas of Jamuna erosion are Sariakandi, Kazipur and Sirajganj of which in Kazipur alone 17,632 persons became environmental refugees within the period of 1974-81.¹³³

The river Meghna also eroded huge areas of its bank. Particular points of the river are more sensitive viz., Bhairab railway bridge (where a 458 x 135 meter area was lost during the 1988 flood), Maniknagar (where 25 to 30 meters of area of land are lost in every year), Eklashpur of Chandpur district and Hymechar (4.02 km of area have been eroded within 1963 to 1973 and in 1988 alone 549 meters of area were lost).¹³⁴ In 1992 no major natural hazards occurred as yet, i.e. till the end of July, but the extent of erosion and population displacement during the period of May to July would illustrate how severe river bank erosion and consequent population displacements can even be in a year when there are no natural hazards like flood.

- May 3, 1992 "50,000 erosion hit people living on embankment" (erosion of the rivers Brahmaputra and Teesta).¹³⁵
- May 20, 1992 "Jamuna devours 12 villages, 100'000 people living on embankment"¹³⁶
- May 31, 1992 "Fresh areas threatened, erosion of Padma leaves 20'000 families homeless"¹³⁷
- July 11, 1992 "Erosion renders hundreds homeless in Jamalpur, Rangpur" (the reason behind this is the erosion of Brahmaputra)¹³⁸
- July 11, 1992 "Erosion: 800 families homeless" (it happened out of an erosion of the river Jamuna only within 48 houses)¹³⁹
- July 16, 1992 "Erosion takes serious turn in 3 districts: Over 15'000 families homeless" (the rivers are Jamuna and old Brahmaputra)¹⁴⁰ (*Source: Daily News - A National News Daily*)

Hence, parallel with the increased population and poverty as well as decreased land-man and resources ratio, declining soil fertility, various natural hazards like flood, desertification, river bank erosion, cyclone etc. are pushing the people, particularly rural poor out

133 M.K. Elahi, River Bank Erosion, Flood and Population Displacement, A Report on River Bank Impact Study, Dhaka 1990, cited in: Monirul Qader Mirza and Subroto Pal, op.cit.

134 Monirul Qader Mirza and Subroto Pal, op.cit.

135 Daily Star (National Daily), May 3, 1992.

136 Ibid., May 20, 1992.

137 Ibid., May 31, 1992.

138 Ibid., July 11, 1992.

139 Ibid.

140 Ibid., July 16, 1992.

of their homestead to join in the group of environment refugees. The rapid rate of urbanization in the four urban centers of the country does not imply development in economic sectors. It implies rather the decreased carrying capacity of nature's resources base. According to a study made back in 1981, i.e. before the flood of 1987 and 1988, the natural increase of urbanization in Dhaka was 18% from 1961- 74, while immigration was 74%. In the same period the natural increase of Chittagong city was 28% while through immigration 43%, in Khulna the natural increase was 27% while through immigration 73%, in Rajshahi the natural increase of urbanization was 30% while through immigration 36%.¹⁴¹

Population displacement would intensify further in the future scenario of sea level rise. One meter sea-level-rise would inundate about 22'889 km² of existing coastal land which is about 15.8% of the total area of Bangladesh.¹⁴² The area comprising of 65% of greater Khulna, 99% of Barisal, 100% of Patuakhali, 44% of Noakhali and 12% of Faridpur will be inundated and as a result 13.74% of the net cropped area and 401'600 ha. of mangrove forest along with its wild life will be lost. Loss of land and economic opportunities will displace 10% of the country's 110.8 million people who will have no option but to move to the unaffected urban areas specially to major cities like Dhaka, Chittagong, Khulna and Rajshahi and will have to live in perpetual poverty.¹⁴³

3. 3. Domestic problems and differences (II.3)

Economic decline and population displacement have been largely responsible for fissures in our social edifice and creation of various social cleavages and ethnic divides. There are other manifestations of domestic destabilizations. All these symptoms have the potentials of affecting the stability of social institutions and structures. Some aspects of these social decays will be explored in the following:

3.3.1. Ethnic divides

In Bangladesh the only ethnic problem is localized in the Chittagong Hill Tract (CHT) between the tribal Chakmas and the Bengalis. For decades the tribal people enjoyed an exclusive treatment during the British rule and lived with their separate identity duly protected. However, the policy of the subsequent Pakistan and Bangladesh government changed this excluded area status and the non-tribal people got their access to this forbidden region. That ensued a new era of conflict in the CHT on the ethnic line.

The CHT covers 13'191 km² of surface area of the country with a very low density of population. Resources of this region attracted people to migrate to this area from the

141 Developing the Infrastructure, op.cit., p.416.

142 Environmental Policy, op.cit., p.179.

143 Ibid.

other disaster prone low lying areas. However, in the earlier period migration of Muslim families in this region was undertaken deliberately to dilute the tribal identity in the CHT.¹⁴⁴ Rehabilitation of the cyclone affected people from the coastal areas to this high lands have largely outnumbered the original people in the CHT. Furthermore, the development activity in the CHT, viz. the Kaptai hydropower project whereby more than 100,000 tribal people were displaced including inundation of 1036 km² of CHT and 22'000 ha of cultivable land have politicized the ethnic awareness of the tribal people of CHT. The Kaptai project as well as various industries in the vicinity of the CHT, viz. Karnaphuli Paper Mill, Timber and Plywood industries, Karnaphuli Rayon and Chemical Ltd., etc. have opened the door to the outsiders. While there was enough scope for the tribal people to find a job in these industries, their unskilled state has allowed the intrusion of skilled laborers from the plain land. The result is decreased land-man ratio, increased competition for the local resources and employment. In 1951 the ratio of tribal and non-tribal was 90.9:9.1, while in 1974 it sunk to 88.4:1.6, and in 1980 it was 67.1:33.9. Beside migration of people in the CHT, mistrust and misperception towards the tribals and non-tribal and between tribal and the governments have fueled the deprived feeling deprivation among the ethnic tribal group and magnified their apprehension that the aim of the Bengali leadership was to reduce them to an abject minority.¹⁴⁵

3.3.2. Social divides

Bangladesh inherited an extended state apparatus from the days of the British rule; during Pakistan regime it was extended further and since liberation, the process has continued. Social divides in the country depend largely on the economic factor which again is guided by power mechanism. During both the colonial and Pakistan period external dependence and economic distortions were accompanied by extensive inter mediation by the state in the allocation, distribution and use of production resources. The power to mediate rested on the concentration of political power in these few coalescing groups which were strengthened by the concentration of economic power. After the liberation of Bangladesh, except for a short lived alternative attempt, the trend and the tenor of the social and economic development process remained the same.¹⁴⁶

The function of the state has virtually become the allocation and distribution of resources among competing interest groups: the small urban interest group; relatively larger but interrelated small-town groups; and even to larger but subordinated rural surplus groups.¹⁴⁷ The basic purpose has been to optimize the control and use of resources in the interest of those who control the state apparatus and are prepared to accommodate each

¹⁴⁴ Shaukat Hassan, *op.cit.*, p.24.

¹⁴⁵ Manabendra Narayan Larma, *Genocide in the Chittagong Hill Tracts: An Appeal to the World Conscience*, Amrita Bazar Patrika, Calcutta, 19 September 1980.

¹⁴⁶ *Rural Poverty in Bangladesh, A Report to the Like Minded Group (UPL)*, Dhaka 1990, p.109.

¹⁴⁷ *Ibid.*

other in order to preserve this social order through containing both outside groups and potentially disequilibrating situations.¹⁴⁸ Hence, there appeared in the country the concentration of political power in the hands of the few who controlled the economic resources. This is still the trend. Another scenario of social cleavages emanates from the search of legitimacy for the government and its stability. In order to remain in power, different regimes found it convenient to use aid resources for reinforcing its control over development processes through a coalition of the urban and rural middle class. Since 1975, when an elected government was overthrown through a bloody coup, the military authority had to pursue legitimacy through various methods to achieve a general acceptability among the mass and create a power base in the emerging urban rich. While a stated concern for the poor was dictated by the need for populist support, the emerging urban rich exercised more influence as it was manifested through the transfer of nationalized industries to private ownership offering undue concessions to the private sector, increasing bank credit for this sector and accommodation for contractors, indentors and importers for planning and implementing the process. Hence, the economic resources became concentrated in one particular group in the urban areas while the inequality continued to grow in terms of number of people remaining below the poverty line in both urban and rural areas and in terms of access to economic resources. The urbanization process would reveal such a division in the society. While there are modern residential areas like Gulshan, Banani, Baridhara in Dhaka and other urban centers where the rich people reside, there are slums and shanty towns in Kamalapur, Badda, Kawaran Bazar, Mirpur, Agargaon, Amtali, Rampura, etc. where the poor and lower middle class resides. The people in the slums reside in subhuman conditions with least municipal facilities like water and electricity supply or sanitation toilets or even the enough space to breath clean air. The infant mortality rate is highest in these areas, i.e. 152 per 1000, compared to the national average of 124 per 1000.¹⁴⁹

In the rural areas the social divide is identified through the possession or otherwise of land because the person who has land has the control over rural economy, social and religious norms, legal matters, politics and so on. Nearly 5% of the households are functionally landless and it is estimated that the portion of the landless has grown faster than the population. Over the period the pattern of land ownership has remained almost unchanged. There has also been no significant change in the distribution of income over the last two decades.¹⁵⁰ In rural Bangladesh the distribution of income has tended to become more unequal; the share of the bottom 40% of the households in the income scale has been unchanged while the top 10% have gained at the expense of a middle 40%.¹⁵¹ There are various reasons behind being a landless ranging from population to succession

148 Ibid.

149 Bangladesh Environment and Natural Resources Assessment, op.cit., p.23.

150 Environmental Policy, op.cit., p.19.

151 Ibid.

system. The end result is an emergence of patron-client relationship between the landowners and the landless. Question may arise whether there is any possibility of class-based organization instead of this existing organization of a patron-client nature. Assessing the present situation possibility for any change in social structure seems remote because:¹⁵²

1. There is no clear cut distinction between people on the basis of their rights to the main means of production, i.e. land. Relationship of most households to land is not fixed; it changes continually; land is either in the process of being gained or lost.
2. For the landless or poor it is difficult to define a common enemy by whom they feel exploited because most of the time his brother or cousin is the land holder.
3. The traditional rural organization is not strong enough to provide a strong basis for the articulation of class interests.
4. Even if the poor would want to articulate some of their interests and discontent against the rich in a more systematic manner, they fear the sanction they may face, viz. the withdrawal of the sharecropping contracts, employment opportunities, credit on good term, political protection, etc.

Although these are the factors that contribute to the maintenance of the patron-client relationship, a movement based on joint class interest is not absolutely alien in the history of Bangladesh. The 'Tebagha movement' in the late 1940's, which demanded a better deal for the sharecroppers, is the most well known example of class-based action.¹⁵³ Migrant labor groups which normally have a purely economic 'single stranded' relationship with their employer also have, when they feel unjustly treated, retaliated jointly in a forceful manner before leaving the area.¹⁵⁴

However, for the time being and for the foreseeable future the existing patron-client relationship is likely to continue where the small group of rich landowners will expand their holding and much larger groups will become totally landless, with a middle category of peasants, either expanding or losing their landed property. Moreover, parallel with this vertical patron-client relationship, there will also be a relationship of horizontal nature between people in the rural areas. Rich peasants will support each other and make alliances with government officials and the urban elites. Poor people will also unite for specific purposes and support each other.¹⁵⁵ However, the possibility of horizontal division to continue for sometime is stronger than the vertical one.

¹⁵² Rural Poverty in Bangladesh, op.cit., pp.40-44.

¹⁵³ Ibid., p.43.

¹⁵⁴ Ibid.

¹⁵⁵ Ibid., p.44.

3.3.3. Political factors having effects on the stability of social institution and social structure

At independence Bangladesh appeared a rarity in the modern age state system: 'a state which also happened to be a nation linguistically and culturally homogenous and united by the spirit and experience of a people's centuries long resistance against foreign and alien aggression, domination and exploitation. Eighty-five percent of this nation also happened to have religious homogeneity-they are all sunni Muslim with a coexistence with votaries of all religions under the sun.¹⁵⁶ However, a closer look would reveal that the country is in the continuum of the nation building process if nation building is viewed to cover the vast range of human relationships, attitudes, activities and social processes; the development of a sense of nationality; the integration of political units into common territorial framework with a government which can exercise authority; the integration of the rulers and the ruled; the integration of the citizens and the various social groups into a common political process; and the integration of the individuals into institutions for purposive activities.¹⁵⁷ Yet the country is in the grip of a serious disunity because of futile controversies over basic issues in our domestic politics. A critical polarization in our politics has fragmented the society to such an extent that a national consensus on fundamental national issues is still a elusive goal. The dynamics of political differences in Bangladesh need to be clearly understood to be able to asses their effect on the stability of our social institution and structures.

The critical factor appears to be the endemic weakness of the state and deep rooted 'crisis of the governance' faced by the successive post independence regimes. Factors that have made up the crisis include a pseudo conflict of national identity, under developed state of political institutions, bitter rivalry among the political parties, factionalism in the political parties that are guided by parochial interests, etc. The war of independence was waged under the leadership of the 'Awami League' party which also formed the first government in 1971. However, the subsequent years of independence witnessed the series of corruption, economic decline, social cleavages and the famine of 1974 which dashed the high hopes and aspirations of the general mass in the newly independent state. As the Awami League failed to meet up the high expectations of our people its government was overthrown through a bloody coup in 1975. The unceremonious exit of Awami League government in fact, set the stage for autocracy either under civilian, military, quasi-military or so-called civilianized military. The tragedy of 1975 marked a watershed in Bangladesh Politics.

