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ON  
BANGLADESH

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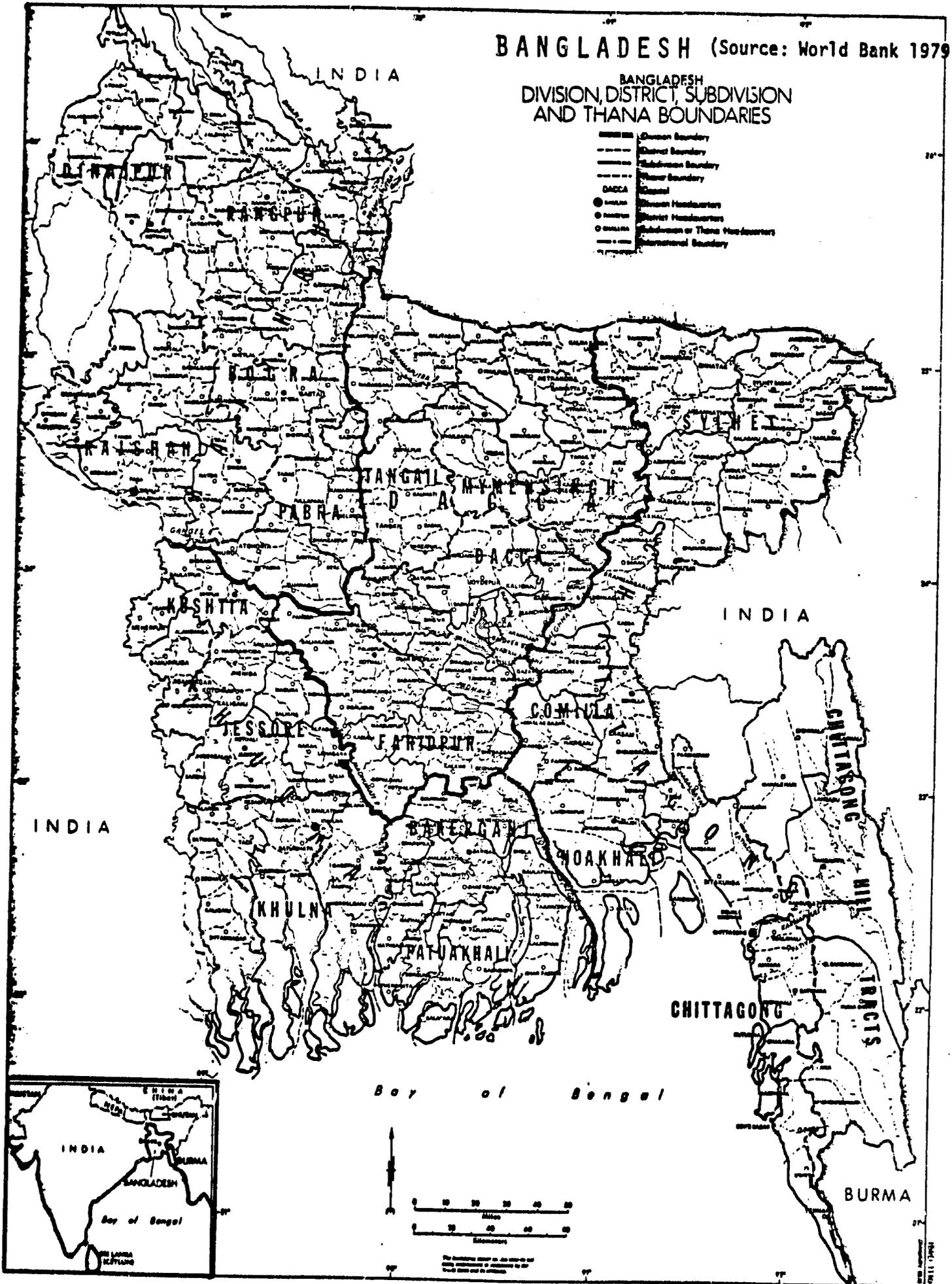
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WASHINGTON, D. C.

APRIL 1980

# BANGLADESH (Source: World Bank 1979)

## BANGLADESH DIVISION, DISTRICT, SUBDIVISION AND THANA BOUNDARIES

-  Division Boundary
-  District Boundary
-  Subdivision Boundary
-  Thana Boundary
-  Dacca
-  Division Headquarters
-  District Headquarters
-  Subdivision or Thana Headquarters
-  International Boundary



## BANGLADESH: DRAFT ENVIRONMENTAL REPORT

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## 0.0 Introduction and summary

Located in South Asia and formerly a part of the British Indian territories which also included India and Pakistan, Bangladesh, covering an area of some 142,500 square kilometers, is roughly the size of Wisconsin.

With a population of over 87 million, Bangladesh is the most densely populated sizable country in the world: population density by most recent estimates is 615 persons per square kilometer overall and 1,063 persons per square kilometer of arable land. This population is remarkably uniform both ethnically and linguistically; it is also overwhelmingly rural, urban population constituting only 8% of the total. About 50% of this population suffers from malnutrition, while intestinal diseases and parasitic maladies such as malaria are also prevalent. Overpopulation represents a major problem for Bangladesh; the need to control population growth (estimated at about 2.9% per year) has been called the most critical problem faced by the country. Large and growing numbers of people put tremendous pressure on the limited resources of the country: most of the arable land is already under cultivation; forests have been lost to agricultural expansion or to meet the fuelwood needs of the people; safe water supplies are limited; and wildlife numbers have dropped as suitable habitat becomes increasingly limited to only a few sections of the country.

Physically, Bangladesh is a low-lying country; hilly areas are found only in the extreme southeast and to a lesser extent in the northeast. Most of the country is comprised of nearly level alluvial plain, much of it deltaic in nature, cut by three great river systems: the Ganges-Padma, the Brahmaputra-Jamuna, and the Meghna.

Climatically, Bangladesh is usually described as tropical monsoon. Rainfall, generally heavy throughout the country, falls mainly during the monsoon season, which occurs between June and September. These rains regularly bring flooding to large portions of the country. Furthermore, harsh weather phenomena are associated with the onset and withdrawal of the monsoon season. Particularly severe are the cyclones, which in some years have brought death and destruction to large areas of the country, especially in the coastal areas.

Water resources. Bangladesh is a land of rivers, which dominate the landscape and provide the major transportation routes in the country. Despite the overabundance of water in these rivers during the monsoon season, the country suffers from shortages of water during the dry season, when river flow is sharply reduced. Furthermore, because of the low-lying terrain typical of most of the country, potential for large-scale storage of water is limited; the only major reservoir is in the hill country of the southeast. Because most of the river flow of Bangladesh originates from without the borders of the country, Bangladesh is also subject to disruption of water resources because of upstream water diversions in neighboring countries. One of the major controversies between Bangladesh and India--finally settled in 1977--involved India's diversion of the Ganges River just short of the Bangladesh border, which brought various adverse effects to Bangladesh.

Groundwater, present throughout most of the country, is generally within 30 feet below ground surface, although deeper aquifers also occur. In some areas groundwater is unusable because of high salinity levels.

Water quality problems include most prominently contamination by human wastes of water used for domestic purposes. According to some estimates, only about 10% of the population has access to safe potable water, contaminated water accounting for much of the disease in the country. Other water quality problems arising from human activities are fertilizers and pesticides residues, and pollution from industrial wastes, which has been most troublesome in the southeast and in the area around the capital city of Dacca. Water quality problems stemming from natural sources include high salinity levels of both groundwater and surface waters, water hardness, and high sediment loads in rivers.

Soils. The soils of Bangladesh are primarily the product of both recent and older alluvial deposits. Most of the soils with agricultural potential have already been brought under cultivation. About 57% of the total land area is under crops, the major crop being rice, which accounts for 80% of cultivated land. The major cash crop is jute. Because of the large amount of land devoted to crop production, range for livestock grazing is extremely limited. Major hopes for increase of agricultural output lie in expanded irrigation operations and the use of fertilizers and pesticides.

Problems with soils involve the effects of flooding and severe drainage problems in several areas. Erosion problems are especially pronounced in the hilly country of the southeast, where slash and burn cultivation is practiced.

Forests. Extensive forest tracts in Bangladesh occur only in the Chittagong Hills of the southeast, although pockets of forest land are found in other areas, and the remnants of a large forested area occur north of Dacca. Existing forest land is exploited for timber, but fuelwood is the principal product of the country's forests, accounting for as much as 95% of wood produced in recent years. Loss or degradation of its already limited forest resources is a serious problem for Bangladesh. Although official figures place the amount of forested land at about 15% of the area of the country, other estimates place it as low as 8%, and forest loss continues as land is cleared for agriculture, including shifting cultivation in the southeast, and forests are felled for timber and firewood.

Wildlife. Growing population and expanding agricultural activities have had a detrimental effect on wildlife numbers in Bangladesh. Because of the heavy concentration of population in the alluvial plains of the country, wildlife habitat is now generally limited to the Chittagong Hills Tracts of southeast Bangladesh, to the Sunderbans of the southwest, and to the Sylhet Hills of the northeast. Even in these areas the remaining populations of rhinoceros, elephants, and crocodiles, to name just a few, are on the endangered list for Bangladesh.

Coasts and beaches. Bangladesh has nearly 600 kilometers of coastline along the Bay of Bengal. Much of the coastal land is regularly inundated by saline waters from the Bay, a problem of particular severity during storms, and systems of embankments have been built to guard against this danger. An important feature of the coastal area are the mangrove swamps of the Sunderbans in the southwest. Degradation of these mangrove areas through exploitation for fuelwood threatens to reduce their value, both as a breeding ground for fish and as a barrier against tidal waves, cyclones, and floods.

Fisheries. Bangladesh has both inland and coastal fisheries, fish providing an important source of protein for the country's population. Fisheries are generally considered to be underdeveloped, however. There are indications that fish life is being adversely affected by pollution in some areas.

Minerals. Bangladesh is poor in mineral resources. However, natural gas deposits have been located and are being exploited. Coal deposits, not yet under development, have also been located.

## 1.0 POPULATION CHARACTERISTICS

Covering an area of 142,500 square kilometers--just slightly less than the territory of Wisconsin, Bangladesh, with a population most recently estimated at from 87-88 million people (as compared with 4.651 million for Wisconsin), is the most densely populated country in the world, apart from densely populated city-states such as Hong Kong and Singapore.

### 1.1 Basic population statistics

Present population 87.1 million (WPDS)

Population at time of last census (1974): 76.398 million (corrected)

Rate of natural increase: 2.9% (WPDS)

Birth rate: 47 per 1,000 population (WPDS)

Death rate: 18 per 1,000 population (WPDS)

Number of years to double population: 24 (WPDS)

Population in the year 2000: 155.1 million (WPDS)

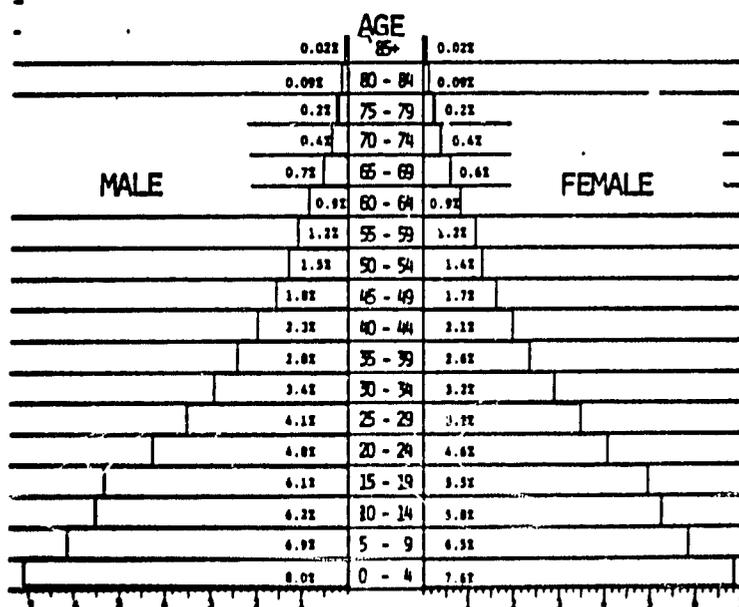
Population under 15: 41-43% (WPDS and MSBoB March 1978)

Population over 64: 3% (WPDS)

Urban population: 9%

### POPULATION PROFILE

(mid-year 1980 projection: based on a total population projected at 88.768 million) of 88.678million: source Monthly Statistical Bulletin of Bangladesh; March 1978)



POPULATION IN MILLIONS

## 1.2 Distribution of population

Bangladesh is a heavily rural society; as of 1974, only about 8.8 of the population lived in towns with populations of greater than 5,000 persons; recent estimates place urban population at about the same level.

