

ENVIRONMENTAL ISSUES IN BANGLADESH - INFRASTRUCTURE, WATER RESOURCES AND AGRICULTURE

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INTRODUCTION

Natural ecosystem provides a multitude of services to reduce environmental pollution and to serve important recreational and aesthetic needs if it is not overexploited by human and animal activities. Exploration of the benefits of natural ecosystem is severely felt as population continue to grow with the concomitant social trend and need to gather in tribes, communities, villages, towns and eventually cities for mutual support, protection and co-operative livelihood. Again, the population growth alone does not reflect the real picture of the demand of human being which is much more than that of growth rate. Although world's population growth rate at the beginning of 1970s was about 2% per annum, but the annual increase of relevant activities to support that augmented population were much higher (Table 1).

Table 1: World average annual rate of increase of selected aspects of human activities (%)

agricultural production	3
industrial base on farm products	6
mineral production including fuel	5
industrial base on mineral products	9
construction and transportation	6
commerce	5

Source: MIT (1971)

Prompted by the impact of industrial Revolution in general, industrialised nations in particular which brought about significant changes in the life style of people, consequently demands for new products increased and, in order to provide for the consumer thirst, the industrial and infrastructural bases expanded and the spiral began and continued unabated. In order to improve human well being the base of developments activities expanded which eventually led to the overexploitation of natural resources. Human activities tend to produce a large number of products, both as waste and as useful products which eventually ends up as waste. Before the development of consumer-based societies and industrialisation, disposal of waste did not create significant problems due to existence of vast tracts of disposable lands, vegetation and natural water bodies; they are able to assimilate them very efficiently. The growing consumption of products in densely

populated areas has resulted in a corresponding rise in the production of waste. This has led to the abuse of previous natural dilution strategy of waste management and has posed as a tremendous threat to the ecosystem: plants, living organisms, air, water, soil, and, every climatic conditions, resulting in overall environmental degradation and health hazards .

The intense population pressure in Bangladesh has already caused degradation of soil-water-air environment, deforestation and loss in biodiversity. This deteriorating environmental quality is further aggravated by poor planning, inadequate and uncontrolled infrastructure development, lack of awareness about environmental issues, absence of appropriate pollution control measures, availability of appropriate legislation, and, inadequate enforcement of available legislative mechanisms to improve environmental quality. Until recently most of the development activities in Bangladesh failed to recognise environmental impacts and implications, and in order to conserve natural ecosystems, well planned, rational and optimal use of land and other natural resources are highly beneficial in long-term economic as well as environmental terms. Sustainable development can only be achieved if the entire gamut of potential impacts of development activities on natural environment are appraised timely and appropriately, and remedial measures are gleaned and implemented arising out of that appraisal. Although in the past very little attention was paid even by donor agencies in developing countries regarding environmental implications of development aid but presently many global initiatives are corroborating a growing sense of awareness and accountability about sustainable development and preservation of the natural environment in general and the ecosystem in particular.

In this paper, an attempt has been made to address environmental issues closely related to infrastructures, water resources and agriculture. That the relevant authorities can hopefully clearly understand the mechanism of development activities in relation to their interaction with the components of environment, and appropriate measures can be taken to minimise potential environmental degradation arising out of such activities.

INFRASTRUCTURES

The potential impacts of development on the natural environment are numerous and can be identified in a

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number of sectoral, and/or cross-sectoral issues related to the environment and development. This section attempts to briefly describe selected general issues related to environment and infrastructures with the emphasis on urban development in the context of Bangladesh.

RURAL AND URBAN SETTLEMENTS

About 80% of total population in Bangladesh live in rural areas, but urban population is increasing very rapidly as shown in Fig.1. By the year 2020 the urban population is expected to reach 8 million (Fig.1). Rapid urban growth is mostly taking place in four major cities namely Dhaka (6.5 million), Chittagong (2 million), Khulna (900,000) and Rajshahi (500,000). The total population of these four cities accounts for about 45% of total urban population in Bangladesh. The 1991 census identified 522 urban centres including these four major cities and 108 municipal towns. The present levels of urban services are of very low quality. The major environmental issues associated with such rapid and unplanned urbanisation are presented in the following sections.