¹⁵⁶ Mizanur Rhaman Sheilly, Nation Building and Political Development in Bangladesh, in: M. Abdul Hafiz and Abdur Rob Khan (eds.), Nation Building in Bangladesh: Retrospect and Prospect, BIISS, Dhaka 1989, p.194.

¹⁵⁷ Iftekharuzzaman and Mahbubur Rahman, Nation Building in Bangladesh, Perception, Problems and Approaches in: M. Abdul Hafiz and Abdur Rob Khan (eds.), op.cit., p.12.

From 1975 onward foreign policy of the government, i.e. 'Bangladesh Nationalist party' (BNP), took a sharp turn and adopted a pro-muslim and pro-west posture which was apparently an abrupt departure from the policy of the earlier regime. From this period a clear division in political ideology also emerged. Another significant development after 1975 was the emergence of the banned jamat-e-Islam (a party that collaborated with occupation forces in 1979) into the political arena.

The coup-d'état in 1982 and the changes in the political scene witnessed a balance between the political ideologies of both pro-Indian and anti Indian orientation. It continued till 1991. But there surfaced a new phenomenon in politics, i.e. the exploitation of religion for politics. The social divide that appeared after the installation of the democratically elected BNP government in 1991 centers round the Jamat-e-Islam which gained a strong support base in the country by now. Persons and groups who want the punishment of the collaborators, even if it has been delayed have been identified as the agents' for India while those who are against such judgment are identified as the middleman for Pakistan. Meanwhile those divisions surfaced in a more militant form among the students who are followers of different ideologies and who have always played a significant role in the change of political scenario in the country. The opposing groups along with their student wings were almost on the point of a physical clash on the 26th March 1992, the day of public trial of the war criminals. However, the arrest of the Jamat leader Golam Azam apparently to provide him a safe custody and the interference of the government saved the situation. A mass scale damage and destruction could thus be avoided. Meanwhile the continuing clashes among the student groups have forced the closure of the higher educational institutions. Hence, it is incredible to see that after two decades of independence factors like India and Pakistan and the ideology of those countries continue to play a very active role in the politics of the country.

3.4. Various dimensions and scope of social effects (II.4)

Economic decline: Economic decline emanating from ecological degradation are mostly confined to Bangladesh. The demand-supply gap that emerges out of agricultural decline are generally attempted to be fulfilled by the import of food grain and other basic necessities. Moreover, job opportunities created by various non-traditional industries, viz. garments, etc. have been able to provide jobs to a significant part of the unemployed parallel with various small and rural handicraft industries established by various NGO's. Migration of the poor beyond the border due to (agricultural decline or the decline in the supply of basic goods) has been non-existent except there or four decades ago when people used to go to Assam and adjacent areas either seasonally for a job or to settle (as the land-man ratio in these areas were much higher). At present people move from rural to urban areas subsequent to a fall in agriculture. However, smuggling in the border areas is a fallout of the demand-supply gap within the country which affects the local industry.

The neighboring countries are not affected by the economic decline in Bangladesh. The contribution of India particularly and Nepal to a lesser degree are significant in the decline of agriculture in Bangladesh through withdrawal of water in the upstream and deforestation in the Himalaya.

Economic decline in Bangladesh does not affect the world economy as such because the farmer's contribution to world economy is insignificant. However, Bangladesh is among the countries dependent on aid and decline in economy in the country pushes it higher in the list of the aid recipients.

Production of industrial and toxic wastes in the country and the economic decline arising out of this factor as well as their effect on human health are confined to the country only since the wastes from Bangladesh have no chance of flowing upstream. Moreover, being industrially underdeveloped the wastes produced in the country do not pollute the ocean to the scale that it does in other countries. The country on the other hand is a victim of industrial and other wastes produced in the upstream countries. The river Ganges is highly polluted. The Ganges flows through four thousand towns in India. By the side of the river there are about 150 big industries of which 81 are jute mills, 18 cotton mills, 7 tanneries, 5 paper mills, 4 fertilizer factories, 8 distilleries and 8 thermal power stations. Apart from these there are many small factories producing color, rayon, acid and drugs.¹⁵⁸ The wastes thrown from all these factories are having an adverse effect on the marine life and people living by the side of the river in the down stream. The amount of waste from melted inorganic carbon was 12.6 million tons and from organic carbon about 2 million tons in the meeting point of Ganges and Brahmaputra which increased to 15 million and 2 million respectively in 1984.¹⁵⁹

Population displacement/migration: Migration due to environmental degradation, viz. flood, cyclone, desertification are confined for the moment within the country, i.e. migration from the rural areas or affected areas to the urban centers. But in the CHT migration of the tribal people to the bordering Indian states has given the ethnic problem an international shape. However, the tribal people moved to India not being directly affected by environmental degradation but being affected indirectly, viz. the exodus of environmental refugees in CHT whereby the tribal people were cornered in the competition for land and employment and the massive insurgency among the tribals and counterattack by the government made the general tribal people to move beyond the border.

Migration of the Hindu population from Bangladesh to India is going on for some time at a limited scale, but it is not the outcome of any communal disharmony. The people of different religion have been living in harmony in the country. While at present migration

158 Desh (Monthly Journal, Calcutta), June 18, 1988, p.34.

159 Daily Inkilab (Bengali Daily Dhaka), August 6, 1988.

to neighboring states is not a vital problem, but in future scenario of sea level rise it might take a serious shape and a major security matter.

Domestic problems and differences: Ethnic divide in the CHT has evolved out to be a bilateral security problem because the insurgent group of the tribals viz. Shanti Bahini is alleged to have its base in the Indian state of Mizoram Tripura, etc. while the Mizo insurgent group called MNP has the Bangladesh government to counter the Shanti Bahini.

Social divides arising out of political ideology are to some extent a concern for India because India, the super power in South Asia would like to see governments of the smaller South Asian countries to flow a policy favoring India.

IV. ENVIRONMENTAL CONFLICT

Induced by ecological degradation and its social effects the following conflicts developed viz. **(III.1);**

- The common water sharing and management dispute particularly the sharing of the Ganges water;

- The Chittagong Hill Tracts problem.

The parties concerned are:

- India and Bangladesh primarily and Nepal indirectly in the water sharing problem;

- The subsequent governments in power and the ethnic tribal groups in the CHT are primarily concerned in the CHT problem and India became involved at a later stage.

- Talpatti Dispute over land formation from large scale siltation.

(III.2.) The water sharing dispute (Ganges) refers to ecological issues in a broader sense, i.e. the conflict results from the social effect of ecological degradation, viz. the withdrawal of water by India resulted in the desertification in the south west and north west region of Bangladesh (through decreased surface flow, decreased ground water recharge, decreased soil moisture and increased salinity) fallout of which is an economic decline and socio-political instability. The CHT problem also refers to an ecological issue in the broader sense, i.e. the conflict results from the social effects of ecological degradation, viz. the migration of environmental refugees in the CHT resulted in an economic decline there. This in turn took the shape of ethnic conflict and subsequently an armed insurgency.

(III.3.) In this context the environmental problems are only aggravating an already existing conflict in both the cases.

4.1. Water sharing dispute

Water sharing of the Ganges has been identified as the most disputed issue in Indo Bangladesh relationship. Perhaps it is the single most issue having the greatest ecological impact on Bangladesh and it is the one that constitutes the most serious bone of contention between the two countries. Nevertheless, it is difficult to understand this problem in isolation from the whole set of the relationship between Bangladesh and India and its background from a historical perspective. For a clear comprehension of this impasse it is worthwhile to go a little deep into the dynamics of the interstate relationship in South Asia and the politics of the region. The following paragraphs are an attempt in that direction.

4.1.1. Dynamics of South Asian politics

Bangladesh as well as the smaller states of South Asia perceive India as a hegemonic power. The origin of such an image has a colonial legacy. India's struggle for emancipation from colonial rule was largely dictated by her twin desire to regain the Indian personality in her entirety, as well as to become the master of her own destiny.¹⁶⁰ The Indian leaders naturally hoped that the British would hand over to them the mantle of political leadership over a territorially intact India.¹⁶¹ But political independence viz. India and Pakistan resulted in a gerrymandered South Asia with rival power centers.¹⁶² But Indian leadership never abandoned the aspiration and formulated her foreign policy with the hope of achievement of the objective viz., India should be the center in all regional activities and other countries of the region should act for the promotion of India's aspiration.

The asymmetry among the countries of South Asia in size, resources and power potentials is already a peculiar feature of the subsystem. The geophysical greatness of India and its population, cultural heritage as well as the unhindered endeavor of Indian science, technology and diplomacy to materialize the above aspirations have reached to such a stage that there is today a gross disparity between India and Bangladesh as well as other countries of the region. This naturally give rise to a feeling of insecurity among the smaller states, even if there is no instigation or demonstration of power from the bigger neighbor. In case of South Asia the bigger neighbor is always busy in doing the reverse which largely is the reason for the lack of confidence among the smaller neighbors towards her. This, instead of promoting India's aspiration for a 'close union', is contributing towards further distancing between them.

¹⁶⁰ Indira Ghandi, *India and the World*, Foreign Affairs, Vol. 51, No.1. October 1972, pp.65-68.

¹⁶¹ Shaukat Hassan and Abdur Rob Khan, *Bangladesh Flood: The Political Debate*, in: M.G. Kabir and Shaukat Hassan (eds.), *Issues and Challenges Facing Bangladesh Foreign Policy* (Bangladesh Society of International Studies), Dhaka 1989, pp.19-20.

¹⁶² *Ibid.*

The combined effects of these two factors, i.e. India's post-colonial aspiration as well as physical, technological and military supremacy not only gave India the impression of her potential as a great power in the world but also helped shape the elite perception of an 'India Doctrine', viz. the country will be a dominant country in the region just as the US, Soviet Union and China happened to be in their respective areas.¹⁶³

The mechanism through which India planned to retain the regional supremacy can be categorized into value system, economic unity and common defense. India preferred to see the values like secularism, socialism and parliamentary democracy to prosper in the neighboring countries. Anything contrary is viewed by India as giving ventilation for outside influence in the region. For example, the emergence of pro-Islamic values after the change of political scenario in 1975 and declaration of Islam as the state religion in Bangladesh found great disfavor with India as was also the case after the Islamization of Pakistan. As for economy, India preferred that South Asia would function as a self-contained single unit in which the economies of the countries of the region would be integrated. Moreover, India advocates the idea that defense and security of the subcontinent need not concern India's neighbors because these are India's concern. Indian Peace Keeping Force (IPKF) presence in Sri Lanka after the 1987 Indo-Lankan Accord and the Maldives operation in 1988 was the real test case in this context which spell out that 'India and only India can be involved in any regional settlement of dispute'. All these naturally give rise the perception in the smaller states towards India that India would leave no stone unturned for exploiting the vulnerabilities and weaknesses of its smaller neighbors be they economic, political or otherwise to promote its geostrategic designs for regional supremacy so that these small states have little option but to learn to live without agonizing India too much.¹⁶⁴ This was demonstrated in New Delhi's dealing with Nepal in early 1989 over trade and transit issue as well as the subsequent changes in Nepal's political scenario.

India on the other hand misunderstand this fear of the smaller states as unfriendly and hostile. India's insistence towards bilateral approach to solve regional issues originates from her fear that all the smaller states would gang up against India to outnumber her in decision making.

This perceptual gap prevailing in the region between the big and the small is present between India and Bangladesh, too. But it was not the case during and immediately after independence of Bangladesh. India's help was a significant factor in the liberation of Bangladesh from Pakistan, the traditional enemy of India. As the euphoria of victory ended India's behavior and high handed dealing with the newly independent state reminded her of the colonial rule from which she had just emancipated herself after a nine

¹⁶³ K. Subramayan, *Indian Security Perspectives*, cited in: Iftekharuzzaman, *The India Doctrine, Relevance for Bangladesh*, in: M.G. Kabir and Shaukat Hassan (eds.), *op.cit.*, p.21.

¹⁶⁴ Iftekharuzzaman, *The India Doctrine, Relevance for Bangladesh*, *op.cit.*, p.26.

month long liberation war. The Awami League government's failure to assert her rights largely due to its gratitude towards India gravely damaged the Indo-Bangladesh relationship. Moreover, India's role in certain debatable areas of the liberated country (like assistance in forming the paramilitary forces in Bangladesh to eliminate political opposition of the League government; India's insistence in maintaining a distance from China as well as the Muslim world, assistance in the ethnic disturbance in the CHT, declaration of sovereignty over the Talpatti Island and an attitude of avoidance to undertake joint survey of the island to resolve the issue, delay in handing over the 'Tin Bigha' corridor to Bangladesh even though Bangladesh instantly amended the constitution to legalize such an exchange of land and so on) have provided enough evidence for Bangladesh to be suspicious about India. India's dealing with the issue of common water sharing further strengthened such a feeling.

Conversely India saw in Bangladesh, during her struggle to be emancipated from Pakistan, a potential ally who would go to any extent to uphold India's politico-strategic ambition. Bangladesh was expected not only to promote India's political values and ideologies like secularism, etc. but also to become a vast market for Indian goods. India all along vehemently objected to any outside involvement in Bangladesh even in non-political areas like flood control, etc. and assumed the role of protector in every security matters. However, sudden changes in the political scenario of Bangladesh with the ouster of the League government found great disfavor with India since it frustrated India's design in the country. This provided her excuse to assume a posture of the 'benign negligence' towards Bangladesh and she started dragging her feet on a number of issues including water sharing which was and has been until recently a demonstration of punishment for Bangladesh for her ungratefulness.