Bangladesh has few large cities; as of 1974 there were only six urban centers with populations of over 100,000. The largest of these was Dacca, the capital, which alone accounted for 26.7 percent of urban population.

URBAN CENTERS WITH POPULATIONS OF OVER 100,000: 1961 and 1974  
(Source: MSBoB: March 1978)

	1961	1974
Dacca	521,034	1,679,572
Chittagong	364,205	889,760
Khulna	127,970	437,314
Narayanganj	162,054	270,680
Mymensingh	53,256	182,153
Rajshahi	58,885	132,909

Although urban centers showed growth between 1961 and 1974, the overall urban population of Bangladesh has not increased enough to change the overwhelmingly rural nature of the country. Urban population in 1951 was 4.3% of total population; this rose to 5.2% in 1961 and to 8.8% in 1974. The bulk of the population still lives in some 71,000 villages of fewer than 5,000 people (Kurian 1978:106). Growth in urban population has been attributed to migration from the densely populated rural areas as well as to a surplus of births over deaths in urban areas (UNESCO/UNEP/FAO 1978: 342).

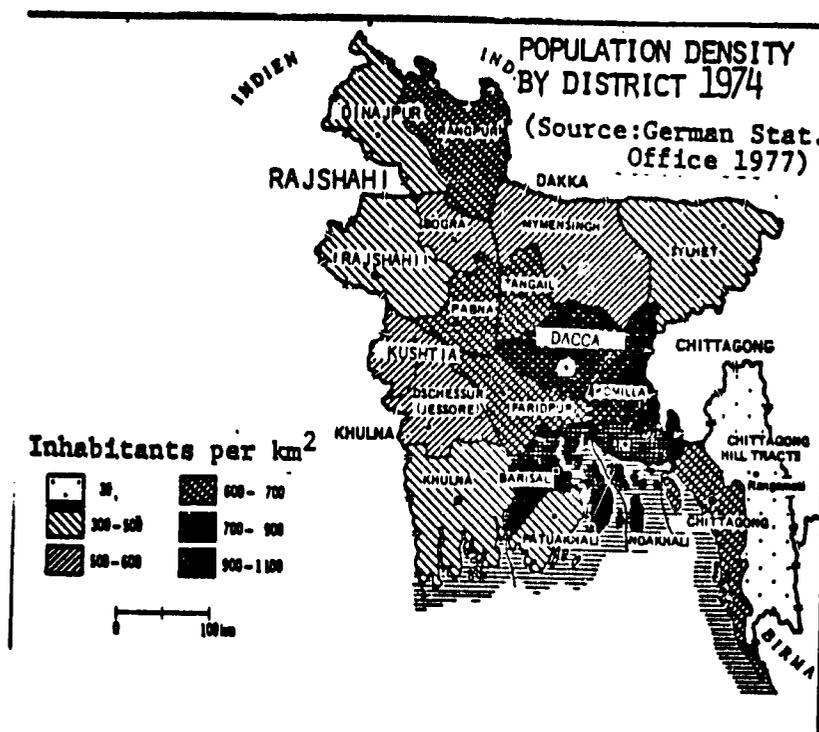
### 1.2.1 Population density (see map and table on page 3)

Bangladesh is the most densely populated country in the world after Singapore. Population density in 1974 was 536 persons per square kilometer; population in 1979 may be as high as 615 persons per square kilometer --1600 per square mile (calculated on a population of 88.7 million from Bangladesh government statistics). Population in relation to arable land is 1,063.6 persons per square kilometer. The lowest population density is in hilly areas away from the Delta, particularly the Chittagong Hill Tracts.

## 1.3 Ethnic, linguistic, religious characteristics

The population of Bangladesh is remarkably homogeneous. Over 98% of the population consists of Bengalis, the remaining 2% being Biharis (a term used to designate non-Bengali speaking Muslims who entered Bangladesh from eastern India after partitioning in 1947) and tribal groups. The tribal groups, who are racially distinct from the Bengalis, live mainly in the Chittagong Hill Tracts in southeastern Bangladesh. The largest groups are the Chakmas, the Marmas, the Tipperas, and the Moros.

\*Defined as urban: center of 5,000 or more inhabitants with such urban characteristics as streets, plazas, water supply systems sewerage systems, electric lights, etc.



**Population by Division and District (1961 and 1974) [pop. in thousands]**

	land area: sq. km.	% of ter.	population		% of pop. 1974	population per km <sup>2</sup>	
			1961	1974		1961	1974
<b>RAJSHAHI DIV</b>	33,374	24.7%	11,850	17,332	24.2%	355	519
Dinaipur	6,711	5.0%	1,710	2,571	3.6%	244	383
Rangpur	9,062	6.7%	3,796	5,447	7.6%	419	601
Bogra	3,794	2.8%	1,574	2,231	3.1%	415	588
Rajshahi	9,324	6.9%	2,811	4,268	5.9%	301	458
Pabna	4,483	3.3%	1,959	2,815	3.9%	437	628
<b>KHULNA DIV</b>	29,493	21.9%	10,067	14,195	19.9%	341	481
Kushtia	3,383	2.5%	1,166	1,884	2.6%	345	557
Jessore	6,571	4.9%	2,190	3,327	4.7%	333	506
Khulna	10,417	7.8%	2,449	3,557	5.0%	235	431
Barisal	4,569	3.4%	3,068	3,928	5.5%	551	705
Patuakhali	3,553	2.6%	1,194	1,499	2.1%	336	422
<b>DACCA DIV</b>	29,420	21.8%	15,294	21,318	30.0%	520	725
Faridpur	6,340	4.7%	3,179	4,060	5.7%	501	640
Dacca	5,988	4.4%	5,096	7,612	10.6%	729	1,089
Tangail	3,282	2.4%	1,487	2,078	2.9%	453	633
Mymensingh	12,810	9.5%	5,532	7,567	10.6%	432	591
<b>CHIGGATONG D</b>	42,328	31.4%	13,630	18,636	26.0%	322	440
Sylhet	12,258	9.1%	3,490	4,759	6.7%	285	388
Comilla	6,369	4.7%	4,389	5,819	8.1%	689	914
Noakhali	3,973	3.0%	2,383	3,234	4.5%	600	814
Chittagong	6,568	4.8%	2,983	4,315	6.0%	454	657
Ch.H.Tracts	13,160	9.8%	385	508	0.7%	29	39
<b>Total</b>	<b>134,615*</b>	<b>100.0%</b>	<b>50,841</b>	<b>71,479**</b>	<b>100.0%</b>		

\*Figures for land area are from German Statistical Office 1977; the deviation between this and figures for the total area of the country, variously reported as 142,500 square kilometers (National Intelligence 1979), 143,998 square kilometers (German Statistical Office 1977 and World Bank 1979), and 144,020 square kilometers (Dutch Bilateral...1980), can be accounted for in part by extensive water areas. \*\*Unadjusted census figures.

In coastal areas are scattered communities of Arab, Dutch, and Portuguese settlers, who form the only significant foreign communities (Kurian 1978:107). Bangla or Bengali is the official language of Bangladesh, but English remains the language of the modern sector.

Bangladesh is 90% Moslem and as such is the second largest Moslem country in the world, after Indonesia; most Moslems belong to the Sunni sect. The second largest religious group--the Hindus--are found in areas bordering India; their numbers have been decreasing since 1947. Hinduism has had a strong influence on Islamic beliefs and practices in rural areas (Kurian 1978:107).

**1.4 Educational characteristics**

General educational indicators (World Bank, WDR 1979).

Adult literacy rate: 22% (no rise since 1960)

Numbers enrolled in secondary school: % of age group

	1960	1976
Total:	47	83%
Male:	66	106% (includes males from outside age group)
Female:	26	60%

Numbers enrolled in secondary school: % of age group

	1960	1976
Total:	8	23%

Numbers enrolled in higher education: % of population 20-24

	1960	1976
Total:	1	3%

Bangladesh has not yet introduced free, universal, compulsory education. Schooling lasts 12 years: five years of primary education, five years of lower secondary education, and two years of higher secondary education. The dropout rate is high at all levels. Only primary education is free. Education is in Bengali in the primary grades, and in Bengali and English in the secondary grades. The school system has been confronted by the problem of declining standards, attributable mostly to a shortage of trained teachers. On the secondary level private educational institutions far outnumber those maintained by the government. Vocational education has been neglected; vocational students accounted for only 0.07% of the total school enrollment in recent years (Kurian 1978:114). For information on universities, see under section 4.4 below.

## 1.5 Health characteristics (from World Bank. WDR, unless otherwise indicated)

Population per physician (1976): 11,350

Population per hospital bed (1976): 4,430

Crude death rate(1977) : 18 per 1,000

Child death rate (ages 1-4)(1977): 23 per thousand in age group

Life expectancy at birth: 47 years  
48 years (Loomis 1976)  
46 years (WPDS 1979)

### 1.5.1 Health problems

The most immediate causes of death are infectious diseases such as cholera, diarrheal diseases, tuberculosis, and measles. Children under five, estimated to account for 40% of all deaths, are affected particularly by diarrheal diseases, diphtheria, tetanus, whooping cough, measles, and other bacterial and viral infections (Loomis 1976:29).

Malnutrition is rampant (at least 50% of the population is, by government estimates, suffering from some degree of protein-calorie malnutrition) and is the underlying factor contributing most heavily to death and sickness (Loomis 1976:1). Gastroenteritis compounded by malnutrition is thought to be the most common cause of sickness. Because of a lack of statistical information, a detailed analysis of communicable diseases is not possible for Bangladesh (Loomis 1976:31). The prevalence of waterborne and fecal-related diseases underlines the desperate need for improved water supply and sanitation systems.

#### malnutrition

Affecting more than 50% of the population, malnutrition is said to be the underlying factor contributing to both mortality and death in Bangladesh, and has been called the most important health problem in the country (Loomis 1976:29), because it renders its victims, particularly infants, more susceptible to the effects of other ailments, including diarrheal diseases, whooping cough, measles, and diphtheria. Types of malnutrition include calorie deficiency (especially severe during dry season and midmonsoon, when cereal intake is low) protein deficiency (estimated to affect 60% of households in the 1960's), vitamin A deficiency (leading to blindness in boys under the age of 5), riboflavin deficiency (intake is low throughout the year for all groups), anemia (average hemoglobin levels are about 2/3's those for Europeans), goiter, and vitamin C deficiency (Loomis 1976:37-38).

As population continues to increase putting more pressure on a limited amount of agricultural land, malnutrition can be expected to remain a problem for Bangladesh.

#### cholera

Cholera, a major problem throughout Bangladesh, is endemic in the

deltic regions of the country. It is transmitted by the drinking of water contaminated with fecal matter from a disease-carrying individual. The disease appears to strike different parts of the country in a seasonal pattern, beginning in September in the northern areas of the country and moving southward to reach Dacca in November and December and the most southern sections in March, April, and May. Although the Cholera Research Laboratory has developed an intravenous treatment that has helped to reduce fatalities, the real key to keep down the incidence of the disease is improved sanitation (Loomis 1976:31).

#### tuberculosis

An estimated 100,000 deaths per year are caused by pulmonary tuberculosis. Over 80% of the adult population have positive tuberculosis skins tests, and there are about 320,000 active cases per year. The disease appears to be more prevalent in rural than in urban areas (Loomis 1976:31).

#### malaria

Malaria, the target of an eradication program since the mid-1960's, has been steadily decreasing in incidence, but residual pockets are found in the border regions. In 1974 it was reported by WHO that of 71 million people at risk to malaria, 30.149 million were in the pre-maintenance phase, 33.011 million in consolidation, and 7.843 in attack phase areas. In early 1974 only 0.65% of about 750,000 blood smears examined turned out to be malaria positive (Loomis 1976:32).

#### other diseases

Although exact figures are not available, the following diseases are known to be prevalent in Bangladesh: diphtheria, tetanus, pertussis, measles, poliomyelitis, typhoid, paratyphoid, visceral leishmaniasis, filariasis, dengue, yaws, venereal disease, and diarrheal disease. Tetanus and diphtheria affect children in particular; tetanus is responsible for an estimated 10% of all infant deaths. Filariasis, like malaria a mosquito-borne disease, is endemic to the northern part of the country; some 14% of people examined in a survey in Dinajpur district were found to be infected. Intestinal parasites such as hookworm, roundworm, whipworm, and pinworm are reported to be ubiquitous. Leprosy affects an estimated 100,000 persons (Loomis 1976:31-32).

### 1.5.2 Health care

The health care system consists of: a centralized public system based on the concept of Rural Health Centers, with referral up to the urban-based hospital; scattered private services such as community cooperative health insurance plans and individual physician care; traditional services based on folk beliefs and herbal treatments. By far the greater part of the population is served by traditional methods. Government health services, widely scattered throughout the country with some concentration in urban areas, are said to have had a minimal effect on health patterns. The most effective care comes from urban-based private physicians and some private community health services (Loomis 1976:3).