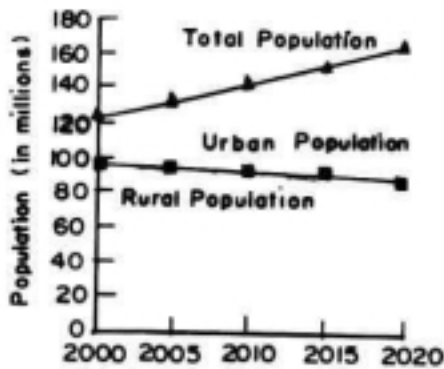


Fig. 1.: Rural and urban population in Bangladesh projected up to 2020 (Baurne, 1999)

Housing

Generally, living conditions are better in urban areas than in rural areas. But the living conditions of the urban poor in Bangladesh are worse than those of rural families. Baurne (1999) estimated that nearly 1.2 million poor urbanites are living in urban slums and about 0.6 million are either squatters or without homesteads. The present housing arrangements in urban areas are 39% in formal households, 24% in informal homesteads, 24% in congested slums and 12% are squatters and homeless. A challenge for future is the resettlement of the slum dwellers to planned areas where affordable infrastructure so as to provide that at least minimum level of service can be provided.

The percentage of present dwelling households in Bangladesh by material of wall and roof of the main structure is shown in Table 2. There is a heavy demand for bamboo and wood for being used as construction

material in housing (Table 2), and there is also a huge demand for firewood to burn of bricks particularly in the rural areas. This is the principal factor for unplanned deforestation, which has detrimental impact on the overall environment in general and changing climatic conditions in particular. Presently only about 6-8% of the country is covered by forest, a reduction of 50% over the past 20 years (Baurne, 1999). Present trend of developments in housing sector may further accelerate the aggravating situation. Housing development also takes up considerable spaces and raise the question of depletion of non-renewable land resources.

Table 2: Percentage of present dwelling households

	Straw/bamboo/(Polythene for roof only)	mud/unburned brick	C.I./Metal Sheet	Wood	Cement/brick
Wall materials	56.2	22.7	10.7	2.4	8.0
Roof material	47.2	-	48.6	-	4.2

Source: BBS(1997)

by material of wall and roof of main structure.

Water supply

Water supply has already emerged as a major concern for the future in terms of both quantity and usable quality. Bangladesh achieved a remarkable success by providing 97% of the rural population with tube-well water. Unfortunately, arsenic contamination of groundwater in many parts of the country has rendered tube-well water unsafe for drinking purpose. The supply of safe and potable drinking water is very poor in urban areas, particularly for the urban poor. About 40% of total population in Dhaka City do not have any definite source of supply of water for their domestic use. So most of them compelled to use untreated water from open water sources to meet their daily necessities. As a consequence, the environmental degradation emanating from water pollution is one of the major causes of diseases in urban slum settlements.

Sanitation and disposal of solid and liquid waste

A huge number of rural households (about 60%) in Bangladesh do not have access to sanitation systems. About 30% of the total Dhaka city's population, 50% of Chittagong city's population and 35% of other divisional/district towns population are served by unsanitary and unhygienic latrines or open defecation directly into the living environment. Where sanitary facilities are not available, septic tank effluent and sludge, bucket latrine waste, and decomposed residential commercial and industrial waste are disposed into storm drains or open water bodies without regard to effluent quality and their detrimental effect on the living environment. These wastes severely pollute soil-water-air environment. The only sewerage system of Dhaka Water and Sewerage Authority (DWASA) having a

coverage is only 15% of the total city population is currently operating at its maximum capacity and discharging sewage to a sewage treatment plant at Pagla, Dhaka. But this sewage treatment plant of DWASA is not adequately equipped for the treatment of sewage to a satisfactory level for their final disposal into open water bodies.