4.1.2. Construction of Farakka Barrage by India on the river Ganges

The Farakka Barrage project, sanctioned by the Indian government in April 1960, was to divert the water of the Ganges through a feeder canal into the Bhagirathi-Hooghly river for the improvement of navigation of Calcutta port. Siltation of the Hooghly river has always been a headache for the Indian government. But the experts international as well as national never considered the project a solution to this problem.¹⁶⁵ Citing the fact that the Indian budget of 1965-66 characterized the Farakka Barrage project as "one of strategic and international importance", B.M. Abbas, an expert on the Ganges water problem, said that the real purpose of the barrage was to control the river for supplying Ganges water to the Indian state of 'Uttar Pradesh' and 'Bihar'. The barrage also provides

¹⁶⁵ B.M. Abbas, *The Ganges Water Dispute (UPL)*, Dhaka 1982, p.14.

a communication link across the river.¹⁶⁶ A more important factor is that the barrage offers to India a political leverage in her dealing with Bangladesh.¹⁶⁷

Although the then Pakistan government protested immediately after the newspaper report about the planned diversion of the river Ganges through Farakka in 1951, India discarded the accusation as purely hypothetical. At a later stage, although the issue became a matter of dialogue between the two countries, Pakistan was never serious to solve the problem; it rather traded the issue with the Indus water and the Kashmir problem.¹⁶⁸ By 1970 the construction of the Farakka barrage was complete except for the feeder canal. After the liberation war and independence of Bangladesh, some positive developments took place, viz. the creation of Indo-Bangladesh joint River Commission to develop the waters of the common rivers (but not the question of water sharing) and a joint declaration at the ministerial level to augment the dry season flow of the Ganges. By 1974 the feeder canal of the barrage became ready for operation. In April 1975 the two countries entered into an interim agreement whereby it was decided for provisional operation of the barrage for a period of 41 days from April 21 to May 31, 1975. Moreover, it was mentioned in the agreement that it was not an agreement for final commission and a continuous operation of the barrage was conditional on their arriving at a mutually acceptable solution. But what is notable is that India did not stop after the expiry of this period and continued the running of the barrage without "arriving at a mutually agreed upon solution". This shattered the trust Bangladesh had towards India.

With the change of political scenario in India, i.e. the installation of Janata government instead of Congress after 1977 election an interim agreement was entered into in November 1977 between India and Bangladesh regarding the share of the Ganges dry season flow at Farakka as a short term solution to the dispute. It was agreed that of the total availability of 55,000 m³/s of water at Farakka Bangladesh would get 34,500 m³/s and India 20,500 m³/s during the leanest period (last 10 days of April). The significance of the agreement is the guarantee clause inserted by Bangladesh that if during a particular 10 day period the flow at Farakka come down to such a level that the share of Bangladesh was lower than 80% of the stipulated share, the release to Bangladesh during the 10 day period shall not be below 80% of the quantum shown in the agreement.¹⁶⁹ Meanwhile it was agreed that in the course of three years of this interim agreement, the joint River Commission would conduct a study and report on the techno-economic feasibility of a suitable scheme or schemes. This could be implemented for an augmentation of the

166 Ibid.

167 Nurul Islam Nazem and Md. Humayun Kabir, op.cit., p.11.

168 B.M. Abbas, op.cit., pp.16-28.

169 Ibid., p.7.

Ganges dry season flow at Farakka to satisfy the requirements of both countries as a long term solution to the dispute.¹⁷⁰

The agreement of 1977 expired on November 1982. By this time the political scenario also changed and the Congress Memorandum of Understanding (MOU) was signed between the countries as an interim agreement for the sharing of the Ganges water for the next two dry season instead of renewing the 1977 Agreement. Under the MOU the 80% guarantee clause for Bangladesh was dropped which meant that from now on there is no guarantee of water for Bangladesh in case of low water availability at Farakka. The MOU also expired in May 1984. From that period till 1991 a complete deadlock prevailed on the water sharing issue despite a continued attempt from the Bangladesh side to raise the issue on a different level of dialogue, viz. head of state, ministerial, secretary, technical, academicians and so on.

4.1.3. The deadlock continues

The point at which the deadlock prevails is the method of water distribution, viz. augmentation or sharing. In pursuance of the provision of the 1977 agreement both India and Bangladesh came up with their respective versions of a long term solution of the problem, neither of which is acceptable to the other. Bangladesh proposes to augment the dry season flow of the Ganges by conserving a part of its monsoon flow through construction of storage dams in the upper reaches of the river system lying in India and Nepal, whereas India proposes to divert the water of the Brahmaputra into the Ganges above Farakka through a link canal across Bangladesh. Bangladesh rejected India's proposal on the ground that the link canal would divide Bangladesh; it would take away much of her precious land, dislocate and disrupt a huge population and will also cause a damage to the ecological balance of the country.¹⁷¹ A huge chunk of the land will be isolated from the main land since both the ends of the link canal will be within the territory of India.

On the other hand India rejected the Bangladesh proposal on the ground that India, as a matter of policy, would not accept the inclusion of the third party in our case i.e. Nepal.¹⁷² Moreover, India argued that the water to be stored would not be sufficient to meet the projected needs of both India and Bangladesh. On the other hand India saw considerable merits in its link canal proposal. First it would compensate the reduction below the Farakka by withdrawing water from the Brahmaputra and help put into effect India's National Water Grid Plan. Secondly the link canal would provide a cheaper and more efficient transportation route than the one currently existing between the states of West Bengal and Assam. From India's security point of view the canal would allow for a

170 M. Rafiqul Islam, *The Ganges Water Dispute: Its International Legal Aspects* (UPL), Dhaka 1982, p.2.

171 Nurul Islam Nazem and Md. Humayun Kabir, *op.cit.*, p.17.

172 *Ibid.*

fast and effective movement of troops and material to the remote north eastern states bordering China and Burma,¹⁷³ which often remains turbulent.

While series of futile negotiations were going on between the two countries, India geared up her water utilization with a view to preparing the ground for demanding greater share of the common waters. India's reluctant attitude to come up with a mutually acceptable solution of the problem strengthened Bangladesh's perception about India as hegemonic. Moreover, the desperate situation that Bangladesh faces due to water withdrawal in an already impoverished economy and natural hazard prone ecology further puts strain on already strained relationship. Although in recent time, i.e. after the establishment of democratically elected government in Bangladesh, a joint communiqué has been signed at the head of the state level for the Ganges water sharing on an 'equitable basis', however, there is enough room for apprehension as to what would be the basis of the equity and to what extent India would compromise her need for water even for the sake of 'equity'. Compared to water the Tin Bigha (a corridor which Bangladesh was supposed to get to travel to a patch of Bangladesh territory situated within India in exchange of a place called 'Berubari' which was a patch of Indian territory situated within Bangladesh) matter was much simpler. After the independence Bangladesh instantly handed over the sovereignty of Berubari' by changing the constitution while it took almost 20 years for India to transfer the corridor, which is of the size of a football ground only. Moreover, after all these years, the transfer of the corridor to Bangladesh is not total. For a very insignificant issue like this it took 20 years for India to settle it only partially. Therefore it is questionable how long it would take India to decide what is equitable for her. Moreover, the recent agreement between India and Nepal regarding the sharing of the Ganges water poses a question mark as to the availability of water at Farakka to be shared between the two countries. On Nepal's part entering into a bilateral water agreement with India is an abrupt deviation from the earlier position, i.e. regional solution to water management problem. While all these political dialogues and negotiations have become almost a routine between Bangladesh and India, Bangladesh continues to suffer more and more due to ecological degradation in the country, mainly on this count.

4.2. The Chittagong Hill Tracts problem

The conflict in Chittagong Hill Tract (CHT) is indeed a multidimensional problem. Although the problem has off late been widely identified as one of ethnic character, the role played by the environmental refugees from the plain land, particularly the disaster prone coastal areas, cannot be ignored. There has of course been factors present in the CHT for an ethnic assertion at some stage but the actual conflict was hastened and sparked off by

¹⁷³ Lok Sabha Debate, 15th Session, 1968, Col 2084, cited in: Shaukat Hassan, op.cit., p.24.

the presence of large number refugees settled in the Hill Tract. Let us see in the following the various dimension of the problem.

4.2.1. The internal dimension

The Chittagong Hill Tracts (CHT) has its own distinctive geographical characteristic. It is situated in the south eastern part of Bangladesh and comprises of an area higher than the plain land of the country. The tribal people living there speak different language which is mainly a combination of Arakanis, Burmese and Assamese. The physical features of the people are mongoloid which is more in common with the people living further east. The tribes have different religions, i.e. mainly Buddhism. As a comparatively isolated area CHT is surrounded by the Indian state of Tripura on the north and Mizoram on the east, by Burma on the south and east and by the Chittagong district on the west. The area is inhabited by various tribes with the 'Chakmas' predominating. Each tribe speaks its own dialects/language but share a common and rich cultural heritage.

During British rule this area enjoyed an 'excluded area' status. On the eve of partition of British India, the organization of the tribal people, viz. Chittagong Hill Tracts People's Association (CHTPA), petitioned to the Bengal Boundary Commission chaired by Sir Radcliff to retain this part with India, since the majority of the population was non-muslim. But Sir Radcliff awarded the CHT to Pakistan on 19 August 1947 on the plea that the region was geographically inaccessible from India. In protest CHTPA started movement and hoisted the Indian flag but Pakistan army suppressed the movement. This resulted in strained relationship and distrust between the government and the tribal people. In 1948 the then government started to settle several hundred Muslim families in the CHT to dilute the tribal identity and curb potential separatist tendencies there.¹⁷⁴ The relation between the government and the tribal people declined further after the amendment of the constitution in 1963 whereby the CHT lost its status as an 'excluded area' which legally opened the door to outside settlers. It went into force in 1964 distressing the tribal people who felt the loss of their autonomy.¹⁷⁵ The situation was further complicated as the change of the constitution coincided with the construction of the Kaptai Hydro Power Project whereby a huge tribal population was displaced from their land.

The dam inundated 1036 km² including 22'000 ha of cultivable land, which is about 40% of the district's total acreage. Ten thousand ploughing and eight thousand 'Jhumiya' (shifting cultivation) families, comprising more than 100'000 persons were affected.¹⁷⁶ The reservoir submerged a vast area comprising 125 'Mouzas', including a major part of the district headquarters at Rangamati, about 153 km of government roads, bazaars and

¹⁷⁴ Shaukat Hassan, op.cit., p.24.

¹⁷⁵ Syed Aziz-Al Hassan and Bhumitra Chakma, Problem of National Integration in Bangladesh, Asian Survey, vol. XXIX No.10, October 1989, p.963.

¹⁷⁶ Syed Nazmul Islam, The Chittagong Hill Tracts in Bangladesh: Integrational Crisis Between Centre and Periphery, Asian Survey, vol. XXI No.12, December 1981, p.1216.

settlements.¹⁷⁷ After a fairly vigorous search it was possible to settle the displaced persons in about 8100 ha of flat cultivable land of somewhat inferior quality compared to the original 22055 ha. This means a net loss of 14'000 ha of land. Of 18'000 families 11'761 have been rehabilitated so far. The average land holding of the 10'000 families having permanent right to land in the reservoir bed was estimated at 2,43 ha per family, but the new settlement in the non submerged and de-reserved areas provided them with scarcely 0,81 ha of land per family on average.¹⁷⁸ The government estimated the compensation amounted to \$59 million but only \$2.6 million were actually allocated. Thus compared to the loss the rehabilitation and compensation were very limited.

While the dam dislocated a huge population and caused the loss of economic opportunity on the one hand, it did not prosper the region on the other hand. The electricity generated from the dam was supplied to the urban areas as well as to the industries set up in the region. Moreover, the job opportunities created by the industries could not benefit the local people because of their lack of skill and knowledge. Rather it opened the door to the outsiders reducing the share of resources for the tribals. While need for fuel and agricultural land are causing over exploitation of land resources there by decreasing the return from land. Movement of people up the hill is causing soil erosion due to overgrazing and deforestation, encroachments etc. hereby ecological balance as well as economic opportunities faced a clear decline. All these further aggravated the feeling of deprivation among the tribals.

Although the tribal people were against the Pakistan rule, they played a dubious role during 1971 liberation war. The Chakma king supported Pakistan against Bangladesh because they were going through the period of reconciliation with Pakistan and the emergence of the new situation threatened that. Hence, after the independence the freedom fighters launched a massive offensive for punishing the collaborators whereby many innocent people were also victimized. So the tribals did not have a good start with the Bangladesh government either.

By 1972 the tribals acquired an ethnic awareness sufficient to shape the ethnicity a politicized one as was demonstrated through the presentation of a charter of four point demand to the then government in 1972. The demands included not only autonomy for the CHT but also imposition of a ban on the influx of non-tribals to the CHT. But the then Prime Minister not only rejected these demands but advised them to do away with their ethnic identities.¹⁷⁹ Faced with the hostile reaction from the government the tribals began

¹⁷⁷ Position Paper on the Chittagong Hill Tracts, Bangladesh Institute of International Studies (BIISS), September 1987, p.37.

¹⁷⁸ Syed Nazmul Islam, *op.cit.*, p.1219.