Of Bangladesh's some 7,000 physicians about 75% are active in urban areas. About 30% are employed by the government, although all have private practices. The country's seven medical schools graduate about 500 doctors per year, a number which was expected to increase to 1,000 by 1978. Most medical training has been hospital-oriented, with little emphasis on public health. Many graduate doctors leave the country to practice in other parts of the world.

There is a critical shortage of nursing personnel; there were only 700 in the country as of 1973, only one for every ten doctors.

Paramedical personnel, including midwives, sanitary inspectors, and smallpox and malaria workers, are more evenly distributed throughout the country than are doctors and nurses. The Five Year Plan 1973-78 called for a dramatic increase in such personnel, who are the chief personnel at the Rural Health Centers and subcenters, which are the only public health facilities in rural areas. The Five Year Plan also called for an increase in Rural Health Centers from 160 to 356 and an increase in subcenter from none to 1,068.

### 1.5.3 National Health Policy

National Health Policy was stated in the First Five Year Plan 1973-78. It called for the establishment of an integrated and comprehensive rural health care system aimed primarily at infants, children, and mothers-- a sharp contrast to the prevailing urban-based curative system. The Plan stressed the need to make low-cost health care available to the majority of the rural population, and emphasizes the need to attack communicable diseases on a broad comprehensive front, rather than through single unipurpose programs (Loomis 1976:2).

### 1.5.4 Water supply and sanitation

The inadequacy of both water supply and sewerage systems in Bangladesh have been identified as perhaps the chief factor in preventing the improvement of the overall health status of the population of Bangladesh (Loomis 1976:64).

#### water supply

Although water is plentiful in Bangladesh, the means of providing a clean and sanitary supply is not, and therefore a good potable water supply is available to only a small fraction of the population. Even Dacca, the capital, does not have a good supply of potable water (Loomis 1976:63). Unhealthful water is the source of much of the disease in the country.

**WATER SUPPLY** (World Health Statistics Report, vol, 29, no. 10, 1976).

	1970	1975
Urban Population		
By house connection	6%	6%
By public standpost	7%	16%
Total urban pop. served:	13%	22%
Rural population		
Population with reason- able access	47%	61%
Total population served	45%	56%

A study of the health situation in Bangladesh (Loomis 1976) presents a much gloomier picture of the water supply situation than that indicated by these World Health Organization figures above. According to the government Planning Commission there were in 1973 only 185,000 government tubewells in the rural areas and only thirty of the seventy-six urban centers had piped water. Furthermore, it was estimated that about 30% of all rural tubewells were inoperative, either because of siltling or poor maintenance and that many of the urban systems were able to supply running water only for four or five hours a day. Taking these factors into consideration, Loomis estimates that less than 10% of the total population had access to potable water (less than 10% of the rural population and less than 25% of the urban population) (Loomis 1976:x,59).

The Five Year Plan called for improvement in the rural water supply situation by increasing the number of drinking-water tubewells to a total of 285,000 shallow and 1,200 deep tubewells; financial aid was to be supplied by UNICEF. The target was one handpump tubewell for every 150 persons in rural areas supplied by shallow wells and one well for every 200 persons in deep well areas (Loomis 1976:59). It has been pointed out, however, that an educational program must accompany tubewell construction, since the people seem to prefer getting their water from traditional sources--mainly rivers and streams. The problem of maintaining tubewell equipment is also a difficult one (Loomis 1976:59).

As for the urban areas, the Plan called for extension of water supply systems to 38 urban centers, including all district and subdivisional headquarters, and the improvement of water supply capacity in seven other important towns (Loomis 1976:63).

sewage disposal

In rural areas of Bangladesh make-shift latrines have been used for human excreta disposal, and rivers and streams have served as waste removal systems. In the urban areas, household systems such as pit privies and buckets are the predominant excreta disposal systems. According to World Health Organization figures, only 5% of the urban population was connected to a sewerage system as of 1975, less than the total urban population served in 1970. Dacca is the only urban center with a sewerage system. The other urban areas are without modern systems, and as of 1976 there were no plans for providing them with such systems (Loomis 1976:63).

SEWAGE DISPOSAL (World Health Statistics Report, vol. 29, no. 10, 1976)

	1970	1975
<u>Urban population</u>		
Public sewerage	12%	5%
Household systems		
Pit privy, septic tank	47%	22%
Bucket	28%	13%
Total urban population served	87%	40%
<u>Rural population</u>		
With adequate disposal	1%	1%
<b>TOTAL POPULATION SERVED</b>	<b>6%</b>	<b>5%</b>

solid waste

Solid waste, like night soil, is deposited on the outskirts of cities (Loomis 1976:63).

1.5.5 Population control

The need to control fertility has been identified as the most critical problem for Bangladesh, which is confronted by a situation in which population is growing due to a high birth rate and an ever decreasing death rate. The most densely populated sizeable country in the world, Bangladesh, already hard put to supply even the minimal food needs of its population and with little land left for agricultural expansion, is confronted by a constantly decreasing ratio between population and its ability to produce food. As economic growth has fallen behind population growth, the average level of calorie and protein intake per head has also dropped, standing in the 1970's at 1600 kcal and 40 grams of protein (increasingly of vegetable origin) per day (UNESCO/UNEP/FAO 1978:542).

Population control programs in Bangladesh date back to 1953, at which time the Family Planning Association began its activities. A limited program of family planning through voluntary efforts was funded under the First Five-Year Plan of the period during which Bangladesh was

still a part of Pakistan. Later (1960) a nationwide government program was launched under the Ministry of Health (Loomis 1976:54-55). Population planning activities were interrupted by the war for independence in the early 1970's, but the first Five Year Plan 1973-78 of Bangladesh seemed to recognize the urgency of the population problem, warning that continued population growth could threaten the "sheer ecological viability of the nation." (Loomis 1976:56). For a time under the new government a unified health and population approach was attempted, but in 1975 health and family planning services were separated, the newly created Population Control and Family Planning Division of the Ministry of Health assuming all responsibilities for population, family planning and maternal and child health activities. With assistance from the United Nations Fund for Population Activities and U.S.A.I.D. the government has been recruiting 6,000 female health workers to implement its programs, including delivery of contraceptives to women and providing information on contraceptive use (Loomis 1976:56). Under the present two-year plan, the government has set a target of reducing the birth rate from 40 to 37 per thousand (World Bank 1979:24).

Another step was the creation in 1976 of a National Population Council headed by the vice-president of the country, to develop a coherent population control program for the country (Loomis 1976:56).

In 1977, 41% of the women of Bangladesh were in the reproductive age group; of these an estimated 9% were using contraceptives (World Bank. WDR 1979: 160).

## 2.0 RESOURCES OF BANGLADESH

### 2.1 TOPOGRAPHY AND GEOGRAPHY

Geographically Bangladesh can be divided into two principal areas: the low-lying rivers and alluvial plain which comprise the bulk of the country and the much smaller area of Chittagong and the Chittagong Hill Tracts to the southeast. On the whole, the rivers, to be considered in more detail below, form the most significant feature of the landscape of Bangladesh and play a dominant role in both the economic and social life of the country.

#### The Bangladesh Plain

The Bangladesh Plain, also called the Lower Gangetic Plain, lies between the Indian foothills of the Himalayas to the north and the Bay of Bengal to the south. This area, dominated by rivers, is sometimes considered deltaic in its entire extent, although the true delta area is smaller. The Bangladesh Plain is characteristically flat; with the exception of some altitudes of up to 107 meters in its northern extents and higher elevations along the eastern border with the Indian states of Meghalaya and Tripura, there are few elevations of higher than 9 meters above sea level. The elevation generally decreases from north to south; south of the line of confluence of the Padma and Meghna Rivers, in the true delta area, the plain is predominantly at sea level. In its lower reaches, particularly in the districts of Khulna and Patuakhali, this area is comprised of many islands formed by the network of rivers.

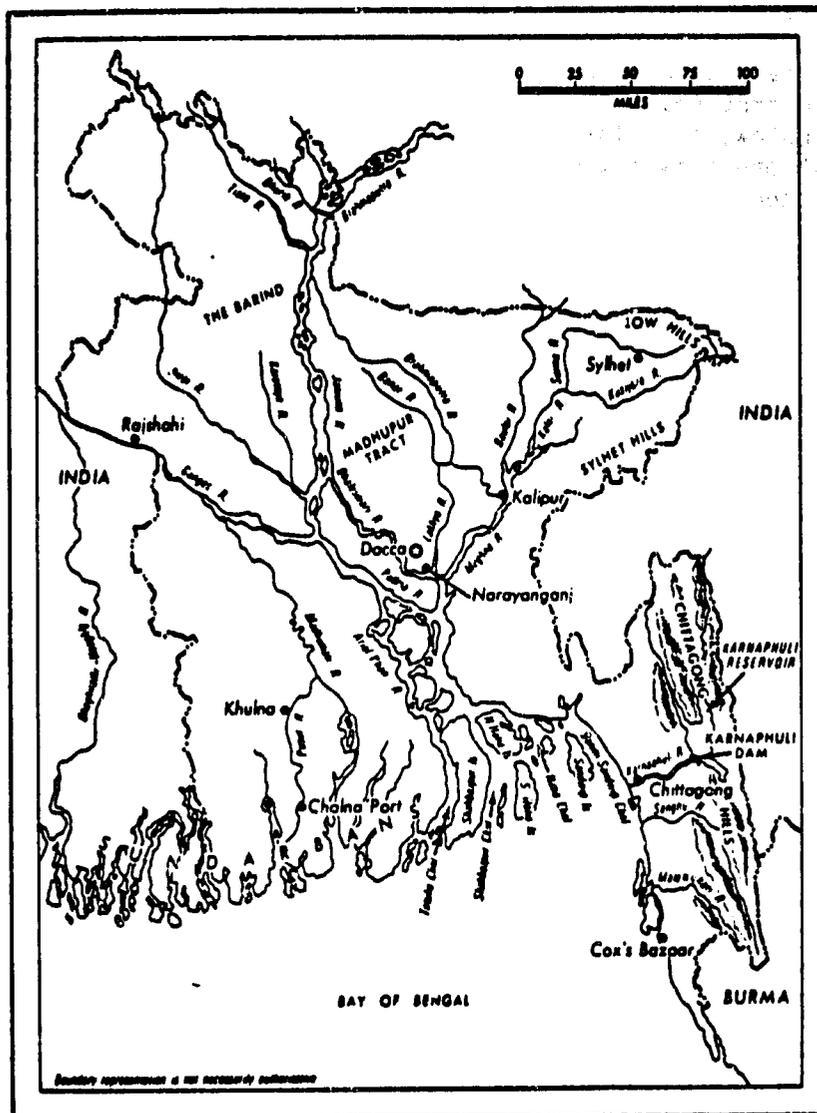
The land characteristics of the Bangladesh Plain, moving from north to south, have been concisely described as "old mud, new mud, and marsh" (Nyrop 1975:58-59). The Plain is also sometimes classified into two areas: old alluvium and new alluvium. The new alluvium, which occupies about three times the area of the old alluvium, is lower in elevation and, because it receives deposits of fertile soils carried by the rivers, is economically more productive. The old alluvium, limited almost entirely to two large areas, the Barind tract of the northwest and the Madhupur Tract just north of Dacca, consists of older alluvial deposits and is generally higher in elevation and less fertile than the new alluvium (Ahmad 1976:6-12). The extreme southern reaches of the plain, extending from the Indian Border eastward to the Padma-Meghna estuary consist of a forested, tidal-washed salt marsh region known as the Sundarbans. Most of the area is too low and swampy to be habitable, and the Khulna and Patuakhali Districts, in which the Sundarbans lie, are, in fact, the least densely populated in the Bangladesh Plain (Nyrop 1975:60-61).

#### The Hills

Constituting about one-sixth of the country, the districts of Chittagong, Ramgarh, Rangamata, and Bandarban in the southeast contain the only significant hill system in Bangladesh.

The Chittagong Hills are a series of narrow, roughly parallel, forested hill chains, which rise steeply to narrow ridge lines, generally no wider than 37 meters and ranging in height from 600 to 900 meters above sea

**Principal Regions, Rivers, and Hills of Bangladesh**  
 (Source: Nyrop 1975:59)



level. The highest point in the chain is Keokradong (1,229.6 meters) near the Burmese border in the southeast extremity of the area.

West of the Chittagong Hill Tracts lies a broad plain cut by rivers draining to the Bay of Bengal. This plain rises to a chain of low coastal hills, most of which are lower than 210 meters. These coastal hills are fronted by a narrow wet coastal plain except in the area to the south of Cox's Bazaar, where they rise directly from the sea in precipitous cliffs.