Solid waste management services have consistently failed to keep pace with the vast amount of solid waste produced in the urban areas. In Dhaka only about 40% to 50% of the total generated waste is being collected by the Dhaka City Corporation and in other urban centre waste collection coverage is in the range of 60% to 70%. There is a low coverage of solid waste collection particularly for the urban poor who receive minimal services, as a result, they often dispose their waste into open water bodies, low-lying areas, storm drains and open spaces and even in city roadsides. Such controlled disposal with high organic material in tropical humid climate is an ideal environment for the survival and transmission of pathogens and other contagious disease vectors. Again, the final disposal of solid waste is conducted in most of the urban centres in uncontrolled and unsanitary manner. Exposed dumping of organic waste in open areas attracts birds and vermin, and causes aesthetic nuisance as well as water and air pollution.

Urban centres in Bangladesh including Dhaka and other big cities except a few planned residential areas (such as Dhanmondi, Gulshan, Banani, Baridhara, etc.) are developing without proper provision for drainage and sewage disposal systems. The storm drains in most of the urban centres are severely affected due to filling of ponds, lakes and natural drainage channels within urban areas. This is due to the skyrocketing price of urban lands leading to the recover valuable lands for residential and commercial purposes. The available natural depressions and ponds also filled with solid waste in many urban areas due to the absence of proper waste management policy strategy. As a consequence, inadequate drainage structures often causes local flooding within a very short duration to due rainfall of high intensity. Again, existing drainage systems are often blocked by the indiscriminate disposal of solid wastes particularly polythene materials, and are an ideal environment for the breeding of mosquitoes and flies, serving as an ideal nest to disease vectors. Unplanned development along drains and encroachments upon drainage areas and facilities are common problems in many urban areas. Due to the shortage of adequate sewerage system in Dhaka, storm drainage system often carries sewage and industrial effluents, discharged illegally and indiscriminately into them. Storm drainage systems also carry untreated and/ or partially treated industrial effluent in most of the urban centres. Most of them discharge their wastewater into nearby canals, rivers, ponds, or lagoons which poses a serious threat to soil-water-air environment and health of the vast upon

living often in unhygienic and severely congested conditions.

Energy Consumption

Bangladesh has only one hydroelectric scheme at Kaptai in the Chittagong Hill Tract area. This was built in the sixty's. Electric power is generated in Bangladesh from fossil fuels, either natural gas (for instance at Ashuganj and Polash) or liquid fuel (as in Barisal and Siddirganj). A number of schemes are underway for increasing production of electric power using fossil fuels. The natural gas (with about 98% CH₄) is also available quite abundantly in Bangladesh. Methane is extensively being used in industrial, commercial and domestic purposes. Presently, Dhaka and Chittagong cities and Comilla town are connected to the natural gas grid. In most of the areas where natural gas is not available, kerosene is extensively used for domestic purposes. Although an enthusiasm was shown for bio-gas generation by a number of agencies (e.g. Local Government Engineering Department, Department of Public Health Engineering, Bangladesh Council of Scientific and Industrial Research), potential and long term sustainability of this technology has not been fully explored. The demand of fire wood for cooking and for burning of bricks (although this practice is banned) in rural areas and many urban areas are leading to extensive and objectionable cutting of trees and deforestation.

Transport sector and the thermal power stations consume a large share of fossil fuel in Bangladesh. Developing countries in general and Bangladesh in particular experience higher fuel consumption per vehicle than in developed countries mainly because of: poor maintenance of roads and vehicles, use of low fuel efficient vehicle, lack of alternative transport mode, and, inefficient traffic management. Urban road transport particularly in Dhaka is suffering from general energy inefficiency problems due to growing road congestion and increasing ownership and dependence on cars. The fuel (such as petrol and kerosene) required in transport and other sectors are generally transported through the road transport and river tankers which are quite vulnerable to accident hazards.