¹⁷⁹ Shaukat Hassan, *Problems of International Stability in South Asia*, PSIS Occasional Paper No.1, Geneva June 1988, p.4.

the process of moving up the higher stages of politicization.¹⁸⁰ By 1973 'Parbatya Chattagram Gana Sanghati Samiti' (PCGSS), a political front and 'Shanti Bahini', a military wing were formed to press for the autonomy demand. By about 1975 the autonomy demand was taking on the character of an independence movement for a home land.¹⁸¹ With the formation of the military wing of the tribals the Dhaka government mounted a military offensive and this drove the tribals to insurgency and flight across the border in search of sanctuaries and assistance.¹⁸² In response to the insurgency President Ziaur Rahman adopted the 'Disturbed Area Bill' in 1980 which licensed the government to use coercive measures. This further intensified the problem instead of pacifying it. Attack and counterattack made the general people, both tribals and non-tribals, hostage to the situation and life in the CHT became intolerable. Migration of the tribals to the Indian state of Assam and Tripura, which was continuing for some time, increased largely to escape the violence in the CHT. This situation further aggravated due to rehabilitation of the environmental refugees from the coastal areas after the cyclone of 1970 and 1991 parallel with the environmental refugees from other areas of the country displaced due to various reasons, viz. flood, river bank erosion, declining soil fertility, landlessness etc. These people created extra pressure on the limited resources and job opportunities. Various governments at various times tried to create job opportunities for the tribals, viz. rubber and pineapple plantation, fisheries projects, etc. But these met with limited success because the non-tribals totally captured all the commercial activities. Clashes over land became a regular phenomena. The tribals, basically agrarian, are totally dependent on land and could not adapt themselves to any sort of alternate subsistence livelihood or failed to adapt because they failed to compete with the skilled non-tribal majority laborers as well as with the corrupt government officials. While the dislocation of people due to the construction of the Kaptai dam could not be rehabilitated totally due to scarcity of land, the government initiated the settlement of non-tribals which came out as the "final blow" to the resource base there. Hence, the natural consequences, the series of clashes, conflicts and violence between the tribal and non-tribal over resources in most of the cases ended in favor of the non-tribals. This further fueled the years of deprivation of the tribals and intensified the insurgency. All these produced such an anti-government feeling among the tribals that they smelt ulterior motive even in simple development activities like construction of roads, educational institutions, etc. Although it was hoped that the District Council Election in 1989 (whereby limited autonomy was vested on the tribals on their administrative units of the CHT) would pacify the ethnic turmoil in the region, peace was short stayed and violence continued to occur till today.

180 Syed Anwar Hossain, *Ethnicity and Security in Bangladesh*, paper presented at a seminar on South Asia's Security in the 1990's: Primacy of its Internal Dimensions, organized by BISS, during 5-7 January 1992, p.4.

181 *Ibid.*, p.8.

182 *Ibid.*

4.2.2. Transboundary dimension

The insurgency in CHT though primarily an integrational problem but being close to Indian border, has its fallout on the Indo-Bangladesh relation. India becomes involved not only because of her close proximity but also due to transborder presence of several ethnic groups. Chakmas had been migrating in Tripura and Assam for many years at a low level. Following the formation of the 'Shanti Bahini' and the series of insurgency and counterinsurgency in the CHT, particularly from the regime of Ziaur Rahman, influx of refugees in those states increased many fold. This became an irritant between India and Bangladesh; firstly when Bangladesh believed that India provided covert assistance and encouragement to the insurgencies¹⁸³ and secondly when the spillover effect of the insurgent activities was politically felt in the border provinces of India which in turn put pressure on the central government to assume posture not to the linking of Bangladesh.¹⁸⁴

When the relationship between the two countries were cordial during Mujib region, there was a co-operation between the two governments to jointly put down the insurgencies, viz. the Shanti Bahini in India and the Mizo National Front (MNF) in the CHT. Mujib had secretly allowed the Indian army to operate in the jungle of the CHT to fight the MNF guerrillas, in the process of which they also took on the Razakars (members of the pro-Pakistani para-military force) who also received support from the Chakma insurgents, which was to Mujib's advantage.¹⁸⁵ In the post-Mujib phase distrust developed between the two government and India accused Bangladesh of assisting Mizo rebels. The counter-accusation was that India was sympathetic to CHT insurgents. The state of Tripura in the north east region of India has faced the burnt of Chakma refugees in two ways. On the one hand it has to live with the problem of the intermittent influx of refugees who flee to India in search of security.¹⁸⁶ On the other the disturbed atmosphere on the border has encouraged its own extreme elements, particularly the Tripura National Volunteers (TNV), to carry on their activities with impunity from their hideouts across the border.¹⁸⁷

This resulted in the pressure on the center to repatriate the Chakma refugees which in turn made the center to take certain a move which vitiated the relationship between India and Bangladesh. Although it was decided between the two in 1981 that 17'000 CHT tribal refugees would be repatriated, it could not be properly implemented and remained a matter of tension between India and Bangladesh. The situation worsened when after 1985 the Indian government reached an accord with the MNF to assist the Chakmas to become more adventurous and politically demanding.¹⁸⁸ In addition the launching of the greater

183 Partha S. Ghosh, *Cooperation and Conflict in South Asia* (Manohar Publ.), New Delhi 1989, p.77.

184 Ibid.

185 Ibid., p.86.

186 Ibid.

187 Ibid.

188 Ibid.

Mizoram plan in 1985 (by some insurgent groups in north-east India saw the CHT as the part of greater Mizoram) made the relationship more strained.

While the transborder spilling over of the CHT insurgencies has aggravated the strained relation between India and Bangladesh from 1975 onward, environmental degradation and its social effect on the CHT pushed the Chakmas to the corner of the state and beyond the border whereby the issue became a more sensitive one from the point of view of security.

(III.4.) The water sharing issue is a regional conflict involving three or more neighboring states (viz. Bangladesh, India and Nepal) of an eco-geographical region (viz. the South Asian Himalayan Drainage Eco-system). The Chittagong Hill Tracts issue is an internal conflict (viz. between Bangladeshi Muslim population backed by the government and armed forces on the one side and minority tribal Chakmas and its insurgent group called 'Shanti Bahini' on the other side) with international repercussion (viz. the involvement of India and to some degree international humanitarian agencies in the issue.)

4.3. Interests/goals pursued by the parties involved

The parties pursue the following interests/goals in the course of the conflict **(III.5.):**

In the water sharing issue the parties pursue the policy for elimination of the environmental problem causing the conflict (viz. sharing or augmenting the common water). Hence, there is a possibility in it for the reversal of the ecological degradation itself (viz. increased surface water flow, higher rate of aquifer recharge, decreased salinity, increased river depth, decreased flood, regeneration of forest, increased agricultural production, increased socio-economic development, etc.).

In the Chittagong Hill Tracts issue the parties pursue other interest and goals which are not connected with the environmental problem together with the policy of redistribution of the environmental costs and adoption to environmental changes to a limited scale. (viz. the subsequent Bangladesh governments adopted various development programs to satisfy various needs of the tribals with a view to pacifying the ethnic dissatisfaction. During the government board was established to be run by the tribal leaders to promote matters like special banking system for the tribals, setting up of an institution for the development of tribal culture, etc. During the government of Ziaur Rahman from 1975 to 1982 a multisectoral development program for CHT raised by ADB at a cost of \$ 1138.4 million was undertaken. This included programs like upland settlement project, communication and transport development, afforestation, settlement projects, agricultural research programs, health facilities, and improvement of cottage and rural industries, etc. During the government of Ershad from 1982 to 1991 a massive development program was launched. In addition to the previous projects a Five Year Plan 1984-85 to 1988-89 with a total allocation of Taka 2621.3 million was undertaken. The plan covered a variety

of development sectors like agriculture, forestry, livestock, fisheries, industry and power, road network, telecommunication, water supply, education, health and family planning. The present democratically elected government pledged to solve the tribal issue politically. The government of Begum Khaleda Zia took the decision to entrust the local elected bodies with the responsibility of seven additional areas, on the top of three which they already enjoyed. Hence, the local governments of Hill Tracts area enjoy considerable autonomy in bringing about their own development in all the important areas including industry, commerce, agriculture, education, public health and the preservation of unclassified forests.¹⁸⁹ Prime Minister has promised further strengthening of the relevant local bodies along with providing additional fund.¹⁹⁰

India on the other hand allowed the influx of Chakma refugees in the bordering Indian states and down played the immigration issue because immigrants are seen as potential voters. Moreover, the insurgency in CHT has been viewed by India as a important bargaining tool at an opportune moment.¹⁹¹ While on the one hand India denies any involvement in the CHT insurgencies, the former always tried to internationalize the issue as a violation of human rights and urged the donor agencies and international NGOs to supervise the aided projects. The impact of this is the request by the International Humanitarian NGOs to back off the repatriation deal on account of what is called "extra-judicial execution in the CHT".¹⁹² India also used and patronized the Chakmas to be used against the Mizo insurgent group, viz. MNF earlier.¹⁹³ However, at present India is pressing hard and raising the issue of repatriation of Chakma refugees on every occasion. However, repatriation could not be implemented partly due to inability to arrive at a mutually acceptable number of refugees, partly due to the absence of a peaceful atmosphere to complete the repatriation.¹⁹⁴ Meanwhile accusation and counter-accusation about arming the Chakma insurgents as well as alleged atrocity against the Chakmas continue to strain the relation between the two countries.

(III.6.) In the case of water sharing one party (viz. India) is primarily responsible for and the other (viz. Bangladesh) primarily affected by the underlying environmental problem.

In the CHT issue the parties involved in the conflict are somewhat equally responsible for and affected by the underlying environmental problem. While long years of economic deprivation, political discrimination, cultural non-recognition, etc. both during Pakistan and Bangladesh periods have generated the ethnic disturbances in the CHT, India's help and assistance to the insurgents also equally fueled the problem to bring it in its present shape. The environmental degradation in the CHT as well as in other areas of Bangladesh

¹⁸⁹ Editorial, Daily Star (Bengali Daily), May 16 1992.

¹⁹⁰ Ibid.

¹⁹¹ Shaikat Hassan, Adelphi Papers, op.cit., p.43.

¹⁹² Position Paper, op.cit., p.71.

¹⁹³ Parth S. Ghosh, op.cit., p.79.

¹⁹⁴ Ibid., p.80.

have exacerbated the issue in the CHT. The influx of refugees are also degrading the environment of the north eastern Indian states of Tripura, Mizoram, etc. through deforestation and over exploitation of the natural resources.

(III.7) The party responsible for the environmental problem pursues, in the water sharing issue, a policy of intentionally externalizing and exporting the ecological costs of its economic activities. At Farakka India diverts the silt free water to irrigate the agricultural land of Uttar Pradesh and Bihar whereby a large volume of silt is pushed down stream. Also the flushing of the Hooghly channel which is heavily silted results in the sedimentation of the rivers downstream. Such activities upstream result in the decreasing depth of river bed and intensity of flood in Bangladesh. While during the dry season India consumes most of the water at Farakka causing desertification and salinity downstream, during the monsoon period, it opens the sluice gates so that the pressure of flood water in India is released . Even here Bangladesh is the net victim in term of flood's frequency, intensity and destruction. Again the upstream country adopts no precautionary measures to check the polluting items from industry and other sources from entering the country downstream through the Ganges.

In the case of the CHT issue the subsequent governments of Bangladesh followed the policy of intentionally externalizing and exporting the ecological costs of its economic activities. The declining carrying capacity of the nature in other areas of the country and comparatively better environment in the CHT attracted people to settle there. The government allowed and sometimes encouraged such migration and settlement. At the same time the governments intentionally externalized the ecological cost arising out of natural hazards, viz. cyclone, tornadoes, etc. Moreover, the government externalized the ecological costs arising out of economic activities like the Kaptai hydro-power project knowing very well the likely impact of such development works.

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The party affected by ecological degradation perceives the problem in case of the common water issue being grave because reduced water flow has resulted not only in environmental degradation but also the socio-economic instability of the south east and north east region as well as the entire country. Not only the agriculture but also the industry, navigation, fisheries, forestry and various other sectors as well as the people who depend

on those sectors have been affected very seriously. Growing food deficit, rising food prices, increasing unemployment, inflation, increasing aid dependence, burden of debt, etc. are all associated with the problem.

The conflicts and its ecological dimension rank high in the foreign policy thrust of the party affected. India with its status of regional superpower and geographically advantageous location is obviously placed in the priority list of Bangladesh's policy. Moreover, in the backdrop of strained relations between the two the issue like water sharing, the source of which is totally out of Bangladesh's control is accorded the highest priority in her regional policy. The importance of the issue can be assumed from the number of dialogues that took place between the two countries at different levels, viz. the head of the state, minister, secretary, experts and so on. Till February 1992 the sixth secretary level water talk has taken place. Almost an equal number of ministerial level talk with a numerous technical committee meeting took place within the span of two decades. The water issue always played a dominant role in any talk at the level of head of the state. Moreover on every occasion, whether SAARC summit, NAM conference, Commonwealth meet or international conferences like one organized under the auspices of the UN, Bangladesh tried to bring the issue of water sharing and to focus on the desperate situation which the country is facing. However, the country perhaps can not go any further to make the issue an international one as it would annoy India, the country whose good will matters a lot in any future water arrangements. Accordingly, Bangladesh has to frame her foreign policy carefully so that it does not affect the sensitivity of a big and difficult neighbor like India.

In the CHT issue, considering its internal dimension the party affected, i.e. the CHT tribals considers the issue as grave because the conflict involves the question of their physical existence as well as the survival of their ethnic identity.