## 2.2 CLIMATE AND RAINFALL

### 2.2.1 Climatic conditions

The climate of Bangladesh, usually described as tropical monsoon, is characterized by high temperatures for about eight months of the year, by high humidity and heavy summer rainfalls; and by small temperature ranges. Three seasons are usually recognized: a hot humid summer season running from March through June; an equally humid but somewhat cooler monsoon season running from June through September or early October; and a winter season running from October through March (Nyrop 1975:65).

Maximum temperatures in the summer months are between 32.7 and 35.5 degrees centigrade, with temperatures occasionally exceeding 37.7 degree during April and May, the hottest months; temperatures during the summer are seldom lower than 21.1 degrees centigrade anywhere in the plains area, and the daily temperature range is almost nowhere more than 12 degrees centigrade.

The winter months are characterized by minimum temperatures seldom falling below 10 degrees centigrade and then only in certain areas such as the Chittagong Hill Tracts, south Sylhet, and north Bengal. Even in these areas, however, maximum temperatures generally exceed 23.9 degrees centigrade. The daily temperature range in winter is usually no more than 18 degrees centigrade.

Humidity is high throughout the country for most of the year. Even during the cooler winter months the humidity range is from 75% to 80%. The most humid regions are the lower delta in Khulna and the Chittagong Coast.

#### Temperature at selected locations in Bangladesh (Nyrop 1975:67)

	Dacca- Narayanganj	Chittagong	Jessore	Mymensingh	Dinaipur
Elevation (meters above sea level)	6.1-7.9	26.5	7.9	18.9	39.9
Hottest month	April	May	April	April	April
Minimum	23.3	24.1	23.1	21.7	21.1
Maximum	33.5	31.6	35.8	32.8	34.6
Coollest month (January)					
Minimum	13.1	13.3	9.6	12.0	9.9
Maximum	25.5	25.8	25.8	24.5	24.1
Annual mean					
Minimum	21.4	20.7	19.9	20.5	19.6
Maximum	30.3	29.5	30.9	29.6	30.1

### climatic regions

Bangladesh has sometimes been classified into three climatic regions: the tropical wet region of the southern and southeastern parts, where humidity is high, summers are long and hot, and winters are dry and mild; the sub-tropical wet region of the northern and north-eastern parts, characterized by high humidity and heavy to very heavy rainfall, but generally hotter summers and cooler winters than the tropical wet region; and the sub-tropical moderately wet region of the central and western parts of the country, featuring high humidity and moderately heavy rainfall, but hotter winters and cooler summers than in the other two regions (Ahmad 1972:43-44).

### rainfall (see map: page 15)

Rainfall throughout Bangladesh is generally heavy but varies from about 50 inches (1,270 mm) in the west to over 100 inches (2,540 mm) in the southeastern and northern parts. The heaviest rainfall is in the Sylhet district of northeastern Bangladesh (200 to 250 inches--5,080 to 6,350 mm), where the monsoon winds strike the Assam hills; Lalakhal in this district with 255.76 inches (6,496.3 mm) of rain per year records the highest rainfall levels. The lowest rainfall is at Laipur in Rajshahi District to the west--47.9 inches (1,216.7 mm) (Ahmad 1972:40).

About two-third of the rainfall received in Bangladesh comes during the period of the southwest monsoon. The winds that bring these rains travel up the Bay of Bengal, striking most of Bangladesh--with the exception of the Chittagong coast--from the south and then swing northwest as they penetrate further into the country.

The two months immediately preceding the monsoon season are characterized by thunderstorms (called nor'-westers/kal-balsakhi in Bengali); because these storms bring an appreciable amount of rain during what is otherwise a dry period, the months of April and May are sometime known as the minor rainy season (Ahmad 1972:41). These storms, frequently accompanied by violent winds that damage both property and crops, occur mainly in the central, western, and northeastern regions of the country and leave the northwest and far southeast virtually untouched.

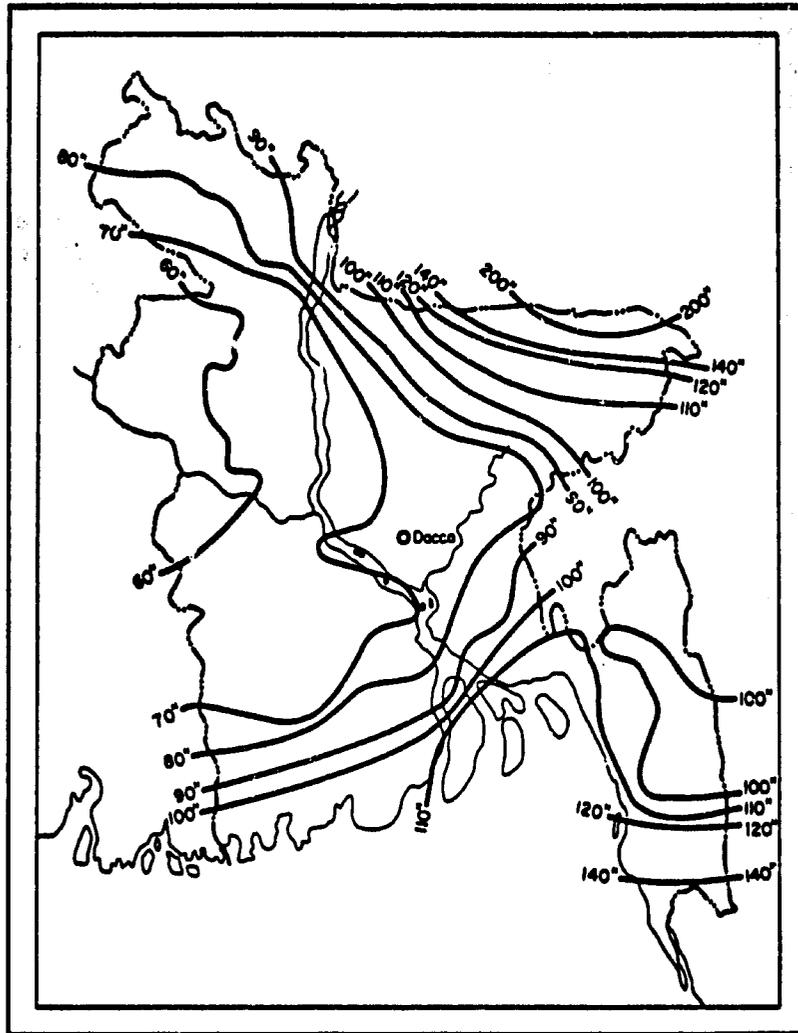
### rains and crops

The major crops of Bangladesh are grown during the monsoon season and depend on rainfall. Perennial irrigation to enable crop planting during the rest of the year is only of recent origin.

Variations in mean annual rainfall from year to year are only moderate, so that there is a high degree of reliability in mean annual amount. Important factors in causing variations in amounts of rainfall received are the nor'westers and the cyclones, which will hit different areas from year to year. Failure of the monsoon may also occur, as in 1972 (Nyrop 1975:66).

For crop production the time of rainfall is of paramount importance,

Distribution of rainfall in Bangladesh [In Inches]  
(from Nyrop 1975:69).



since late arrival of the monsoon or of the storms of the nor'westers will affect crop germination, and an early cessation of the monsoon can affect the size of the harvest. In low-lying Bangladesh too much rainfall is more often a problem than too little, since excessive rains bring flooding that can badly damage or destroy crops. The heavy rains brought by the nor'westers frequently result in damage to rice paddies sown with the early rains in April and May and to jute fields as well (Ahmad 1976:21).

### winds and cyclones

Winds exercise an important influence on the weather of Bangladesh. The rain-bearing monsoon winds have already been considered above, as have the violent thunderstorms or nor-westers. The central flatter areas of the country are also sometimes struck by tornados; although of less frequent occurrence than the nor'westers, the tornados are far more destructive.

The most widely destructive of the storm systems in Bangladesh are the cyclones, which are most often associated with the retreating monsoon winds in September and October, although they may also occur into November and December or in the pre-monsoon season in April or May. Striking from the Bay of Bengal, they are most destructive in the south of the country. Cyclones bring not only winds of over 160 kilometers per hour but also torrential rains, and they are frequently followed by tidal waves which may be as destructive as the cyclones themselves.

Cyclones of extreme destructiveness are wide-scale disasters affecting the whole country. The worst cyclone of modern times occurred on November 12, 1970 and was followed by a high tidal flood the next day. Bringing winds of up to 240 kilometers per hour, the cyclone caused the greatest damage in the coastal region, but its effects extended to the whole country; although the official death toll for the cyclone was placed at 199,090 the actual number of lives lost may have been as high as 595,000. Eight other severe cyclones occurred during the period 1960 to 1970. On October 10, 1960, a heavy cyclone struck the coastal areas of Barisal, Noakhali, and Chittagong, only to be followed three weeks later by a second disastrous cyclone which hit Chittagong and the Noakhali Islands, virtually destroying the port town of Chittagong. A cyclone in May 1965 brought heavy damage to the capital city of Dacca and resulted in the loss of about 20,000 lives. Several severe cyclones have occurred since (Nyrop 1975:66; Ahmad 1976:19; Drews 1972a).

## 2.3 WATER RESOURCES

Water resources and their development constitute a major problem in Bangladesh. Bangladesh suffers generally from a problem of too much water during certain seasons of the year and too little during other periods. During the rainy monsoon season, the rivers of Bangladesh rise to flood the land, while during the drier seasons river flows are drastically reduced. Water shortages during the dry season are felt most severely in the northeastern portion of the country and in the lower delta areas. Furthermore, the coastal regions of the country, particularly the Sunderbans, are regularly inundated by the sea; these areas consequently have groundwater with salinity levels of 1200 parts per million in dry season (Drews 1972a).

An assessment of the water situation in Bangladesh in the early 1970's concluded that water resources were sufficient to meet the country's needs but that the supply would soon become inadequate because of planned river diversions and increased use of water both for irrigation and industrial purposes. The assessment foresaw water quality problems arising from higher bacterial counts and increased alkalinity intrusion in the lower delta, as well as from increasing use of pesticides and fertilizers (Hussain and Arbuthnot 1973:87).

### 2.3.1 Surface waters

#### 2.3.1.1 Rivers of Bangladesh (see map, page 12)

Rivers, as mentioned above, are a dominant feature of the landscape of Bangladesh, the greater part of the country being the delta of three large rivers: the Padma, the Jamuna, and the Meghna, all of which discharge into the Bay of Bengal.

All of the major rivers of Bangladesh have their origin outside of the country itself. The drainage area of the three major rivers is some 600,000 square miles, but only 7.5% of this area lies within Bangladesh. (Abbas 1973:64)

The Ganges and the Brahmaputra each has an annual peak discharge of from two to three million cusecs. The Meghna discharges may be as high as half a million cusecs. In contrast to these flood flows, dry season discharges are quite low; the Ganges during the dry season carries between 50,000 to 70,000 cusecs\* near the India-Bangladesh border, while the discharge in the Meghna may drop as low as 3,000 cusecs. Dry season flow of the Brahmaputra is considerably higher, however: 125,000 to 200,000 cusecs at the India-Bangladesh border. The rivers reach their peak flow usually in August and then begin to decline, water level falling rapidly by the end of the monsoon season in October (Husain and Arbuthnot 1973:88).

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\*cusec=cubic foot per second; 1 cusec=0.28 cubic meters

### The Ganges-Padma

The Ganges enters Bangladesh from India in the northwest of the country, after which point it is known as the Padma. Flowing southward from the main flow of this river are hundreds of rivers and streams; chief among these distributaries of the Padma are the Madhumati River and the Arial Khan. The network formed by these rivers creates a delta composed of many different channels, sometimes called the "many mouths of the Ganges." The Bhagirathi-Hoogly River, which turns south just before the Ganges reaches the Bangladesh border was once the main channel of the Ganges-Padma, but since the late 18th century the channel has shifted eastward, so that the present major outflow is east of the Madhumati River in Bangladesh. In its eastward move the river has left an area of dead or dyne rivers running from the Indian border to the Madhumati River.

### The Brahmaputra-Jamuna

The Brahmaputra originates in southern Tibet, flows across India and enters Bangladesh in northern Bangladesh, where, after being joined by the waters of the Dharla and Tista Rivers, it becomes known as the Jamuna. A wide river, flowing southward in often-shifting channels, the Jamuna joins the Padma about 72 kilometers east of Dacca. Like the Padma, the channel of the Brahmaputra-Jamuna has also shifted since the 18th century; the [Old] Brahmaputra, which once carried the main flow, is now a distributary of the Jamuna flowing southeastward to join the Meghna River system.