Roads and other transportation systems

During the 1900s, the major parts of present Bangladesh were connected by north-south and east-west grid of railway lines. At that time river transport served as a very important mode of transport for the people as well as for goods. Since 1950s a concerted effort was made to build roads connecting large cities and towns. Since 1970 the focus was on the building of local roads, connecting small town with police stations and major marketing centres. This last effort of local road building provided enormous benefits of the convenient transport of rural farm producers to markets and has had stimulating effects on the development at local levels. However, construction and maintenance of this road transport and other transport systems have associated

adverse effects. This, particularly land transport, includes loss of non-renewable wetlands and agricultural fields. Other associated effects are the displacement of communities and change in social behaviour (customs) resulting from the ease of movement. The construction processes require huge amount of earth, stone, aggregate, asphalt, the extraction of which generate their own adverse impacts. The proper drainage of water may be restricted due to construction of roads without adequate provisions for cross drainage with the consequence of flooding and restricted drainage in the abutting areas during periods of high intensive precipitation. This may cause damage to vegetation, crops and wetland habitats and some times permanent loss of wetlands and agricultural fields. The congested water is polluted and is an ideal breeding nest for disease vectors. Roads running through forests and plantations may cause destruction of forest and plantations and may severely affect and even eliminate wildlife. Construction of roads, particularly secondary roads and road structures interfere with navigation and specially boat communication which still serves as a major and very important mode of transport, at least during monsoon period of the year. Obstruction of drainage system, particular in confined urban centres and industrial areas may lead to serious pollution problems.

Air and noise pollution are common problems in transport sectors. There are various source of air pollutants generated by land transport. Fuel additive such as lead has harmful effects on the mental development of children and can affect kidney, liver and reproductive system. Carbon dioxide emissions has possible adverse impact on changing climatic conditions. These negative impacts are more predominant in confined urban areas. About 80% of all benzene emissions are from motor vehicles (Seik, 1998). Benzene is both odorous and linked to certain cancer. Nitrogen oxides emissions, converted to nitric acid and combined with sulphur dioxide, form a significant component of acid rain, which definitely poses a serious threat to ecosystems. Particulate matters in the form of fine solids or liquid articles in the air or emissions such as dust, smoke or smog resulting from roads, wear and tear of tyres and brakes, and engine combustion can pose health hazards and damage vegetation along side of the roads.

The constriction of waterways by roads and road structures may increase water flow velocity, and cause erosion during floods and subsequent siltation in the downstream. This may also change local and regional hydraulic regime. The increased siltation of rivers and canals create a major problem to river transport system, which is presently revolutionised by mechanisation of boats. Air and noise, and water pollution through spillage of oils and chemicals are also common problems when mechanised boats and vessels are used in river transport. Construction of ports and similar

facilities, and dredging of rive beds to maintain navigation channel pose serious threats to aquatic habitats.

Flood protection structures

It is apparent from the report of Danish Ministry of Foreign Affair (DMFA, 1989) that each year about 26,000 km² or 18% of the country is flooded. During severe floods, affected areas may be 52,000 km² or 36%, equivalent to 60% of the net cultivable lands. In addition, nearly 12% of the cultivable areas are inundated by saline sea water due to high tides or cyclones. Embankments and dams are common structural measures that have been widely used for controlling floods and for protecting many cities and towns in Bangladesh. But construction of such structures interfere with the free movement of water, fish migration, breeding and production. The unplanned structures also interfere with the natural drainage systems and may cause siltation problems in the down streams of rivers and canals. This is further discussed in the following water resources section.

WATER RESOURCES

Water resource development issues are cross-sectoral, resulting from a large number of development activities including :

- ◆ diversion of existing water course, tunnelling or construction of flood control structures;
- ◆ storage of water to create reservoirs;
- ◆ spillways, hydro-electric power generations;
- ◆ irrigation and
- ◆ dredging and filling, groundwater extraction etc.