In view of the transboundary implications the other party affected, i.e. Bangladesh, also perceives the problem as grave since it prepared the way for the intrusion of India into the internal matter of the country.¹⁹⁵ But the issue rank is not much higher in the foreign policy thrust because much exposure of the issue would reveal the integrational weakness of the country. The issue ranks high in the foreign policy of Bangladesh only when a requirement arises to expose India's involvement in the issue.

4.4. Perception of the conflict

(III.8.) In case of the water issue Bangladesh perceives the issue as an environmental conflict having its repercussion on socio-economic and political stability of the country. India does not consider the issue as one of conflict . For her it is rather a necessity to serve her domestic interest.

¹⁹⁵ Ibid., p.73

In case of the CHT the tribal people consider the conflict as a traditional one (ethnic, social, religious, etc.) involving an environmental dimension arising out of a decreasing land-man and resources ratio.

Bangladesh also perceives the conflict as a traditional one (ethnic) involving an environmental dimension. The governments in power always acknowledged the problem of environmental degradation of the CHT which they tried to compensate through various programs like forestry, fisheries and different agricultural programs, research, etc. Moreover, the 'Jhum' cultivation which contributes to soil erosion has always been a matter of major concern for the governments.

India perceives the issue as a purely traditional one, i.e. the integrational problem of Bangladesh that has turned into insurgency due to an unaccommodative as well as a violent attitude of the Bangladesh government. India cannot, however, remain indifferent to a development like this so close to her border. On the surface India tries to project the issue as a violation of human rights.

4.5. Means at the disposal of conflicting parties

The parties engaged in the conflict have at their disposal the following means of fighting out the conflict (**III.10**):

In case of the water issue Bangladesh does not have the economic or military means to fight out the conflict. However, the public opinion is very strong against India regarding her (India's) attitude towards the issue. The public opinion both at the regional and at the international level also is in favor of Bangladesh. At the Rio conference on "Environment and Development" it was decided that the case of the Ganges was not only a water sharing issue but an environmental problem and could be raised as such in international forums from now on. The world became sympathetic to Bangladesh particularly after the flood of 1987 and 1988. In 1989 a conference was held in London in cooperation with the World Bank, with the Government of Bangladesh and with the experts of international repute to find out ways and means for fighting the menace of flood in Bangladesh.

On the other hand India possesses all the means to fight out the conflict, viz. the economic, military, diplomatic as well as the mobilization of public opinion. The economic and military strengths of India do not require explanation. Except for a small segment of conscious people who understand the suffering of the lower riparian, the general mass in India would not allow the government to make any concession of water at the cost of their agriculture or economy. Moreover, the entire economy of West Bengal depends on the navigability of the Calcutta port which requires a certain amount of water to flush the silt out of the river Hooghly. The issue is already an irritant one between the center and the state, as the center has diverted the water of the Ganges from West Bengal to 'Bihar'

and 'Uttar Pradesh. Reduction of water to West Bengal arising out of possible Indo-Bangladesh agreement would further deteriorate the center-state relation which the center would try to avoid. Added to these are also the possibilities for the articulation of historic and traditional rivalry toward Bangladesh, a muslim dominated country.

The conflict has been/is still being fought out by the following means:

In case of water issue, it has always been and is still being fought diplomatically, viz. under the forum of SAARC, OIC, UN etc., where the Bangladeshi representatives tried to convince the Indian side to give due share of water to Bangladesh. Even Bangladesh brought the issue to the United Nations in 1976 where it was decided that the issue should be resolved bilaterally.¹⁹⁶

The CHT issue (internal dimension) has been fought out by the parties politically, viz. the District Council Election (whereby the tribals would get the right to rule themselves in three tribal dominated areas in the CHT), representation of the tribals in the National Parliament, nomination of a woman from the tribals in the reserved seat for women in the Parliament, etc. The tribals also tried to resolve the issue politically before taking resort to arms, viz. the presentation of various demands to various governments beginning from Bengal Partition in 1947 through the Chittagong Hill Tracts People's Association (CHTPA), the formation of Jana Sanghati Samity in 1972 and the presentation of various demands of the tribals to the then Prime Minister, the presentation of Memorandum to the then President Ziaur Rahman, the presentation of various demands in October 1982 and so on. Although the issue has not been fought out legally there is pressure on the Bangladesh government to sign the international conventions relating to the protection of refugees. This would have made it obligatory for Bangladesh to face the issue legally. The issue has been fought economically by the Bangladesh government with a view to pacifying the ethnic discontents, viz. various development projects undertaken by various governments and by various donor agencies. Other means like non-violent resistance has also been used by the tribal groups, viz. strikes in the CHT, demonstration (non-violent) in the capital etc. Military measures have been used by both the parties the consequence of which is the formation of 'Shanti Bahini' of the tribals and the permanent stationing of armed forces by the Bangladesh government.

In the CHT issue (external dimension) both the countries have tried and are still trying to resolve the issue politically. A peaceful atmosphere in the CHT and repatriation of Chakma refugees are two of the most important agendas that are discussed in each and every bilateral talk. In 1981 an agreement was reached between the two countries whereby the Bangladesh Government agreed to take back 17,000 CHT tribal refugees. In 1987 the number rose to 24,000 but the implementation of the agreements could not be made successfully either because of disagreement as to the total number of refugees or

¹⁹⁶ B.M. Abbas, *op.cit.*, p.64.

because of the absence of a peaceful atmosphere in CHT to start repatriation. Bangladesh also urged the Indian government at different times not to assist the insurgencies in the CHT. In the recent visit of Prime Minister of Bangladesh to India a joint communiqué was signed whereby the Bangladesh Government assured that a representative political level committee would be set up to encourage the repatriation of the refugees. Apart from the help of the Indian government the Bangladesh government tried at various times to stop armed insurgency peacefully, viz. in 1983 a general amnesty was declared for the Chakma rebels with various rewards attached with it, viz. a grant of Tk. 5,000 to all during the first year of surrender, allotment of five acres of government land to those who wanted to live in CHT, grant of agricultural and other loans on nominal interest, provision of job in paramilitary and security forces, provision for vocational training and opportunities to go abroad, making them eligible for participation in elections at the union levels, etc. Besides political means, the issue has been fought between the two parties militarily. Exchange of fire between the Bangladesh border forces and the border security forces of India is a frequent occurrence. Moreover, the insurgent groups of CHT acquire their supply of arms and ammunitions from India, although India never admits such allegation.

As regards the CHT issue the conflict has already been fought out militarily between all the parties. In the issue of water sharing although the conflict has not been fought out militarily until now, there still exists danger of violent clashes in the border areas in case the situation worsens further and if the environmentally affected people can not be provided with any alternate means of survival. Although military or violent clashes have not yet taken place over the Ganges issue, some bordering rivers which mark the international boundary between the two countries have already been subjected to military and violent clashes, viz. the river Muhuri. Due to construction of dams, etc. in the upstream of the river Muhuri Bangladesh faces drought during the dry season and flood during the monsoon. Moreover, it has resulted in river bank erosion on the Bangladesh side and accretion of land on the Indian side. Yet another result is the shifting of the mid channel of the river much within Bangladesh territory. Thus the border demarcation line between the two countries enters into Bangladesh territory. This often gives rise to tension and conflict between the local peoples who ultimately seek the help of border forces of each one's country. Similarly the Ganges issue also could initiate a mass scale migration for the victims of the ecological degradation to the bordering Indian state. Such a development may spark off chaos, tension as well as ethnic conflict between the two countries with the potential of turning it into armed insurgency. However, a full scale war between the two countries is a remote possibility because Bangladesh does not possess the capability to fight out one of the leading military powers of the world, viz. India. Moreover, a scenario of mass migration and consequent ethnic clashes is also a hypothetical one. Another scenario can emerge out of India's involvement in fueling the feeling of deprivation among the land- less peoples in the south west and north west regions of Bangladesh to

deflect the attention of the people from the water withdrawal problem. Hence, there is possibility of another social turmoil in the country. However if an open military conflict between the two countries occurred, it would be a short-stayed affair. If the conflict is conducted militarily, it may take one of the following shapes:

- a) An interstate war between the parties concerned in case of the water issue without direct military intervention by another regional country.
- b) An anti-regime war in case of the CHT issue with indirect military intervention by a foreign power, viz. India.
- c) Any other form of violent conflict.

In case of the CHT the insurgencies have started since 1976. Normal life in CHT is disturbed, disrupted and even threatened by the guerrilla operations of the 'Shanti Bahini' insurgents and counterinsurgency operation of security forces. Aided by the favorable terrain of CHT the insurgents follow the tactics of guerrilla warfare, viz. ambush on security forces either on land or water; harassing fire on security forces camps and villages of non-tribals; killing of non-tribals as well as tribals not supporting them; kidnapping of government officials and prominent citizens including tribals for ransom; sabotage activities against power grid lines; destruction of bridges, culverts, roads, construction plants and forest resources extraction equipments; firing on civil transports both on land and water; and attempt to create tribal exodus to India by fomenting communal riots, etc.¹⁹⁷

Skirmishes over the CHT issue are also very common. Since most of the 'Shanti Bahini' camps are situated within bordering Tripura (25 camps) and Mizoram (6 to 10 camps)¹⁹⁸, they can very quickly cross the border, accomplish their mission and flee back to the Indian territory. There have been reports of Shanti Bahini raiding Bangladesh Rifles (Border Force) camps along the border and deep into Bangladesh territory under cover of the Indian Border Security Forces.¹⁹⁹

While killing, kidnapping, etc. are always taking place between both the internal parties in the CHT, massacre did not occur since the killing, etc. usually took place at a low level intensity to attract the attention of the government as well as the international NGOs. However, early this year the number of death on both sides escalated with the occurrence of the 'Lougang Massacre' whereby the tribals claim that the death of tribals mounted to 3000, (the official no is 25). The incidence could, however, attract attention of the humanitarian international groups more to the CHT problem. Terrorist assaults are already there and it can enhance further if the problem persists. However, such assaults until now are confined to the CHT areas. The operations that are usually undertaken by

¹⁹⁷ Syed Anwar Hossain, op.cit., p.17.

¹⁹⁸ Ibid.

¹⁹⁹ Bangladesh Observer (English Daily), May 13 1986; Holiday (English Weekly), June 7 1986.

the insurgent groups exhibit skill and sophistication as well as advanced military equipments like a rocket launcher, etc. The issue has already passed the stage of 'show-the flag' action, patrols, etc. which the tribals did once in 1948 and again in 1971.

4.6. Effect of the violent/military conduct of the conflict (III.14.)

The environment: In the water sharing no violence or military action has yet taken place over the issue. In a hypothetical situation of conflict involving military operation first strategy of India would be to close the sources of all the water coming to Bangladesh (In the past India is known to have adopted such strategy against West Pakistan back in April 1948 when she stopped the supply of water flowing into Pakistan through the Indus. For five weeks 600'000 ha of land received no water. The situation was described by E.E. Lilienthal, former Chairman of the Tennessee Valley Authority: "No army with bombs and shellfire could devastate a land so thoroughly as Pakistan could be devastated by the simple expedient of Indian's permanently shutting off the source of water that keeps the fields and people of Pakistan alive".²⁰⁰ In that case the entire ecosystem of the country would be devastated. Acute desertification and salinity would destroy not only the agriculture but also the industry, navigation, forest, fisheries etc. Survival in this region would be at stake. Another scenario could be the devastating flood, (the possible strategy which would be taken by India in case of an open conflict), by opening up all the sluice gates of her dams and barrages upstream. This would also destroy the entire ecosystem of Bangladesh. Even if no such measures are taken by India, small scale clashes and conflict would also destroy the delicate ecosystem of the country by aggravating the existing degradation. This would most probably take the form of pollution of air and water bodies which would have a large scale negative impact on the human and aquatic life as well as on the biodiversity. The mangrove ecosystem would also face serious problems which in turn would destroy the ecological equilibrium of the country.

Social and political situation: Ecological degradation at the enhanced scale would further intensify the social and political instabilities. Natural resources to support the economy would be scarce. The result is decreased production in every sector of economy, rising prices of food and other essential commodities, increased unemployment, migration of people at a mass scale to the urban areas, unplanned urbanization, increase of slums, etc. All these results would give rise to increased conflict and clashes among the local people. Migration of people would increase many times more than it is at present. Transboundary migration in search of green pasture would result in the hostility and conflict between the migrated people and the local people. This would further intensify the conflict between the two countries. The issue has political implications even when there is no military conflict. The government's failure to resolve the problem with India is always a matter of

²⁰⁰ G.W. Chowdhury, *Pakistan's Relations with India 1947-66*, (Pall Mail Press) London 1969, pp.156-157.

public resentment. The politicians of Bangladesh, well aware of the prevalence of this feeling among the general mass, tried to capitalize from the issue. But whenever a party comes to power after exploiting such a feeling can make little headway in resolving the problem. Their effort is greatly constrained by India's principled position of a bilateral rather than a regional and multilateral approach. As a result anti-Indianism continues to grow among general mass. This complicates the problem further instead of solving it. Since the amount of water to flow in Bangladesh is absolutely within the control of the upper riparian it gives the India a leverage over the Bangladesh and an imperative for the Bangladesh to live with the latter rather than annoying her.