### The Meghna

The Meghna, formed by juncture of the Kalni River and some small tributaries to the northeast of Kalipur, is the major river system in the northeast of the country. As is clear from the map on page 12, there are inter-connections between the Meghna and the Jamuna River systems by way of the [Old] Brahmaputra River and the Dhaleswar River. The Meghna experiences tidal currents which may be felt as far up the river as Kalipur and are noticeable for as much as thirty to forty miles further upriver.

### The Meghna-Padma Estuary

All of the major river systems meet south of Dacca and spread out into the Bay of Bengal through a large triangular estuary, which includes many permanent islands and many temporary islands, some of which, known as chars, are formed by silt and may either remain or erode. The rivers of Bangladesh carry huge loads of silt which are deposited to form sandy flat islands known as chars, some of which may become permanent (Ahmad 1976:11).

### Rivers of the southeast

The major river in the Chittagong Hill Tracts is the Karnafull, with a drainage area of about 20,000 square kilometers). The minimum discharge

of this river is 6,000 cusecs. The Karnafull has been dammed to form the only major reservoir in Bangladesh (the Kaptai Reservoir), which which serves as the basis for the only major hydroelectric power production in the country (Hussain and Arbuthnot 1973:88-89).

### 2.3.2 Groundwater (see map, page 20)

The groundwater table over most of the country is within about 30 feet below the ground, depending on the location and the time of the year. Better aquifers are found at about 300 feet in depth (Abbas 1973:64-65). The maximum water table depth in the delta area usually occurs in May, while the highest levels are found at the end of the monsoon season in September or October.

### 2.3.3 Utilization of water

#### Irrigation

Irrigation is one of the major water uses in Bangladesh. It is generally agreed that because most of the potential agricultural land in Bangladesh is already under cultivation irrigation offers the chief possibility for agricultural growth and the attainment of the goal of foodgrain self-sufficiency by allowing increased cropping intensity and ensuring higher yields.

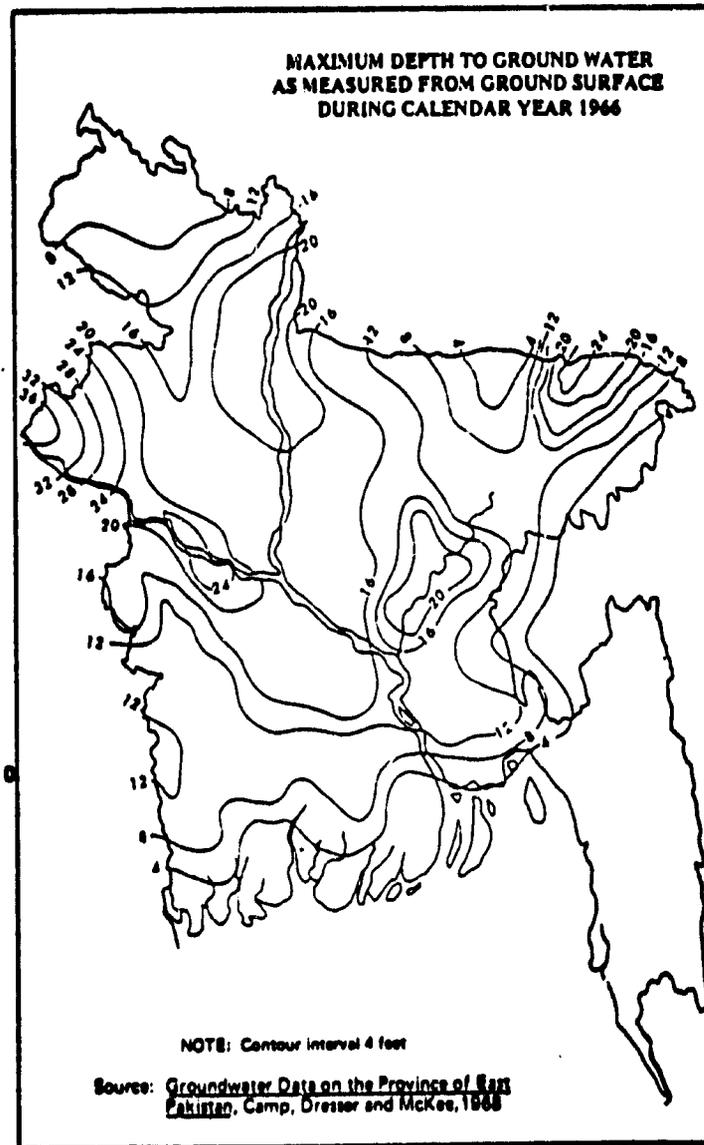
Growth in irrigated agriculture has, however, been slow. According to Bangladesh government statistics, only 9.8% of the total cropped area was irrigated as of 1976-77 (MSBOB:March 1978:33). About 7% of this area was irrigated by groundwater, the remainder by surface water. The Ministry of Agriculture estimates that by 1986 groundwater will account for as much as 37% of total irrigated area (World Bank 1979:30).

As of 1976-77 the breakdown for irrigation systems by percentage of total irrigated area was: gravity schemes (4.0%); low-lift pumps tapping the water of rivers and ponds (52.6%); deep tubewells (5.6%), shallow tubewells (0.3%); handpumps (0.7%); and traditional methods such as doons (conical buckets used to lift water from ponds, etc.), swing baskets (36.8%) (World Bank 1979:30-31). It has been judged that future irrigation strategies will have to lay increased emphasis on groundwater. Shallow tubewells appear to be the most cost efficient method of using groundwater, and several assessments of the situation have urged their increased use (World Bank 1979:32).

#### domestic water

Domestic water supplies in the some 30 cities which have piped water systems is derived mostly from wells. The two largest municipal systems together used an estimated 60 million Imperial gallons (275,000 m<sup>3</sup>/s) in 1973, more than all other systems combined. Most of the population obtains its domestic water from hand-pumped tubewells or from surface ponds or tanks or from rivers. Per capita use per day is estimated at only a few gallons (Hussain and Arbuthnot 1973:90) (see 1.5.4. for more detail on domestic water use).

**MAXIMUM GROUNDWATER DEPTH FROM GROUND SURFACE (1966)**  
(Source: Drews 1972)



### Industrial water

Industrial water use is concentrated in seven areas in Bangladesh. As of 1973 it was estimated that none of these areas needed more than about 200 gpm (12.6 l/s) for industrial purposes (Husain and Arbuthnot 1973:9).

### hydroelectric power

Because of its generally flat terrain, Bangladesh offers few possibilities for hydroelectric development. The only hydropower station in the country is on the Karnaphuli River in the Chittagong Hill Tracts, about thirty miles inland from Chittagong in the southeastern section of the country. This hydroelectric installation has a capacity of 80,000 kilowatts in two units with provision for another unit of 50,000 kilowatts. In recent years it has accounted from anywhere from 22 to 27 percent of electricity produced by electric utility companies (Abbas 1973:70; German Statistical Office 1977:19).

### navigation

The rivers and other waterways of Bangladesh are transport routes equal in importance to railways and highways. The major rivers serve as the chief arteries of communication, and the rivers and smaller channels form the connecting routes between cities and villages. Navigation possibilities are also being incorporated into multipurpose projects of the Water Development Board. Vessels include steamers for and barges for freight and passengers, and innumerable sail and handpowered craft serving villages. (Abbas 1973:69-70).

## 2.3.4 Major water problems

### flood and flood control (see map page 22)

Flooding regularly affects some 15 million acres in Bangladesh yearly, causing damages to crops and property estimated at Taka 650 million per year\*. About 14 million of the 15 million acres flooded are under cultivation. Flood protection in these areas is necessary if agricultural production is to increase (World Bank 1979:29).

Because of the danger of floods, government programs dealing with water in Bangladesh have traditionally concentrated on confronting the flood problem which faces so much of the country. Most of the efforts of the Bangladesh Water Development Board have been directed at flood control, other concerns such as irrigation being introduced only at a later stage (World Bank 1979:30).

Flood control possibilities are many but some options such as storage and diversion of water are difficult in Bangladesh because of the dearth of significant storage sites. A dam has been constructed on the Tista River in Rangpur in the north, however, and there have been studies directed at diverting the water from the Jamuna into the Old Brahmaputra for flood control, irrigation, and power production



(Nyrop 1975:77). Catchment conservancy to reduce runoff through afforestation and soil conservation cannot be undertaken on a large scale in Bangladesh because most problem areas do not lie within its borders but rather in the Himalayan regions of other countries. Dredging is nearly impossible in Bangladesh because such operations would be quickly thwarted by the heavy silt loads carried by the rivers: up to 800 million tons annually in the Ganges and up to 1.6 billion tons annually in the Brahmaputra.

The construction of embankments has, therefore, been taken to be the most practical method of flood protection for the country, since a well-managed system of embankments, functioning with sluices and regulators, interior drainage channels and major pumping plants, can exclude exterior flood waters. Such a system of embankments has been constructed for a 135-mile stretch along the western bank of the Jamuna River to provide protection for an area of 579,000 acres in the Rangpur, Bogra, and Pabna districts. One result has been higher rice yields (Abbas 1973: 66-67).

### water salinity

#### surface water

Salinity of both surface and groundwater is a problem in Bangladesh. In the dry season, ocean salinity is carried up the river channels by the tides. Salinity penetrates much further inland in the western than in the central or eastern sections of the delta, where dry season river flows are greater. At Mongla, 80 kilometers inland, the chloride content has been found to be as high as 6,000 mg/l a month before the coming of the monsoon rains, while in the central and eastern sectors, chloride content is only 32 kilometers inland is lower, even in the dry season (Hussain and Arbuthnot 1973:90).

Control projects have been designed to prevent the intrusion of saline waters into portions of the coastal saline lands occupying some 6,000 square miles (16,540 square kilometers) along the Bay of Bengal. Here land has been reclaimed for rice cultivation by the construction of embankments which protect lands from flooding by saline tidal waters. The Coastal Embankment Project calls for about 2,500 miles of earthen embankments with automatic flap gates for draining out accumulated rainwater from the reclaimed area during periods of ebb tide. As of 1973, about 2,000 miles of embankments had been constructed and about 1.6 million acres of agricultural land had been reclaimed. The line of these embankments (see map on page 22) runs behind the area of the Sundarbans in Khulna District, but in Patuakhali District embankments are actually built up to the edges of the sea around islands such as Bohia Island in Patuakhali District. Embankments have been built at a standard height from 12 to 14 feet in all areas; however, there are strong indications that greater heights are needed on the eastern-facing embankments, which must withstand higher water during cyclones than western-facing embankments. During the severe cyclone of November 1970, for example, breaches occurred in the embankments on the eastern side of Bohia Island, while the embankments on the western side remained intact (Abbas 1973: 69; Drews 1972a:69).

### groundwater salinity

In the lower delta area, particularly in the southwest, salt water intrusion prevents the use of groundwater for both domestic and agricultural use. The limit of salinity incursion into groundwater is indicated on the map on page 25. However, it is reported that non-saline groundwater sufficient to supply numerous wells has been found at depths of from 240 to 3400 meters under small low islands off the southeast coast (Husain and Arbuthnot 1973:90).

### hardness of groundwater

Groundwater hardness has been found to be greater near the Ganges and its tributaries than in the rest of the delta area. Iron content is often quite high, sometimes running about 50 mg/l (Husain and Arbuthnot 1973:90).

### sediment loads

Because of low-lying topography Bangladesh has no storage sites which could assist in flood or low-flow regulation of its major rivers. The great sediment load of the combined rivers of Bangladesh is about 2.4 billion tons annually--greater than any other river system in the world (Abbas 1973:64).

### degradation of water resources: water pollution

The major water quality problem at present is the quality of the drinking water, which is generally high in bacteriological content because of contamination by human wastes (see 1.5.4).

Water quality problems are also created because of the use of fertilizers and pesticides in agriculture. The Fisheries Directorate has reported, for example, that increasing applications of fertilizers are affecting fish spawning in rice fields and that pesticides are killing the plankton on which freshwater fish feed (WER June 18, 1979:10).

The still small industrial sector of the Bangladesh economy creates water quality problems by the practice of dumping toxic wastes into rivers or burying them in the ground (WER, June 18, 1979:10). Water quality problems from industrial wastes have affected most seriously the Karnafull River in Chittagong, which cannot be used as a source of water for the city of Chittagong because of effluents from industrial operations such as a petroleum refinery. Textiles and chemical plants in the area of Dacca have affected the quality of surface waters particularly when wastes are discharged into streams with low flows during the dry season. Tests for biochemical oxygen demand (BOD5) run on samples collected from most of the largest rivers found the highest BOD value (6.1 mg/l) in the Sitalakhya River in the city of Narayanganj (near Dacca) in December, the low flow period for that river (Husain and Arbuthnot 1973:90).