Water resources development activities often cause an alteration in the hydrological regime of the project and surrounding areas. These changes may be very large, especially in major impoundment, irrigation and hydro-electric power generation projects. They may also result in establishment of new access roads and acceleration of encroachment upon upstream areas in the watershed, these activities result associated impacts on land use, agricultural practices, forests, wildlife, aquatic habitats, mineral development, health hazards, etc. throughout the watershed and surrounding areas. The followings are examples of some impacts which have in the past been identified in some water resources development projects:

- loss of productive land to construct different structures (such as embankments, dams, roads, etc.);
- increased access to the project area serves to accelerate human encroachment upon forest cover, wildlife and aquatic habitat;
- change in hydrological regime both in the project area and downstream due to impoundment and over exploitation water from their sources;

- subsidence, lowering of water table and deposition of salts and other unwanted minerals that may arise from the over exploitation of groundwater;
- deterioration of soil properties particularly in the waterlogged areas;
- potentially greater loss of crops and property under conditions of extreme flooding and structural failure;
- rapid siltation of river channels and salinity encroachment, particularly in the coastal belt due to reduced river flow resulting from construction of dams, embankments, etc., and over exploitation of upstream water for irrigation, aquaculture, fisheries and such other uses;
- siltation of irrigation canals and fields due to deposition of sediment loads taken from source of water;
- soil erosion, particularly in deep earthen canal or from surface wash if water table rises significantly;
- effects on downstream water quality and quantity that may create water use conflicts;
- other water use conflicts such as coastal agriculture, brackish versus freshwater aquaculture/fisheries;
- uncontrolled extraction and diversion of surface water also reduces availability of water for navigation and fisheries, loss of formerly flooded habitats and restrict their movement, reduces fish production and increases over-fishing;
- loss of valuable wildlife in case of inundation;
- ecology, particularly aquatic ecology is significantly altered in channel improvement, dredging and filling projects;
- may alter disease vector balance, (e.g. may create breeding nest for mosquitoes and similar disease vectors) and reduce the availability proteins due to loss of fisheries; and,
- displacement of communities.

Agriculture is the main occupation of the people in Bangladesh employing about 70% of labour force. This sector directly contributes nearly 30% to the gross domestic products (GDP) with about 7.97 hectare net cultivatable land, which accounts 54% of the total area of the country. Currently (in the year 1997-98) 13% of the net cultivatable area is triple cropped, 51% double cropped and 36% single cropped. Rain-fed agriculture still accounts for a large part of agricultural production, and area irrigated by different methods are shown in Table 3. There is a potential to increase the production by intensified cropping through supplementary irrigation and improved rain-fed farming system. Presently there is an emphasis to increase acreage of rice, by cultivating High yielding varieties (HYV) rice, which displaces traditionally adapted resistant varieties. This bias towards HYV rice increases the use of agrochemical – both fertilisers and pesticides. In 1997-98, total consumption of urea, Triple super phosphate (TSP), SSP in Bangladesh was about 1.9×10^6 , 5.0×10^4 and 1.0×10^5 tons respectively. This use of chemical fertilisers is increasing with time. The evaluation of water quality of few rivers has shown a maximum concentration of 9 mg/l of nitrate in water (Alam, 1996 and Rahman, 1997). In Bangladesh, the use of pesticides to control pests, which is an integral part of modern agriculture, is increasing with time (Table 4), but unfortunately has the most adverse impacts on environment and health. Again, the use of pesticides is not effectively controlled in Bangladesh and toxic persistent pesticides such as DDT, although banned for agricultural use, are reported to be imported illegally and are being used for the protection of rice crops. The tail-water runoff from such agricultural fields can cause surface water pollution, while deep percolation can cause groundwater pollution. According to ESCAP (1987) about 25% of total used pesticides reaches coastal water, so about 500 tons of organo-phosphorous and 250 tons of DDT have reached into sea water in 1984-85.

It is apparent from DMFA (1989) that low organic content, high cropping intensity, improper cropping sequences and faulty crop management practices already caused depletion of soil fertility in Bangladesh.

AGRICULTURE

Table 3: Area irrigated by different methods in 1997-98

Methods	Irrigated area, ha	% of net cultivatable land
Power pump	706, 478	8.9
Tube wells	2678138	33.6
Canals	162753	2.0
Swing baskets	338461	4.3
Total		48.8

Source: BBS(2000)

Table 4: Pesticide consumption from 1984 to 1993 in Bangladesh in metric ton.