In the CHT issue violent military activities of the conflict have already affected the environment of the CHT as well as the bordering states of India. While the Bangladesh army and security forces clear the forest to reduce the insurgents' hideouts in the CHT, the migration of Chakma refugees is destroying at a mass scale the forest and other natural resources in the states of Tripura, Mizoram, etc. Moreover expansion of roads and other forms of communication in the remote forest areas by the government is also destroying the balance of the forest ecosystem. While the Bangladesh Government presents these activities as development works, insurgents believe that these are done to allow easy movement of troops and military equipments. Any further escalation of the conflict would definitely aggravate the existing environmental degradation.

The conflict has its social and political implications, too. While the loss of economic opportunities, displacement and discrimination forced the tribals to turn to insurgency, the conflict between the 'Shanti Bahini' and the Bangladesh government has also hampered the economic activities for both the tribals and non-tribals together with a feeling of insecurity. Such a situation is in fact, disincentive for the people here to be involved in any long term development projects. Moreover, it is also becoming a very expensive undertaking for the resource scarce country like Bangladesh. A permanent stationing of armed forces in the CHT and the occasional military operation both against the insurgents as well as the Indian forces require a huge amount of money. Parallel with this the government is continuously trying to pacify the tribal feeling of deprivation through confidence building measures. Such measures involve various economic activities like construction of roads, educational institutions, health complexes, agriculture expansion and research, forest preservation, etc. In the CHT these development programs are undertaken even at the expense of development of other regions of the country.²⁰¹ Confidence building measures also include rehabilitation of the tribal rebels at a high cost. In short the whole affair is having its mark on the economy of the country. Migration of people at a large scale beyond the border is another social implication of the CHT conflict. While the conflict affects the social setting within the CHT, it does so in the Indian states of Tripura, Mizoram and Assam, too. Extra pressure on the resource due to mi-

201 Syed Anwar Hossain, *op.cit.*, pp.11-14.

gration of the Chakma refugees reduces the land-man and resource ratio creating increasing unemployment, rising prices of foods and essential commodities. This creates dissatisfaction among the local people which leads to the anti-immigration uprising in those areas.

The issue has security implications, too. It is a very sensitive security issue for any government in power of both in intraborder and transborder perspectives. Since the sources of the conflict is the integrational problem of the country, the government has always tried to maintain a low profile regarding this while the opposition political parties tries to give is a high profile with a view to exploiting the weaknesses of the government. Moreover, disturbance in the CHT allowed India to interfere in the internal affairs of the country. Since India's campaign of the issue is one of human rights, violation has resulted in the world wide attention of the international human rights NGOs, particularly the Buddhist and Christian which exert pressure on the government in CHT ethnic minority matters.

V. APPROACHES TO PEACEFUL CONFLICT MANAGEMENT AND CONFLICT RESOLUTION

5.1. The general state of relations between the conflicting parties (IV.1.)

The relationship between the conflicting parties, viz. India and Bangladesh (both in the water issue and the CHT issue) is already strained because of many issues where the parties have serious differences. The perceptual difference has already been discussed earlier. Besides this the 'Talpatti' dispute border smuggling, trade imbalance, communal tension, etc. are some of the issues that contribute toward straining relation between the two countries. Added to these are the problems of water sharing and Chakma refugees.

The relationship between the tribals and the non-tribals as well as that of the government vis-à-vis the tribals is already strained and this has been aggravated by the problem's environmental dimension.

Structures of communication between the parties: Between India and Bangladesh there exist various bilateral, regional as well as global structures of communication. Regional co-operation is a relatively recent phenomenon. Prior to the 1980s India and Bangladesh met either on a bilateral platform or in a global forum. Both India and Bangladesh are members of the United Nations, as well as its major organs, agencies and programs including the specialized agencies, viz. UNDP, UNEP, UNCTAD, ESCAP, etc. All these bodies have their regional headquarters where there are enough opportunities to communicate between the two countries. Moreover, both the countries are members of organizations like NAM, Group of 77, NIFO, etc. also where they can communicate and negotiate.

There exists the regional structure of communication between the under-organization, viz. South Asian Association For Regional Cooperation (SAARC) established in 1985 at the initiative of Bangladesh. All the seven countries of South Asia are members of it, united to the principle of sovereign equality, territorial integrity, political independence, non-interference in the internal affairs of other states and mutual benefit.

The organizational set up of SAARC has five tiers. At the apex is the 'Summit' composed of the heads of state or government of member states. The 'Summit' meeting takes place once a year. The next tier is the Council of Ministers composed of the foreign ministers of member states. The Council meets twice a year. The main function of the Council include formulation of policies; review of progress of co-operation; decision on new areas; and establishment of additional mechanism. The standing committee is the next highest body of SAARC and is composed of foreign secretaries. The Committee meets following the meeting of the Council of Ministers. This is the main operational unit which is involved in the approval of projects and programs including matters relating to finance; determination of intersectoral priorities; mobilization of resources; and definition of new areas. Next is the programming Committee as the organs of senior officials of foreign ministers which act as the national focal point of SAARC activities. It also meets twice following the meeting of the Standing Committee. The function of the Programming Committee is to assist the Standing Committee in matters relating to regional projects; inter-sectoral priority; review of activities and such other matters as may be necessary. The last tier of the SAARC sets up is the Technical Committee on agreed areas of cooperation and comprise representatives of member states, concerned ministries or department, acting as a sectoral focal point. As the main implementational unit the Technical Committee reports to the Standing Committee via the Programming Committee. The main function of the Technical Committee are: determination of potential and scope of activities in concerned sectors, formulation of programs and projects, determination of financial implementation of programs and projects, recommendation on apportionment of costs; implementation and coordination of sectoral programs and monitoring of progress in sectoral implementation.

The charter of the association made provision for establishing a SAARC secretariat and accordingly the secretariat has been set up in Kathmandu, which became operational since 1987. The purpose of secretariat was to have a body of a full time regional staff to coordinate and monitor implementation of various activities and to serve and assist such implementation. It is composed of a secretary general, seven directors coming from seven member states, and an appropriate number of general services staff.

Initially three areas were chosen for cooperation, viz. terrorism; drug trafficking and abuse; and women in development. By 1987 eighteen areas were chosen for cooperation, viz. agriculture, health, population, meteorology, postal service, rural development,

science and technology, sport and culture, telecommunication, transport, tourism, scholarship, youth exchange, etc.

However, the programs do not include regional water management. Environment became the area of concern since 1987 and in 1988 it received the top priority because of the flood in Bangladesh and earth quake in India. Accordingly it was decided in 1990 at the fifth SAARC summit that the year 1992 be declared the 'SAARC Year of Environment'.

Bilaterally also India and Bangladesh have a well established structure of communication. After the independence of Bangladesh in 1971 a 25-year Peace and Friendship Treaty was signed between the two countries whereby it was pledged that their relationship shall be based on the principle of sovereign equality, territorial inviolability and non-interference in the internal affairs of each others and also that no one should allow its territory to be used for the purposes contrary to the interest of others. Regarding the water management issue the Joint River Commission was established in 1972 to ensure the most effective joint efforts in maximizing the benefits from their common rivers. The commission is constituted by each participating government appointed chairman and three members (of these two are engineers) who hold the office for a period of three years. The chairmanship of the commission is held annually in turn by Bangladesh and India. The commission has, according to article 4 of the charter of JRC, the following functions, viz. to maintain liaison between the participating countries in order to ensure the most effective efforts in maximizing the benefits from common river system to both the countries, to formulate flood control measures and recommend its implementation; flood warnings and the study of flood control, irrigation and to carry out research on flood, etc. The ordinary session of the commission is supposed to take place four times a year with provision for a special meeting at any time at the request of either government. The decision of the commission is taken on the basis of unanimity and if any difference arises in the interpretation of the statute of JRC it is to be dealt with by the two governments on a bilateral basis in a spirit of mutual respect and understanding.

Hence, there are various level of established structure of communication between India and Bangladesh. However, question may arise as to the reliability of these structures. Before beginning to explore this it is to be noted that in the real politic law is often hostage of politics. Bangladesh failed to achieve any significant gain or concession from India out of any structure of communication be it global, regional or bilateral. The only Bangladeshi attempt to externalize the issue in 1976 was reverted back to the parties to pursue a bilateral solution. The multilateral forums like NAM, Commonwealth, etc. do not enter into such specific contentious issues. They rather opt for vague and broad areas of co-operation. SAARC is the only forum where there was a chance to solve such issues but its charter specifically excluded the bilateral and contentious issues from its area of co-operation because SAARC adopted a functional approach, i.e. to initiate a selective type of cooperative endeavors in selective areas. Moreover, the prerequisite for success

of regional cooperation, i.e. congruence of security and/or threat perceptions, commonalities of politico-ideological orientations, common foreign policy thrust and a consensus on the role of the pivotal power and so on, are absent in the region. The process of SAARC is rather hesitant and the non-participation of India and Bhutan in the Sixth SAARC summit in Sri Lanka poses a big question mark as to its reliability. Similarly the JRC is also an instrument of politics. Moreover, the water sharing question is kept beyond the purview of its jurisdiction. The series of meeting of JRC end with the futile note of exchange of information and datas because neither party accept the recommendation of the other. The commission is almost non-functional at the moment.

In the CHT issue (Intra border dimension) there also exist various structures of communication between the tribals and the government most important of which is the Local Government Council. It is a council of three districts in the tribal majority areas of the CHT, viz. Khagrachari, Rangamati and Bandarban having limited autonomy and power to deal with certain affairs, viz. maintenance of law and order, primary health care, education, fisheries, forestry (except reserve forest), agricultural cooperatives, tribal laws, custom and culture, trade licenses and permits and transfer and settlement of land holding. The council consists of 30 members - 19 tribal and 11 non-tribal; all directly elected by the people.

Besides this, there are various committees in the CHT, both of the tribal and government, to represent and communicate with each other. From the government's side there are:

- a) The CHT Council Committee: consists of the chief executive of the country; ministers in charge of home affairs, finance and foreign affairs; chiefs of the Army, Navy, Air Force as well as the general officer commanding of the CHT area.
- b) The CHT Coordination Committee: consists of the general officer commanding, commanders of the military regions, heads of civil administration up to the district level of the area and heads of all department/agencies of the area. It sets priorities on the basis of the needs of the people of the CHT and coordinates all development activities to ensure unity of efforts and optimum utilization of resources.
- c) District Coordination Committee headed by the regional commander, coordinates various activities of the area, viz. civil, military, legal, administrative, developmental and so on.

The tribals are mainly represented by the 'Parbattya Chattagram Jana Sanghati Samity' (PCJSS). Moreover, there was a tribal convention which was a political forum developed in 1977 where leading tribal intelligentsia and politically conscious persons were encouraged to discuss and sponsor a political solution to the problem of CHT. But it stopped following the change of political scenario of the country in 1981. Although at later period the convention was revived (after the government stopped the settlement of the non-tribals), it lost much of its original flavor.

In the case of these structures of communication their reliability is also very much questionable. First of all there is mistrust towards each other which gave rise to reciprocal non- accommodative position. The local Government Council is yet to be in top operational form to handle the situation in the CHT even after two and a half years of election. It can not function properly due to lack of coordination between the local Government Council, the civil administration and military administration. While there is allegation that all the powers have not yet been vested on the Council, there is a counter allegation that the members of the Council do not represent the people of the CHT; rather they are busy in serving their own ends.

5.2. Possible approaches to the elimination of environmental problems (IV.2)

At this level all the possibilities, viz. unilateral, bilateral, multilateral as well as global possibilities for eliminating or solving the environmental problem exist.

5.2.1. Unilateral actions

Any attempt to solve the problem of environmental degradation within the country shall involve first and foremost population control, whereby pressure on land, water, forest, atmosphere and ocean would decrease and the nation can opt for a sustainable development strategy.

Next important unilateral action (which also applies to the bilateral, regional and global efforts) is to integrate the environmental aspects with development activities. Inter-sectoral issues should be considered on a priority basis and trade-offs should be made to achieve a comprehensive development strategy. Steps that should be taken unilaterally include the following:

A land use policy reform: It should be done on an urgent basis covering and introducing multidisciplinary intersectoral approaches with a view to ensuring optimum use of land, protection of land from degradation, reclamation of utilized or degraded land for suitable use and improvement of the land resources for future generation. While on the one hand attention should be given to the physiographic unit of the land before utilization for various purposes, good agricultural land should not be allowed for non agricultural use on the other. Attention should also be given to the coastal land which is vulnerable to accelerated erosion. Consolidation of land holding, prevention of fragmentation of land, vertical expansion of rural and urban settlement instead of horizontal expansion, etc. should be incorporated in the new land use policy. Measures should also be taken to check land degradation by controlling 'shifting cultivation' or cultivation on the slopes, indiscriminate use of biocades, round the year irrigation on the same plot, over exploitation of biomass from agricultural field, etc. Rehabilitation of fallowed or abandoned land

should be undertaken for the purposes best suited according to location, soil, hydrological region of such land.

Protection of the existing forest and mass scale reforestation programs: It can be undertaken unilaterally to prevent environmental degradation. For this the first and foremost duty would be to provide the population with alternate energy like solar or hydropower. Next step that can be taken is to create massive awareness among the people to participate in country wide afforestation program alongside preservation of forest. Social forestry and community forestry should be promoted with the various incentives attached to them. Strict ban should be imposed on exploitation of forest on environmental sensitive areas like catchments, steep slopes, and other protected areas like wild life sanctuary, and game reserves. Exploitation and regeneration of forest should be done according to working plan. Transfer of forest land to non-forest use should be stopped and earlier transfers should be reviewed for re transfer to Forest Department. The widening gap between demand and supply should be bridged by taking steps like augmentation of supply and economy in use. Special efforts should be taken to preserve the 'Sundarbans' and for this pollution in the coastal areas by oil tankers ships and industries should be checked.