### 2.3.5 Government policy and water projects

The chief goals of Bangladesh government policy as regards water control is to increase crop production through flood protection, irrigation, and drainage, although other related objectives have included navigation, conservation and improvement of fisheries, hydroelectric power production and reclamation of land in the coastal regions.

The Bangladesh government has prepared a master plan for water development. This plan, which covers roughly a twenty-five year period, designates individual projects, suitable for development in stages, that are aimed at providing multipurpose development through the the construction of embankments in suitable areas (Abbas 1973:7).

As mentioned above, major water-related projects have involved, above all, protection of agricultural lands through flood control installations, with irrigation as a secondary benefit; the construction of embankments has received particular emphasis (see 2.3.4). Because water supplies are low during dry season shallow ponds or "tanks" have been created to store water to be used for domestic water. Moreover, there are throughout the country clusters of tube wells and thousands of low-lift pumps used for local irrigation (see 2.3.3 above). In the southeastern portion of the country the hilly terrain provide more opportunities for the storage of stream discharge for use during the dry season; the damming of the Karnaphuli River about twenty-five miles from Chittagong in southeastern Bangladesh has created an enormous reservoir principally for the generation of hydroelectric power.

Other important water projects have been:

1) Ganges-Kobadak Project

The first major water project, this project consists of a gravity canal and flood control irrigation system to cover 2.6 million acres in Kushtia, Khulna, and Jessore districts.

2) The Dacca-Demra-Project

Completed in 1968, this project is an irrigation and flood control system which uses pumps to evacuate or furnish water as needed.

3) The Tista Barrage

Completed in 1968, this dam in northern Rangpur, serves 1.9 million acres with both irrigation and flood control.

Government water projects suffered a serious setback because of the disastrous cyclone of November 1970 and the war of independence in late 1971 (Nyrop 1975:76-77). These projects have relied heavily on outside assistance. Recent plans calling for the investment of \$28 million for a drainage and flood control project to improve some 278,000 acres and benefit some 865,000 rural people, for example, rely on a credit of \$19 million from the International Development Association, a World Bank affiliate (WER January 15, 1980:4).

### 2.3.6 International aspects of water resources management

Nearly all of the rivers of Bangladesh originate from without the country. In fact, with the exception of the Meghna, all major rivers derive only a small portion of their flow from run-off within Bangladesh itself. Therefore, questions of water control for Bangladesh are often international in dimension. Upstream water development in India, for example, may have serious consequences for Bangladesh. Upstream storage of water in rainy season can decrease downstream flood peaks while upstream irrigation withdrawals in dry seasons make downstream low flows even lower. The water development plans of Bangladesh are, therefore, contingent on India's use of important rivers such as the Ganges. Furthermore, Bangladesh is also concerned about the level of pollution in the rivers entering its territory from India (Abbas 1977:72; WER October 24, 1977:4).

The major dispute between Indian and Bangladesh regarding the use of the waters of the Ganges arose with regard to the Farakka Barrage, a dam constructed by India on the Ganges just short of the Bangladesh border. Designed primarily to divert water into the dying Hooghly River system, so as to provide water to flush the port of Calcutta, the Farakka Barrage, commissioned in 1974, had adverse effects on agriculture, irrigation, fisheries, forest, navigation, and industry in Bangladesh, as well as on health and the ecology of the country. More specifically, withdrawals were so great that roughly 8,420 square miles of land were affected by salinity at 500 micromhos, 5,760 at 2,000 micromhos, and 4,850 at 5,000 micromhos; the index of salinity in the Bhairab River, for example, went up to 13,600 micromhos per centimeter in April 1976, compared to the previous average of 500. After strong protest by Bangladesh, an agreement between the two countries was reached in late 1977. The agreement provides that water is to be shared if flows should fall below an agreed level during dry periods of the year and further stipulates that India is not to withdraw more than 200 cusecs of water between the dam and the point where both banks of the river converge in Bangladesh. (WER December 5, 1977:5).

The chief body for cooperation between Bangladesh and India in matters regarding use of their joint rivers has been the Indo-Bangladesh Joint Rivers Commission. Set up in the early 1970's, the Commission, under the 1977 agreement regarding the Farakka Barrage, was authorized to conduct studies relating to the augmentation of the dry season flow of the Ganges. Other cooperative efforts undertaken by the commission have included: an integrated flood forecasting and flood and cyclone warning system and the investigation of medium and small projects which could render benefits to large numbers of people in both countries (Abbas 1973:73).

### 2.3.7 Water monitoring

By one recent account there are some 10 inland freshwater pollution monitoring centers, and some 20 sampling centers in the country. It has been proposed that three centers for marine pollution control also be established (Dutch Bilateral...1980:4). Regular monitoring stations locations include those at the Karnaphuli Paper Mills complex in Chittagong, on the Halda River near the Chittagong Water and Sewerage Authority Intake, on the Buriganga River near the Chandighat waterworks Intake (in Dacca) (WER October 24, 1977:4).

It was reported in 1977 that the government of Bangladesh was conducting a survey of the types and numbers of industries and sewage treatment plants discharging waste into rivers as well as chemical analysis of the concentration and types of herbicides and insecticides carried by each river (WER October 24, 1977:4).

Also in this connection, the Water Pollution Control Board has reportedly fixed water quality standards for drinking, aquatic, and recreation waters in Bangladesh (WER October 24, 1977:4).

## 2.4 SOILS

A soil map was compiled in 1970 on the basis of the findings of the Soil Survey Project, Pakistan, which started in 1961 with the objective of providing a semi-detailed soil survey of the agricultural areas of East and West Pakistan. Because a major part of the area of the country was not surveyed during the project, the map is judged to have limited reliability (FAO-UNESCO 1977:9). It is the basis of the Bangladesh part of the FAO-UNESCO Soil Map of the World. General reference is to: 1971. Soil resources of Bangladesh. Rome. Technical Report No. 3. Soil Survey Project, Pakistan.

### 2.4.1 Soil types

The soil information presented below is derived from the FAO/UNESCO Soil Map of the World, volume VII. The information is also presented on the map on the next page. Six dominant soil types are seen to occur in Bangladesh: Gleysols, Cambisols, Fluvisols, Nitosols, Histosols, and Vertisols. These are presented below in the order of their extent of occurrence in Bangladesh, the most prevalent group, Gleysols, coming first. Subgroups of these classes such as, for example, Eutric gleysols (Ge), usually occur in association with other soil types. The number immediately following the letter designation (e.g. Ge<sub>2-1/2a</sub>) summarizes these associations. In the list below these groupings are also shown under ass and inc: those soils listed as associates (ass.), are those which share more than 20% of the area of the dominant group; those listed as included (inc.) occupy less than 20%. Symbols for texture (1,2,3), which immediately follow the class designation, are explained in the key to the map, as are symbols for slope (a, b, c), which follow the texture number.

#### 2.4.1.1 GLEYSOLS [G]: 7,492,000 hectares: 67.47% of total territory

All of the groups of the gleysols share the problem of poor drainage which restricts land use and potential.

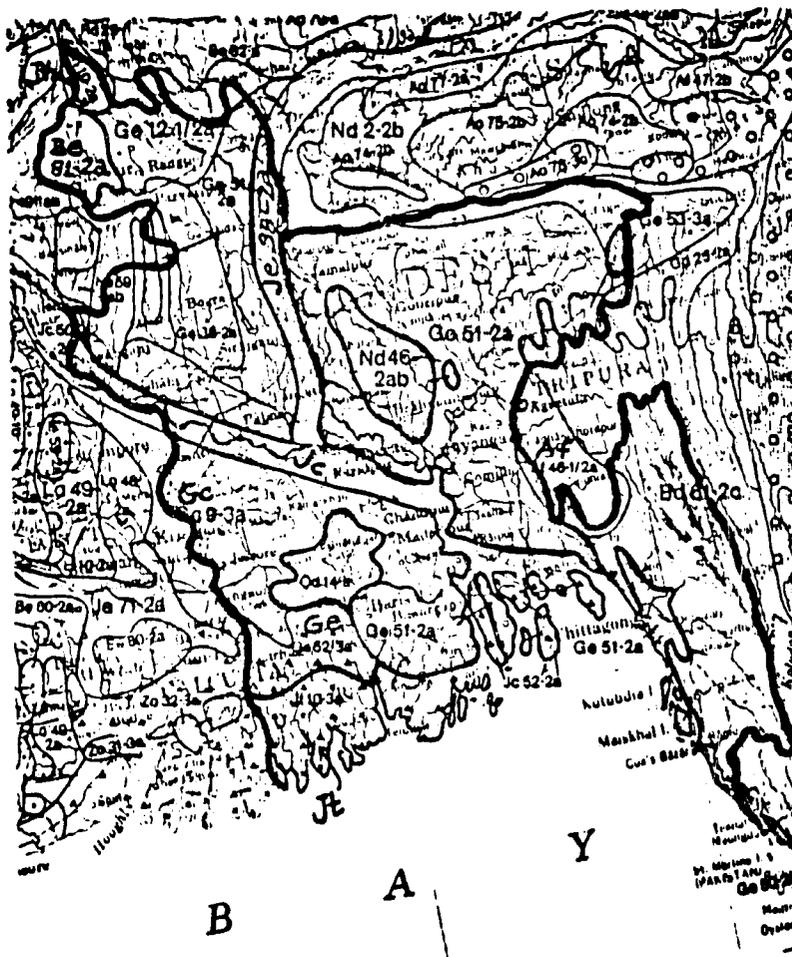
Eutric Gleysols: 7,492,000 hectares: 52.5% of total territory  
Map symbol: Ge

Also designated as: Typic haplaquept

These soils are widely developed on piedmont and low terrace soils in Bangladesh, where they are used for cultivation of rice and some other crops or mesta (kenaf). Trees are rare, except around living areas, and other crops are rarely grown. In the more humid eastern and central parts of Bangladesh, the soils are double-cropped; an early broadcast crop (aus) is followed by a late transplanted rice crop (aman). In the drier Barind tract, the extent of the broadcast crop is smaller and depends on the quantity of pre-monsoon rainfall.

Problems: drainage problems make dryland agriculture almost impossible; natural fertility is low; fertilizer necessary to sustain yields.

SOIL MAP OF BANGLADESH  
(from FAO/UNESCO 1977)



Symbols used

Af Ferric acrisols

Bd Dystric cambisols

Be Eutric cambisols

Bh Humic cambisols

Gc Calcariic gleysols

Ge Eutric gleysols

Jc Calcariic fluvisols

Je Eutric fluvisols

Jt Thionic fluvisols

Nd Dystric nitisols

Od Dystric histosols

Other symbols used: terrain: a level to gently rolling  
 b rolling to hilly  
 c strongly dissected-mountainous

texture: 1 coarse  
 2 medium  
 3 fine

Suitability: with irrigation, two crops per year of rice can be grown.

Groupings as shown on map:

Ge51-2a 5,025,000 ha.; 35.21% of total  
Inc:Je Jc Be Gh(Humic Gleysols)  
climate: cool winter hot tropical; humid semihot tropical

Ge38-2a 923,000 hectares; 6.47% of total  
Inc: Ne Af Je  
climate: cool winter hot tropical

Ge52-3a 786,000 ha.; 5.5% of total  
Inc:Gc Jc Jt  
phase: saline  
climate: cool winter hot tropical; humid semihot tropical

Ge12-1/2a 467,000 ha.; 3.28% of total territory  
ass: Be  
climate: cool winter hot tropical

Ge53-3a 287,000 ha.; 2.01% of total  
Inc:Gd Od  
climate: cool winter hot tropical

Ge50-2/3a 4,000 ha; 0.03% of total  
ass: Je  
Inc: Jt Oe(Eutric Histosols),We(Eutric Plansols)  
climate: humid semihot tropical

Calcaric Gleysols Gc: 2,136,000 hectares; 14.97% of total territory  
Map symbol: Gc

Groupings as shown on map:

Gc9-3a  
ass: Bg  
Inc.: Jc Od  
climate: cool winter hot tropical

2.4.1.2. CAMBISOLS [B] 2,218,000 hectares; 15.54% of total territory

These occur predominantly in hilly regions where vegetation consists of tropical evergreen and deciduous forests.

Dystric Cambisols: 1,863 ha.; 13.05% of total territory  
Map symbol: Bd  
Also designated as: Brown Hill Soils

Occur in the high rainfall areas of Bangladesh. They mostly cover steep slopes and generally are used for forest or grazing, although some areas are terraced to grown irrigated rice or rainfed maize, wheat, potatoes, and fruits such as apples and pears (general). Some areas with these soils are used for tea plantations(FAO/UNESCO 1977:58).

**Problems:** subject to erosion unless properly terraced.  
 poor in plant food, especially phosphate and bases;  
 require potassium, nitrogen, lime and phosphate for good yields;

**Suitability:** forests and controlled grazing; bench terracing with intensive conservation measures; respond well to application of fertilizers.