Year	Insecticide			Fungicide	Herbicide	Rodenticide
	Granular	Liquid	Powder			
1984	2977.34	808.81	103.96	32.20	61.50	1.24
1985	2228.18	672.12	158.97	34.62	85.92	3.67
1986	2993.05	856.65	262.34	106.82	56.67	13.05
1987	3098.00	599.67	244.32	46.05	61.41	3.96
1988	3520.11	523.09	120.40	2064	79.63	8.38
1989	5670.44	779.08	168.53	49.83	61.87	2.92
1990	6545.67	1001.39	69.05	316.46	104.79	20.24
1991	5601.01	943.02	79.30	361.47	98.58	40.44
1993	5818.69	1023.52	84.15	565.48	111.36	57.11

Table 5 shows the pesticide usage and agricultural yields in selected countries in the world. It is important to note that Japan, with the twice the US yield of food per acre, uses seven times higher pesticide. Again, US itself, with just over twice the yield of Africa, uses about twelve times more pesticides. Therefore, unplanned irrigation can pose a serious threat to the ecosystem, resulting in degradation of soil-water-air environment, loss in biodiversity and health hazards. The followings are examples of some adverse impacts associated with agricultural developments:

- reduces soil fertility, a large fraction of water applied for irrigation is lost by evaporation and evapotranspiration leaving unwanted salt and other minerals in the root zone. Groundwater with high sodium absorption ratio and residual sodium carbonate used for irrigation increases soil alkalinity. Turbidity contained in irrigation water may change soil texture over a period of time. Micro-nutrients may be drained out, leached away or carried out by eroded soil. Continuing irrigation with the use of chemical fertilisers as a substitute for organic matter result in progressive loss in soil fertility;
- all chemicals applied for irrigation are not fully utilised by crops, a large fraction such chemicals and heavy metals along with pathogens are being drained out or being carried out by eroded soil into the natural body of water. Washing of agrochemical container in water source also contribute a significant amount of pesticides and fertiliser residue into natural water body. This may lead to increased mineralization, increased nutrients causing eutrophication, and increased toxicity. This
- deteriorating water (both surface and ground water) quality impair all beneficial use of water;
- the above change in water quality considerably alter downstream aquatic ecology affecting fisheries both in river and marine/estuaries associated with river system;
- spraying of pesticides in irrigation fields also affects the non-target groups of beneficial insects, birds, live stocks and wild animals;
- use of agrochemical destroy the breeding ground of paddy fishery;
- agricultural runoff after spray application may increase the concentration of pesticides in the immediate wetland to a level lethal to aquatic habitat;
- persistent pesticides (such as DDT and other chlorinated hydrocarbons) result not only immediate adverse effects but accumulate in the environments. This includes accumulation in soils, and river bottom mud, and accumulation in flora and fauna, sometimes with marked impairments of adult birds and fish, and goes on bio-magnification in food chains;
- over exploitation of groundwater for irrigation may also interfere with domestic water supply system; and,
- in addition to water pollution and overall environmental degradation, health hazards associated with irrigation practice includes hazards to personnel handling toxic substance

Table 5: Pesticide usage and agricultural yields in selected World areas [Source: MIT (1971)]

Area or nation	pesticide use, gm/ha	rank	yield, kg/ha	rank
Japan	10790	1	5480	1
Europe	1870	2	3430	2
United States	1490	3	2600	3
Latin America	220	4	1970	4
Oceania	198	5	1570	5
India	149	6	820	7
Africa	127	7	1210	6

CONCLUDING REMARK

The intense population pressure in Bangladesh has already caused degradation of soil-water-air environment, deforestation and loss in biodiversity. This deteriorating environment calls for protective measures and proper management of existing scarce resources for maintaining self assimilating capacity of the ecosystem to achieve sustainable development. Thus this study is aimed to identify major environmental issues closely related to infrastructure, water resources and agriculture, in the context of Bangladesh, with a goal to pay more attention and take remedial actions to minimise environmental degradation in planning and implementing future development activities.

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