The fresh water sector: Certain steps can be taken to check industrial and agrochemical pollution. Planned exploitation of ground water would also contribute, to a certain extent to improve the environment. Installation of waste treatment plant in the industries (particularly those which are located by the side of the water bodies), regulation and proper use of pesticides and chemical fertilizers, provision for dumping industrial and urban wastes as well as the wastes from the ships and oil tankers should be made and strictly maintained. Development of an infrastructure for proper water utilization in the country is mandatory. The Bangladesh Water Development Board is already engaged with duties like regulation of river flow for efficient movement of water and silt, prevention of salinity intrusion, water conservation, land reclamation, water shed management, etc. However since the source of water is not within the control of the country, unilateral action can achieve very little success. Moreover, the removal of silt, etc. is very expensive and complicated (since the source of silt is also beyond the country), which the country can barely afford or undertake. New traffic system cannot be implemented in the foreseeable future because of the complex network of the river system. Besides these, BWDB can opt for maximum utilization of the water that is available within the country through steps like rehabilitation of deep wells, replacement of shallow tubewells by deep ones in cases where the ground water level has fallen beyond the reach of the former, collection of rainwater for subsequent use, construction of desalinization plants, using potential heads of seashores to create partial vacuum for producing fresh water, etc. Steps should also be taken to supply fresh water to the urban and rural areas as well as providing a proper sanitation system to control the pollution of the water to be used for drinking and other purposes. Intersectoral matters should be given due emphasis so that

neither sector is affected by the other and for this a comprehensive water development plan should be taken incorporating the environmental consideration in it. The flood control, drainage and irrigation projects should be reviewed so that these are socially and environmentally accepted. Afforestation programs can be taken by the side of the rivers to control river bank erosion.

Countering atmospheric pollution and green house effect: In this regard Bangladesh's unilateral actions would be more of an adaptation strategy rather than a controlling one. Of the controlling strategies, the control of the pollution from the vehicles, control of deforestation, mass scale afforestation program, fuel efficient energy use, etc. should be included. Sea level change (which would inundate the low-lying coastal areas, make coastal structures non-functional, destroys existing mangrove forest and expand intrusion of salinity into the mainland) could be mitigated by keeping high water out, by constructing new or modifying existing embankment along the coast and river banks, or allowing the low-lying land to inundate and accelerate the siltation/land accretion process by appropriate intervention or a combination of these two.²⁰² It should be kept in mind while constructing the embankment or other obstruction that the land is not deprived of the required amount of flood water to acquire new alluvium or soil moisture or to remove the silt from river to the flood plain and so on. An adaptation strategy should also include measures to adapt to the changed climate, i.e. change in spatial and temporal distribution of rainfall and temperature. This would include diversification of crop and employment opportunities, change in cropping pattern and farming practices, etc. At the national level it will be necessary to (a) adjust the food security system, (b) adjust resource allocation and input availability, (c) promote alternate employment, (d) develop new irrigation facilities, (e) reorganize the agricultural infrastructure, (f) develop and introduce new crops suitable for change or changing climate, (g) preserve genetic diversity and (h) provide improved information on agro-chemical potential.²⁰³ As regards increased intensity of flood, cyclone, tornadoes, drought, etc. emanating from the climate change flood requires regional action for a long term solution to the problem. However, as a short term step flood embankment projects can serve the purpose of controlling the flood.

For cyclones and tornadoes an early warning system and disaster preparedness plans and programs can mitigate to some extent the destruction caused by those natural calamities. As regards drought introduction and development of drought resistant crops and more irrigation facilities to drought-prone areas in order to reduce vulnerability of agriculture to drought can be adopted.

Prerequisites for implementing the unilateral actions:

²⁰²Environmental Policy, op.cit., p.247.

²⁰³ Ibid.

In order to address the critical needs and important issues related to the environment and natural resources, short, medium and long term approaches are needed. In the short term a number of initiatives should be taken by the government in concert with the donor country and other interested agencies to reduce further environmental degradation and to develop the technical skills; an information base and institutional capacity is needed to move forward with a sustainable development agenda. A medium and long term objective should be to continue building up efforts aimed at institutional strengthening and to program support for critical areas of natural resource management and environment conservation. This shall include not only extended support for research and advanced studies in resource management, EIA, etc. but also to implement the various reports made on environment, viz. the National Water Plan, Coastal Zone Management plan or Action Plan For Flood Control, etc.

Institutional constraints should be removed because in Bangladesh an intersectoral co-ordination of a development planning is hampered by a multitude of specific agencies and frequently overlapping jurisdictions of conflicting mandates. Moreover, institutional linkages should be strengthened.

A strong and effective environment policy is a must for the country which shall ensure strict implementation of the legal provisions. A legal framework in many instances needs to be further updated and better adapted to cope with the current problem and projected demands.

Cooperation between the government and the non-governmental organizations (NGOs) as well as private enterprises should be strengthened, whereby one shall be benefited by the other's experience, information and expertise. The private industrial enterprises will attain a growing responsibility (to utilize resources and mitigate environmental damages resulting from industrial process) through such cooperation.

Finally public awareness is a must for successful implementation of the sustainable development strategy which can be created through environmental education, mass participation of people in various conservation campaigns like tree plantations or the proper use of water or energy and so on. Press, media, NGOs, etc. can play a very effective role in this regard. A massive awareness should be created countrywide as to the danger of population growth, the limited land and resources and to the fact that the survival of the future generation depends on the proper use and conservation of the resources today.

5.2.2. Regional actions

Environmental degradation in the country also requires regional efforts to solve it. It shall include the following steps:

The population of the rivers downstream (arising out of various industrial and urban wastes disposed by the upstream country) can be mitigated by adopting waste treatment procedures for the industries and urban centers in the upstream.

Control of desertification and salinity in the north west as well as in the south west areas of the country requires the sufficient flow of surface water in the Ganges round the year. A regional drainage basin approach should be adopted by the countries of the region that share the Ganges.

Control of siltation and flood in Bangladesh requires a water shed management in the Himalaya as well as reforestation in the entire river basin areas. The sufficient flow of water in the Ganges is also necessary to push the silts downstream. Only such a measure will decrease the rate of siltation in the downstream. That will also minimize the frequency and intensity of flood in Bangladesh. This would also decrease the rate of the river bank erosion in the country.

Prerequisites for the implementation of the regional efforts:

To achieve the above mentioned objectives the prerequisites are:

Environmental diplomacy initiated by Bangladesh among the countries of the region towards creation of awareness as to the interdependent as well as unified characteristics of the regional ecosystem. For this a series of negotiations and conferences, etc. within the region are to be undertaken.

A river basin approach to manage the regional rivers should be undertaken to solve the problem of flood, siltation, salinity .

A forum like the SAARC can be the appropriate organization to initiate and accomplish all these steps.

An international convention regarding the non-navigable water use is a must in solving the problem arising out of the common water use in the region when there is mistrust towards each other.

The mobilization of multilateral arrangements other than the SAARC is also necessary. Establishment of technical committees in joint programs of research, training, investigation, monitoring, basin planning, etc. can be undertaken where staffs would be drawn from each of the co-basin states.

Other countries of the region should help Nepal to exploit her hydropower as an alternative energy with a view to reducing pressure on the forest. While the huge amount of electricity generated by Nepal would enrich Nepal as well as other countries of the region, it would also reduce the hazards like siltation, flood, salinity in the Himalayan basin region. The mobilization of the UN and its related agencies like the UNEP, UNDP, FAO, etc. can prove helpful in achieving afforestation programs in the Himalaya.

The measures and steps suggested above presuppose the existence of a close understanding of each others problems as well a cordial interstate relation in the region. Also the political will among the countries of the region is the most important condition for attaining all these.

However, parallel to the regional effort Bangladesh should also pursue the bilateral approach with India for a short-term solution to the problem of flood, desertification and salinity. Bangladesh can also explore bilateral understanding with Nepal as regards the purchase of cheap hydro-power electricity of which Nepal has great potentials; such arrangements would substantially reduce pressure on the forest resources of Bangladesh and benefit Nepal financially to cover much of her investments in hydroprojects.

5.2.3. Global efforts

Any countermeasure to environmental degradation known as the "Greenhouse Effect", is contingent upon a global effort. Since no abrupt change in the world-wide production and consumption pattern can be achieved, the strategy to be adopted is to slow down the warming. This can be done in various ways, viz.:²⁰⁴

- a) Reduction of carbon-dioxide emission through using less fossil coal by:
 - Finding more efficient ways to use clearer burning fossil fuel;
 - Manufacturing of more fuel efficient vehicles;
 - Shifting the mix of the energy supply option away from such carbon intensive sources as coal;
 - Taking a a new look at non-fossil alternatives, e.g. solar, hydropower, nuclear etc.
- b) Reduction of the emission of other greenhouse gases like methane, nitrous oxide, CFCs.²⁰⁵
- c) Reduction of deforestation and mobilization for reforestation. Policy formulation in this area shall require the following steps:²⁰⁶
 - The creation of general awareness as to the importance of the forest and mobilization of the people to reforestation;
 - Taking an initiative for a high yielding food production and alternate the energy source so that the pressure to expand agricultural land or the fuelwood demand is reduced;
 - Providing assistance to the developing countries in achieving alternative energy, high yielding food production and so on;
 - Bringing a change in the trade policies of the developed countries whereby these will discourage the import of tropical wood; and
 - The adoption of policies like 'debt-for-nature-swap' by the donor agencies, financial institutions which will mobilize reforestation as well as preservation of forests.

²⁰⁴ Irving Mintzer, *A Warming World: Challenges for Policy Analysis, Economic Impact*, pp.8-10; also David A. Wirth, *Climate Chaos, Foreign Policy*, No.74, Spring 1989, pp.13-16.

²⁰⁵ Ibid.

²⁰⁶ Sandra Postel and Lori Hoise, *Reforesting the Earth, Economic Impact*, No.65, 1988/89, pp.13-19.

Besides an atmospheric change, degradation of oceans arising out of pollution requires a global effort to tackle it. The Third World's part of the oceans is the favorite spot for the industrialized states to dispose off their toxic chemical and radio active wastes. Weakness of the environment ministry (both expert in manpower as well as in the technological capabilities) as well as the patrolling system in the territorial sea and Exclusive Economic Zone (EEZ) allows such activities of the industrialised states to go unabated.

Prerequisites for the implementation of the global efforts:

With a view to achieving the above objectives multilateral treaties with a standard binding under international law are needed. That would require each country to take prescribed actions. Environmental diplomacy by the country is required to let the world know of the likely effect of the global warming on the country concerned. A north-south dialogue should be created whereby the north would come forward to help the south through various ways, viz.:

- Transfer of technology;
- transfer of technical know how either through training in the north or sending experts to the south;
- Transfer of technology at a cheaper price;
- Quota for the Third World goods in the world market;
- Giving the Third World aid free of overburdened conditionalities and so on.

A mobilization of world's public opinion as well as the NGOs can achieve greater results (as has been seen in the Earth Summit in Rio whereby the International Convention on Climate Change as well as on Biodiversity have been adopted by the world. These would help reduce the global warming if everyone is sincere about the implementation of the provisions. Moreover, it is the world's public opinion that the water issue in Bangladesh has obtained the recognition that the issue is very much related with the environment. The mobilization of the UN and other international agencies would be more appropriate to implement the steps required to fight global warming, viz. reforestation, the alternate and efficient energy use, etc.

5.3. Possible approaches to eradicate social effects of environmental degradation (IV.3.)

5.3.1. Unilateral actions

Social effects of environmental degradation including economic decline, population displacement and domestic problems and differences require primarily unilateral approaches to eliminate them. This would include the following steps viz.:

Adoption of a sustainable development strategy is compulsory in attaining a self reliant economy which should consider not only the fulfillment of the present need but also the need for the future generations.

The strategy to tackle the economic decline would first of all achieve the goal of the human resources development through population control, employment generation, health and hygiene facilities, planned urban and rural human settlements, supply of pure drinking water, a mass literacy program, improvement of transport and communication, development of women and so on.

Next step would be to increase agricultural production which would include not only crop agriculture but also fisheries, forestry, poultry, livestock, etc. Crop agriculture production can be increased through the proper use of fertilizer and manure, the rational and efficient use of pesticides, the evaluation of the irrigation projects, the selection of crops suitable to soil and site, the crop rotation and diversification, the selection of improved seeds, the maximum and rationale utilization of water, the maintenance of irrigation equipments and channels, the installation of new equipments and so on. Improvement of fisheries shall include allocation of fishery in areas which are outside the flood control and irrigation projects, control of water pollution, preservation of aquatic habitat in the forest and wetlands, prescribing catch quota in different fishing grounds to avoid over fishing and so on. For livestock improvement a base line survey of poultry and cattle population, a crash program of genetic improvement, an increased fodder supply, a regular vaccination, etc. are needed. The protection of the genetic diversity should include steps like review of sectoral policies and incorporation of conservation dimension in the respective policies, EIA of development projects, the expansion of the protected area system like national parks, etc. replenishment of the protection of the resources and conservation of the biodiversity including various species of wildlife, agriculture, fisheries, forestry as well as physiography.

Besides these, measures are required for supplying basic goods for population like fuel-wood energy, etc. Which can be done by exploring alternate energy. This would also help improve the soil quality and fertility as biomass extraction from land would be reduced.