Groupings as shown on map:

Bd61-2c

ass: Ao (Orthic Acrisols)

Inc.: Gd (Dystric Gleysols); l (Lithosols)

climate: cool winter hot tropical

**Eutric Cambisols:** 294,000 hectares; 2.06% of total territory

Map Symbol: Be

Also designated as: Noncalcareous brown floodplain soil.

In the Brahmaputra flood plain. Found on gently undulating land, these soils are moderately well drained. They are used for rice in summer and other crops in winter.

Groupings as shown on map:

Be81-2a

ass:Ge

Inc.: Bh

climate: hot semitropical; cool winter hot tropical

**Humic Cambisols:** 61,000 hectares; 0.43% of total territory

Map symbol: Bh

Also designated as: Black Terai Soil

These soils are found in the Terai plain at the foot of the Himalayas. In most areas, they are little used for agriculture and remain under forest; in northern Bangladesh, where the forest has been cleared, rice is the principal crop.

**Problems:** rather sandy; rapid permeability; requires supplemental irrigation for rice growing in years of below-average rainfall. ..

Groupings as shown on map:

Bh10-2a

climate: hot semitropical

**2.4.1.3 FLUVISOLS [J]:** 1,529,000 hectares; 10.7% of total territory

The fertile fluvisols of the Ganges Delta in Bangladesh, aided by heavy rainfall, flooding, and high temperatures, can produce two to three rice crops per year; this has been a factor in population rising to 300 per

square kilometer. On the other hand, severe summer flooding means that only rice can be grown. These soils are the most intensively cultivated and most highly productive soils of this region. Although under traditional management practices, crop yields are only moderate to low, many of these soils have maintained continuous crop production for centuries with low levels of manuring; under modern agricultural practices, they respond well to fertilizer use and can give high yields of new rice varieties wherever irrigation is practicable in the dry season. Better water control is the major input needed for increased production. (FAO-UNESCO 1977:62-63).

Calcic Fluvisols: 3.1% of total territory

Map symbol: Jc

Also designated as: Calcareous alluvium

These occur in the calcareous alluvium of the Ganges river flood plains.

Groupings as shown on map:

Jc50-2a 108,000 hectares; 0.75% of total

ass.: Gc

inc.: Ge

phase: saline

climate: cool winter hot tropical

Jc52-2a 341,000 hectares

inc.: Ge

climate: cool winter hot tropical

Eutric Fluvisols:e 542,000 hectares 3.80% of total

Map symbol: Je

Also designated as: Noncalcareous alluvium

These occur in the noncalcareous alluvium deposits of the Brahmaputra River.

Groupings as shown on map:

Je38-2a

inc. Ge

climate: cool winter hot tropical

Thionic Fluvisols: 538,000 hectares 3.77% of total

Map symbol: Jt

Occur under mangrove forest or on land cleared of such forest and are most extensive in the Sunderbans of the Ganges Delta. Where brought under cultivation with the aid of protective embankments or drainage, the soils are mainly used for one crop of transplanted rice in the monsoon season. Suitability: best left under forest; this provides not only timber and pulpwood but also helps to protect inland areas against the cyclones on the Bay of Bengal. Reclamation for agriculture is costly and can not be justifiably economically.

Groupings as shown on map:

Jt10-3a

ass: JcZg (Gleyic Solonchaks)

Inc: 0 (Histosols)

phase: sodic/saline

climate: humid semihot tropical

## 2.4.1.4 NITOSOLS [N]: 485,000 hectares; 3.40% of total

The Nitosols are used for poor crops of rice and mesta--a substitute for Jute (see FAO-UNESCO)

Dystric NitosolsMap symbol: Nd

Also designated as: Deep red-brown terrace soils

The dystric nitosols are covered by Shorea robusta forest in parts of Bangladesh, where they are well to moderately well drained (FAO UNESCO 1977:94).

Groupings as shown on map:

Nd46-2ab

ass: Ao

Inc.: G<sub>e</sub> Gh

climate: cool winter hot tropical

## 2.4.1.5 HISTOLS 355,000 hectares; 2.49% of total

These soils occupy basin sites that are subject to deep seasonal flooding and remain wet throughout the dry season. They are extensive in the Ganges Plain but also occur in pockets in other areas, particularly in the Sylhet basin in the northeast. Most remain under natural vegetation of tall reeds and grasses that may be used as materials for construction or mat making. Rice cultivation is possible only where there is a mineral topsoil to provide adequate bearing capacity (FAO-UNESCO 1977:65). They have a low development potential.

Dystric HistosolsMap symbol: Od

Also designated as: Peat

Groupings as shown on map:

Od25-a

Inc: G<sub>c</sub> Jt

climate: cool winter hot tropical

#### 2.4.1.6. ACRISOLS [A]: 57,000 ha. 0.40% of total territory

Occur near the border with the Indian state of Tripura in the east of Bangladesh. Most of these soils are under forest (FAO/UNESCO 1977:57).

##### Ferric Acrisols

Map symbol: Af

##### Groupings as shown on map:

Af46-1/2a

ass: Ap (Plinthic acrisols) G

Inc.: Jd

climate: cool winter hot tropical

#### 2.4.2 Other soils classifications

Ahmad (1976) breaks the soils of Bangladesh into several groups: the hill soils of the Chittagong Hill Tracts and other hilly areas; the saline or alkaline sandy soils of the inundated coastal regions; the sandy soils of rivers and levees; the silts deposited along the major river systems (pal mati); the clays covering depression areas in North Bengal and the Mymensingh-Sylhet marshes; the extensive loams (doash), which tend to be clayey in the south west and sandy in the north east and north west; the red soils (khia) of the old alluvium areas such as the Madhupur Tract and Lalmai, where laterisation has taken place; and the swampy soils in marshy areas, particularly in Khulna and Patuakhali (Ahmad 1976: 21-26).

#### 2.4.3 Problems with soils

Soils problems have been touched upon under the discussion of individual soil types presented above. They include drainage problems among Eutric Gleysols; erosion problems with the Dystric Cambisols of the Chittagong Hill Tracts; and severe flooding among Fluvisols.

Slash and burn agriculture has severely aggravated erosion problems in the Chittagong Hill Tracts, where soil has run off denuded hillsides, leading both to soil loss and to heavy silt loads in streams. No information was found on the effect that this siltation may have had on the Kaptai Reservoir formed by the damming of the Karnafuli River or on the hydro-electric installation associated with it.

A problem of soil use not related to agriculture is that the general alluvial nature of many of the soils of Bangladesh results in a severe shortage of gravel or coarse aggregates used in the manufacture of reinforced concrete. Often brick are manufactured and then broken into small bits for use in concrete manufacturing (Dutch Bilateral...1980:4).

## 2.5 FORESTS

### 2.5.1 Forest resource

Official forest figures for Bangladesh indicate that about 15.4 percent of the country remains under forest cover: some 2,205,210 hectares (Monthly Statistical Bulletin, March 1978:30). On the other hand, the Asian Development Bank, in a recent assessment of the forest situation in Asia, lists only 1.2 million hectares of forest area for Bangladesh, or about 8.4% of the total area of the country. (Richardson 1978:11). Recent satellite studies by the World Bank of the land use situation in Bangladesh also indicate that deforestation has progressed more rapidly than is officially recognized. In the discussion of forest types presented below--derived from the presentation of participants in a 1975 UNESCO/MAB meeting on forest ecosystems in South Asia (UNESCO/MAB 1976), about 1.4 million hectares of land--or about 10% of the total area--is accounted for.

The Asian Development Bank classifies Bangladesh as a country deficient in forest in forest resources and at a low level of industrial development. Such countries are said to be typified by severe depletion of the forest resource, erosion of water catchments (despite attempts to correct this situation), and the consequent loss of agricultural land that leads to further pressure on what remains of the forests. Furthermore, forest institutions in such countries are generally weak and the overall economic situation of the country is not favorable for long-term investments required for reforestation (Richardson 1978:11).

### 2.5.2 Forest types and areas (see map, page 37)

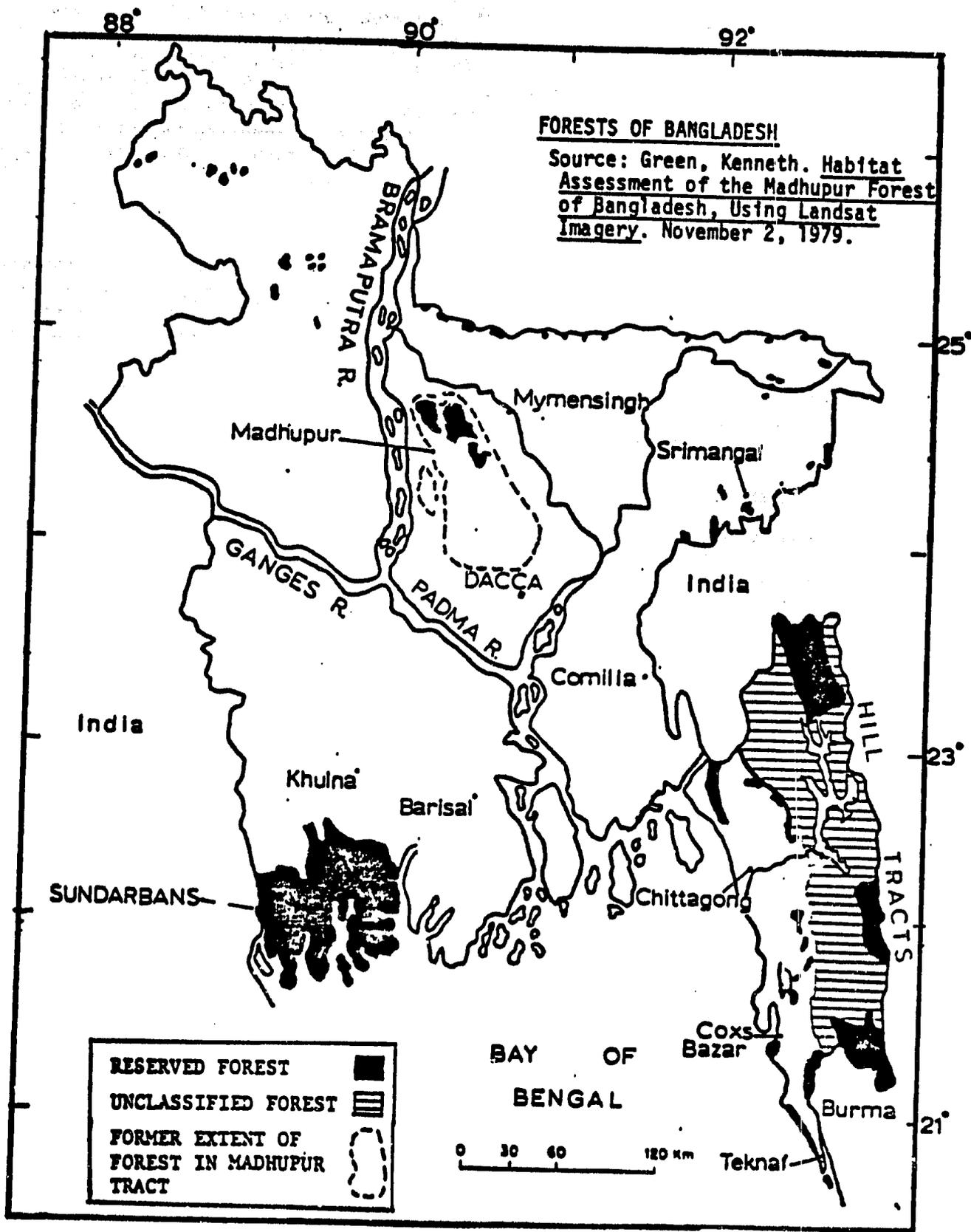
Four types of forest are present in Bangladesh: semi-evergreen forests, low-grade deciduous forest, fresh-water swamp forests, and tidal or mangrove forests. As indicated by the map on page there are, apart from scattered forest areas in Dinajpur, Rangpur, and Sylhet, only three extensively forested areas in the country: the Sundarbans, the Chittagong Hill Tracts, and an ever decreasing area just north of Dacca.

#### semi-evergreen forests

Found mostly in the Chittagong Hill Tracts of the eastern area of the country, these forests cover some 6,988 km<sup>2</sup> (4.9% of total land area). There are many evergreen and deciduous species, occurring in association with each other and with bamboo jungle. The forest is characterized by a great variability in species composition, no forest being uniform or clearly defined over a large area. These forests are subject to repeated shifting cultivation. They are also clear cut and artificially regenerated (UNESCO/MAB 1976:36). Important trees occurring in these forests are: jarul (Lagerstroemia flos-reginae), gamhar (Gmelina arborea), and garjan (Dipterocarpus turbinatus). Some forest plantations have been established in the Chittagong Hill Tracts; these have included plantings of teak (Tectona grandis), gamhar, jarul, chapalish, and mahogany (Ahmad 1976:110).