Disruption of communication and transport due to siltation, flood, etc. can be solved through short term measures like dredging, flood control measures like construction of embankments dams, channel improvement, emergency flood ways through the diversion work, etc. parallel to the construction of the roads and railways on an emergency basis. An emergency construction force would be fruitful in this regard.

As regards the decline of production in the world market attempts should be made to improve the quality of export items though encouraging the private sectors. Efficiency of the public sectors should also be improved. Attention should be given that undue conditions are not attached to the aid. Exploitation of basic resources should be rationalized alongside the promotion of non traditional items.

As regards population displacement due to natural hazard as well as over exploitation of resources unilateral efforts would include steps like proper rehabilitation of the displaced people through providing an alternate source of income preferably in the place of origin. But if they have already been displaced and gathered in the urban centers, they should be rehabilitated properly in the planned urban centers with provision to earn livelihood. Emphasis should be given as to the health, sanitation and education of the people of these urban centers. The income generation for these people should not be directed towards exploitation of basic resources like land, water, forests etc. but towards non-traditional items like small and cottage industry etc. However, it is better to take action prior to environmental degradation. Ground water exploitation should be done in a planned way together with the exploitation of land and forest resources.

As regards migration beyond the border the rate can be reduced greatly by providing alternate economic opportunities by setting up industries, both small and large. A stable and congenial atmosphere in politics and economy shall discourage migration beyond the border even if there is a temporary displacement due to natural hazards like flood cyclone, river bank erosion, etc. As regards domestic problems and differences the following may be considered:

The ethnic divides arising out of migration of the flood and cyclone affected people to the CHT can be solved to a certain extent by distributing the environmental refugees in various parts of the country rather than to CHT only. Rehabilitation of the displaced people should also be done in a way that they do not cause the local people to lose their economic opportunities. Rehabilitation of the ethnic minority who are displaced due to hydro power projects, should be done with special attention to be given to adequate compensation for the losses they suffered.

The social divides prevailing between landless people and landowners can be solved by enacting a suitable land reform policy. Where land should be distribution of land on a cooperative basis can be thought of. There should be laws as to the limit of land holding. Fallowed lands should be revitalized and distributed among the landless. Alternate economic opportunities should be created for the landless peasants.

As regards political divides efforts should be directed towards consensus building on core issues giving democracy an institutional shape, building up political institutions, etc.

Prerequisites for the unilateral actions:

An increase in agricultural production would involve a sustainable development strategy to be implemented through a "National Environment and Conservation Policy" parallel with separate national policies for each sector of agriculture. Also it shall require the strengthening of institutional capabilities, trade offs between various sectors, research and training, creation of public awareness and so on.

Increase in supply of basic goods like fuelwood etc.: Parallel with the national policies for supply and regeneration of these goods, mass scale awareness and self restraint should also be promoted. As regards traffic, etc. emergency mobilization of resources as well as administration is an important prerequisite.

Increase of production for world market: It requires an efficient management cover like an export promotion bureau maintenance of quality innovation, trained manpower, etc.

As regards rehabilitation of the environmental refugees a national rehabilitation policy with strong implementing authority having strong sectoral coordination is a must. International aid programs can be invited to help achieving this objective. Mobilization of UN and its agencies as well as the NGOs are required to create an alternate employment generation as well as education and health training. Financial institution after the model of the 'Grameen' Bank would also be very much effective in an employment generation among the displaced people. The allocation of land, for instance, should have a strong legal backing so that the displaced people are not harassed.

As regards rehabilitation of the displaced people in the CHT, a high level committee having an adequate tribal representation should be established. It should work with a strict ethical and legal backing regarding the protection of minority rights and values.

As regard social divides a legislation is necessary together with a strong implementing authority as to the distribution of government acquired and fallowed land as well as a check regarding a limitless land holding. A mobilization of social welfare organizations and NGO's would be more effective in generating alternate economic opportunities like cottage industry, poultry, etc. on a cooperative as well as on an individual basis.

As regards political divides political goodwill is the most important prerequisite. Institutionalized democracy, strong and effective constitution, strong and efficient legislative administrative and judicial bodies are also essential to minimize the political divides. This is to be remembered, however, that political divides with respect towards each other is healthy for a democratic environment.

5.3.2. Regional efforts

As regards economic problems and declines it can be solved regionally by common economic markers. This shall make the upper riparian countries more attentive toward the ecosystem of the lower riparian so that the latter can produce a quality item for the common market. The soil quality and climate of various parts of the region is suitable for different products and a common market would allow the area to specialize in the particular product. This in turn would benefit each other regarding quality and quantity and diversity of various products (viz. Bangladesh can buy the hydropower from Nepal in exchange of goods like jute, leather or tea, to reduce pressure on fuelwood). Competition

in the world market would require more quality goods than in the regional market. This would be more convenient for Bangladesh as well as for other countries of the region.

As regards pollution and a large scale negative impact on the health of the lower riparian awareness can be created among the upstream areas as to their waste disposal system.

As regards population displacement and migration, the neighboring countries should take the environmental refugees as a temporary arrangement until the damages cause by hazards like flood or cyclone, etc. could be managed in the affected country.

As regards domestic problems and differences in Bangladesh non-interference in the domestic affairs of the country by other countries of the region can minimize the political and ethnic divides to a certain extent.

Prerequisites for the regional actions:

The withdrawal of trade barriers, as well as taxes on export or import are essential. This can be either corollary or supplementary to the economic cooperation under the SAARC. Economic and foreign policies of the countries of the region need to be designed so that there is not any fundamental difference among them.

As regards transboundary pollution environmental alliance is needed which shall work under a regional environment policy and convention regarding protection of the regional environment. There should be provision for penalty in case of breach of any regulation of the convention.

As regards population migration environmental alliances needed for temporary rehabilitation of the transboundary environmental refugees until the situation is suitable enough for their return home.

As regards domestic differences political goodwill of all the countries of the region is required.

5.3.3. Global efforts

The social effects of environmental degradation in Bangladesh can be solved globally in a peaceful manner through mechanisms, like New International Economic Order (NIEO). Under this concept countries like Bangladesh would receive preferential treatment since the country was a colony and the colonial powers have totally exhausted natural resources from the country. Now it is time to return their dues. Under the NIEO, Bangladesh would receive the share of profit from products of the industrialized state in accordance with the principle of 'Permanent Sovereignty of States Over National Resources'. Bangladesh would also be economically benefit if the principle of 'Common Heritage of Mankind's is followed strictly by the rich countries whereby Bangladesh would get a share of profit from the exploitation of common wealth and resources like

the high seas, etc. Transfer of technology from the north to the south would also bring economic development in the Third World developing countries like Bangladesh.

Prerequisites for achieving the global efforts:

World wide environmental diplomacy, environmental alliance, north-south dialogue, international convention on NIEO and the like, convention on environment and development (whereby the poor countries having serious environmental problems shall benefit), etc. are essential. Mobilization of the United Nations at the top of the hierarchy and the NGO's and social movements (acting as a grass root pressure group) at the bottom of the hierarchy shall be fruitful in achieving these objectives.

5.4. Perspective on environmental conflicts in Bangladesh context (IV.4.)

At this level the objective would be to achieve a comprehensive common security particularly in views of the changed perception of security which includes not only a military built upon power relations between the states. Security today is essentially the function of development. It encompasses the entire realm of social, economic, political, military as well as the environmental aspect of national life with a view to attaining comprehensive development. Hence, security is a whole set of activities relating to a nation-state building and anything contrary to it is a threat to security. When such a development relates to more than one country the objective would be to achieve a comprehensive common development to attain comprehensive common security.

As regards the Ganges water dispute, since the problem involves two countries and the source of the problem is not within Bangladesh, any solution of the dispute requires either bilateral, regional or global efforts. a bilateral approach, however, can be taken only as a short term solution. A long term solution requires a regional approach because of the regional characteristics of the Himalayan drainage system. The multifarious problems of conserving the ecological balance of the system, viz. desertification, flood control, lowering surface and ground water level, sedimentation and siltation, river bank erosion, etc. cannot be resolved in isolation from each other. Therefore a river basin approach including India, Nepal and Bangladesh would be most practical. Flood control, for instance, can be solved through an afforestation program in the Himalaya. Improvement of the hydro power would provide Nepal with alternate energy and reduce fuelwood exploitation in the Himalaya. This would reduce the intensity of flood in Bangladesh. A bilateral solution between India and Bangladesh should be that of 'sharing' not augmenting of water because transferring the river from one area to another would merely shift the problem from one area to another and not augmentation of the flow of the river in the real sense. As a regional approach the construction of the storage dam can be promoted to supply the dry season flow to downstream. There has to be a broad outline or a plan covering the entire drainage basin to assure the coordinated and

harmonious development of various works in relation to all the reasonable possibilities of the basin. It should be borne in mind by the upstream countries that imbalance in any portion of the ecosystem would ultimately disrupt the entire unit of the system whereby all in the countries of the region would be affected.

Globally efforts also can be taken to solve the water sharing dispute and its related impact in the sense that the issue is not only a bilateral contentious issue but an environmental one, affecting everyone in the long term.

Certain prerequisites:

Environmental alliance between the countries of the region as well as between the north and the south is necessary with a view to achieving conventions, laws and institutional coverage to solve the problem.

Environmental issues have already been included in the SAARC agenda. Because the water sharing issue has a great deal to do with the environment it also should come under the SAARC agenda.

The Joint River commission should be turned into a regional organization rather than a bilateral one and should be independent of the political organizations of the related countries. It should be an organization of the scientists, researchers, technical experts, academicians who would work only to maintain the ecological balance of the region.

International laws on 'Non Navigable Water Use' is a must for acquiring a legal backing in resolving the water issue.

The organization dealing with the sectoral issues of water like flood, deforestation, sedimentation, etc. should also have a regional coordination center to obtain comprehensive development in all these issues.

Frequent occurrences of international convention like the Rio Conference would help achieve the world wide public opinion which in turn would work as pressure on the world leaders to resolve issues like Ganges. International help and assistance both financial as well as technological shall help minimize the intersectoral issues like flood protection and control, rational ground water exploitation within the country, etc. This would minimize the intensity of the dispute. For these the mobilization of the UN and its specialized agencies as well as other international organizations like the World Bank, etc. is needed. Mobilization of NGO's both national and regional as well as international would be fruitful to create awareness as to the environmental as well as to the related socio-economic problem and to work as pressure groups. These organizations can help generate alternate economic opportunities in the Ganges dominated area to decrease the intensity of the problems as a short term solution.

The most important and essential prerequisite for achieving a resolution of the problem would require goodwill from all involved.

As regards the CHT issue an unilateral approach should be directed towards building a mechanism at every level of national life to accommodate the desires of the minority groups. Resolution of the problem also requires bilateral cooperation. Peaceful resolution of the problem would serve the interest of all the parties. Continuation of insurgency is costly for both Bangladesh, India as well as 'Shanti Bahini'. For Bangladesh the draining of resources to this protracted counter insurgency operation jeopardizes whatever nation-building efforts that have been undertaken or could be undertaken. For India, a country that itself is now being threatened by strong centrifugal challenges from countless directions, it would not be a wise policy to keep harboring insurgents from across the border with a motive to retaining leverage over a weak neighbor. Hence, any approach of accommodation from Bangladesh would be welcome by India for upholding mutual interest. The 'Shanti Bahini,' which itself has gone through so many vicissitudes over the years, should realize that its objectives either in part or full can be achieved only through a meaningful dialogue and negotiation and certainly not through an indefinite and inconsequential "bush war". A peaceful resolution of the problem unilaterally would involve the following prerequisites:

- A moderate section of both majority and minority communities should be mobilized and strengthened for negotiated settlement;
- Firm and timely action should be taken to redress the grievance of the minority groups;
- Wherever possible a measure of limited autonomy should be granted for the general interest of the state. Transfer of such limited autonomy should be real and not merely on paper.
- Efforts should be taken to eliminate corruption in the local government bodies.
- Particular emphasis should be given to protect the minority values, cultures, rituals, etc.
- Safeguard of adequate representation of the tribals in the policy making at the national level;
- A forum aimed at establishing links between the leaders of the minority groups and the center should be launched;
- Insurgents should be encouraged to surrender arms and settle as law abiding citizens through the declaration of a general amnesty;
- A massive confidence building measures should be launched which shall have a legal backing in sectors like land ownership for the tribes. Gestures like the removal of armed forces from the CHT and the stationing of a police force to maintain law and order would be fruitful in this regard.

Bilateral approach would include the following steps:

1. Negotiation between the two countries should be undertaken frequently at all bilateral level, viz. head of state, ministers, secretary, armed forces, border Security forces of the respective countries. In all these meetings there should be an adequate tribal representation.
2. Provisions like protection of minorities should be included in the SAARC charter. That will remove, to an extent, the uncertainty and insecurity the ethnic and religious minorities suffer from.
3. Creation of a peaceful atmosphere and a guarantee of continuing peace in the CHT are essential for encouraging the Chakma refugees to return home;
4. A South Asian interstate body should be set up to undertake extensive timely studies of transnational minority groups. It should identify the strains in interstate relations and recommend measures that can be taken to pre-empt an interstate tension and conflict;
5. Launching of a committee (for repatriation of the refugees and proper rehabilitation) having an adequate representation of the Chakmas as well as other political parties is essential.
6. The mobilization of the UN, its specialized agencies as well as the NGOs should be encouraged as to the proper rehabilitation of the refugees; but they should not be allowed to participate in the political process of the country as it would further complicate the issue;
7. Political good will of all the parties involved is the most important pre-requisite to achieve a peaceful resolution of the issue which in turn would help achieve comprehensive common security.

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