#### low-grade deciduous forests

Found mostly in the northwestern districts, these forests, covering some 1,148



square kilometers (0.81% of total land area) are a continuation of the eastern Himalayan forests. These patchy forests, consisting of blocks of less than 0.1 hectares to about 40 hectares, are dominated by Shorea robusta (sal) occurring both in pure stands and in mixtures with Aibizzia, Terminalia, and Artocarpus species. Careya arborea is the most important associate. These forests are clear-felled, followed by coppice or seedling regeneration (UNESCO/MAB 1976:36). This forest type is that found in the once extensive Madhupur Tract or Madhupur Jungle north of Dacca.

#### Fresh-water swamp forests

Occupying the basins of the north-east region of Bangladesh, these forests, dominated by Barringtonia acutangula and Trewia nudiflora, are largely submerged from June through September. One hundred hectare plots consisting of various tree species have been set aside as reserve forests. The vegetation of most of this area (about 275 km<sup>2</sup> just below the Khasi hills) is reed and grasses (Erianthus, Saccharum, and Paragmites), and the remainder is cultivated. The forests are worked but very little and when they are the trees appear pollarded (UNESCO/MAB 1976:36).

#### Mangrove or tidal forests

These forests, which cover some 5,993 km<sup>2</sup> (4.2% of total land area)--reportedly the largest block of mangrove forest in the world\*--in the tidal plains, consist of species adapted to low-lying clay soils that are often flooded during high tides. About six or seven species occur in association, important economic species being: Heritiera minor, Excoecaria agallocha, and Sonneratia apatala, with mixed stands of Heritiera and Excoecaria being the basic type. However, extensive stands of Sonneratia also occur. These forest are worked by a system of selective cutting and natural regeneration (UNESCO/MAB 1976:36).

### 2.5.3 Status of forests

All forests are state-owned, but their legal status varies. There are three basic categories:

reserve forests: Individual has no rights; all activities are under the authority of the Forest Department;

protected forests: a few activities are prohibited but all other rights such as collection of brushwood, grazing, etc., are exercised by the community;

unclassified state forests: no activity--including the lighting of fires--is prohibited; there is shifting cultivation throughout the entire area.  
(UNESCO/MAB 1976:36).

### 2.5.4 Forest utilization

As indicated by the table on page 39, firewood is the chief product of Bangladesh's limited forests, accounting for about 95% of wood produced

\*WER, January 29, 1979:3. According to this brief news item, mangrove forest occupies 12.5% of Bangladesh and "one-third of the population, directly, or indirectly depends upon it for their livelihood."

WOOD PRODUCTS (source: 1976 FAO Yearbook of Forest Products)  
(F=FAO estimates)

	p r o d u c t i o n		import values: 1976	export values: 1976
	1961-65	1976		
<b>ROUNDWOOD PRODUCTION:</b> (1,000s of cubic meters)				
TOTAL: all non-coniferous	7,796	14,776		
Firewood	7,087	14,012 F		
Industrial roundwood	709	764		
Sawlogs and veneers	509	450F		
Sawnwood&Ties	296	291	\$18,000	
Sawnwood Sleepers	296	285F 6	\$18,000	
Pulpwood&particles		64		
Other Ind. roundwood	200	250F		
<b>FINISHED WOOD PRODUCTS</b> (1000s of cubic meters)				
Wood-based panels.		1F		
Veneer sheets		30		
Plywood (1968 prod was 23, sank to 7 in 1972)		13F		
<b>PULP</b> (1000s of metric tons)				
Wood pulp (1,000 of metric tons)	25	13	\$7,278,000	
mechan. wood pulp	25	3		
semi-chem w.p.			\$4,813,000	
chemical w.p.		10	\$2,465,000F	
Unbleached sulfite p.			\$593,000F	
Unbleached sulfate p.			\$935,000	
Bleached sulfate p.			\$2,465,000	
Other fiber p.		25		
<b>PAPER</b> (1,000 of metric tons)				
paper&paperboard	65	45		\$3,226,000
newsprint	33	20		\$3,058,000
printing&writing pap.	28	20		\$168,000F
other paper and p'board	5	5F	\$80,000F	
household & sanitary pap.		7F	\$50,000F	
wrapping and packaging paper and paperboard misc.		3F		\$231,000F
<b>TOTAL IMPORT/EXPORT VALUES</b>			<b>7,322,000</b>	<b>\$3,226,000F</b>

In 1976. Firewood has been gathered not only from local areas but in particular from the Chittagong Hill Tracts, which supplies large quantities of firewood for use in urban centers, and from the Madhupur Tract near Dacca (Ahmad 1976:118). Forest production has generally remained rather low in Bangladesh.

Various trees have been exploited for timber in Bangladesh. The chief timber tree in the Sundarbans is sundari (Heritiera minor), which has been used for telegraph and electricity poles, while gengwa (Excoecuria agallocha) has been used in the boxwood and matchwood industries. Goran (Cerlops roxburghiana) from this area has been used for posts for small sheds and firewood, and dhundal (Carapa obovata) is used for the pencil industry (Ahmad 1976: 117). The forests of the Chittagong Hill Tracts yield garjan (Dipterocarpus turbinatus) for railway ties and flooring as well as chapalish (Artocarpus chaplasha) used for chests and dug-outs, gamhar (Gmelina arborea) for doors and sampans, and jarul (Lagerstroemia flos reginae) for railway ties and boats. The forests of the Chittagong Hill Tracts also produce large quantities of bamboos, which have a multiplicity of uses, including house construction, mat production, and paper production. There is also some teak production (Ahmad 1976:118). The chief commercial wood of the Madhupur Tract is sal (Shorea robusta), which is used for poles and firewood.

Forest extractions are performed in two basic forms: by small contractors, who buy lots at public auction, and by large-scale mechanical extractions operated by a semi-government corporation. Minor forest products are harvested on a permit basis and with the use of traditional indigenous methods for which there is much "scope for improvement" (UNESCO/MAB 1976:36). (The effects of varying intensities of cutting bamboos, methods of harvesting bidi leaves from Careya arborea, and of extracting exudation products from trees on their subsequent growth and yield are being investigated.) Experience has shown that the yield of industrially-utilizable timber is very low (UNESCO/MAB 1976:36).

Other forest products include beewax and wild honey from the Sundarbans, cane for manufacture of furniture, sati (a tuberous plant used for starch production), and products from wildlife.

Attempts to increase forest production are being promoted by the Bangladesh Forest Industries Development Corporation, which is working reserve forests in Kassalong and Matamuri and has plans for exporting timber from these forests (Bangladesh. Ministry of Finance...1977:123).

### 2.5.5 Forest degradation and disturbance

#### Problems

Because of its dense population, Bangladesh has very little undisturbed forest area. It has recently been judged that baseline studies using undisturbed forests are, therefore, not possible. The extent of the disturbance depends on the accessibility of the forest area, the least disturbed being the least accessible (UNESCO/MAB 1976:36).

The rate of deforestation in Bangladesh as estimated in 1976 was 0.01 million

hectares per year (Sommer 1976:19). Satellite pictures taken as part of the FAO-UNDP sponsored LANDSAT program, as well as pictures taken and analyzed by the World Bank, indicate rapid deforestation of the northern region of Bangladesh, particularly in the Madhupur Tract north of Dacca, and denudation of the vegetation in the Kaptal Lake area to the south-east (WER July 16, 1979:7). There are also deforestation problems in the mangrove swamps of the Sunderbans, where reforestation is now being attempted. Problems of encroachment on forest areas and brush cutting and grazing have been linked to certain socioeconomic factors, particularly a high degree of unemployment and underemployment (MAB/UNESCO 1976:37).

Forests lands tend to disappear as forests are converted to permanent agriculture; this problem is most severe in forests that border agricultural areas and in those which can be most easily converted to arable land. Because forest land and agriculture land have traditionally been intermingled in Bangladesh, this problem is particularly severe. Campaigns for increased food production, have inevitably resulted in the disappearance of forest lands (UNESCO/MAB 1976:37).

Problems are particularly severe on the low hill areas near areas of permanent agriculture, where the local populace, who use the forests to meet all their demands for forest produce, not only cut back brushwood but also use the area for livestock grazing. This heavy demand on the vegetation helps to keep the land bare. Grasses are usually absent, shrubs such as Eupatorium odoratum appear after the trees are removed, and in those areas most adversely affected, thorny bushes appear (UNESCO/MAB 1976:37).

Shifting cultivation is a problem in the south-eastern hilly regions, where it is widely practiced by indigenous tribes. As the numbers of these people have grown, the cycle of shifting cultivation has shortened, and land no longer lies fallow for long periods of time. This has resulted in damage to watersheds and reserve forest areas, and in many areas the over-use of the land and fire have rendered hilly slopes unsuitable for further cultivation. Furthermore, the construction of a major dam on the Karhafful River and the consequent creation of Kaptal Lake by the flooding of large areas of forest land has reduced the land available for shifting agriculture and put greater pressure on remaining forest areas.

Deforestation has resulted not only in increased erosion and damage to watersheds in areas such as the Chittagong Hill Tracts but also generally to reduction of habitat available for wildlife. Over-exploitation of the mangrove areas of the Sunderbans for fuelwood and timber have resulted in the degradation of an important barrier against cyclones and tidal waves (Dutch Bilateral...1980:5).

#### 2.5.6 Reforestation

Plantations of teak were established in Bangladesh in the Chittagong Hill Tracts during the first half of this century. By one recent account Experiments are reported to have been conducted on afforestation with quick-growing exotics such as poplar and pines and tropical fruits and trees such as cashewnut, oil palm, rawafia, and birl. Commercial rubber plantations have been established in the Chittagong Hill Tracts and there

are plans for the establishment of coffee plantations as well (Ahmad 1976: 120). There are also reports of attempts at reforestation in the mangrove areas of the Sundarbans (Dutch Bilateral...1980:5).

The government has also recognized that shifting cultivation is a problem that must be confronted, and has made attempts to encourage shifting cultivators to adopt new systems of cultivation. One attempt has involved encouraging shifting cultivators to plant trees along with their crops so that trees will already be established on the land when the cultivation cycle is completed and they move on to a new plot (Ahmad 1976:111). This system, known as taungya, is reported to have proved unsuccessful, however, because of a lack of resources and "unbalanced approaches"(UNESCO/MAB 1976:37).

### 2.5.7 Forest training, education, and research

The Bangladesh Forest College is capable of providing training for sub-sub-professional staff but lacks facilities for education and training at the professional level. Training in forest ecology is also not available, either at the College itself or at the universities (UNESCO/MAB 1978:37).

According to an assessment of the reforestation effort from the mid-1970's reforestation efforts have changed considerably in Bangladesh, especially since forest industries prefer softer and resin-free woods, which had not been studied in the past. Studies conducted at the Forest Research Institute at Chittagong have, therefore, focused on:

- seed production, processing, storage, and development of seed sources
  - nursery practice, including seed pretreatment, and the germination and growth of seedlings;
  - field planting techniques, including the nature, age, size, etc. of planting material, causes of mortality in the field, and soil conditions;
  - the growth and yield of soft-wood species;
  - macro- and micro-climate and water regimes;
  - the chemistry, physics and biology of soils in reforestation and afforestation areas;
  - the floristic composition of the forests;
  - tree improvement and establishment of seed orchards.
- (UNESCO/MAB 1976:37).

LANDSAT Imagery has been used in Bangladesh as an aid to natural resources development. The program is financed by FAO and UNDP (WER July 16, 1979:7).

Suggested topics of research related to shifting cultivation and its effects on forests and soils are:

1. evaluation of the effects of shifting cultivation on the environment, especially the soils;
2. the establishment of tree farms, including tree crops, production and supply of superior seeds and clones.

3. studies on tree farm management, with special reference to the economic size of holdings,

The Bangladesh delegation to a 1975 MAB meeting on tropical deciduous and semi-deciduous forest systems in Asia, suggested that the first priority for Bangladesh "should be given to education and other forms of assistance to shifting cultivators and others who damage the forest, often out of economic necessity. Without this assistance, all the efforts of trained workers are unlikely to result in significant improvements" (UNESCO/MAE 1976:37).

## 2.6 WILDLIFE

### 2.6.1 The Resource

Wildlife in Bangladesh is largely limited in its occurrence to the forests of the Chittagong Hill Tracts of southeast Bangladesh, to the Sunderbans of the southwest, and the Sylhet hills.

#### 2.6.1.1 mammals

##### primates

The slow loris (Nycticebus coucang) occurs principally in Sylhet, Chittagong, and the Chittagong Hill-Tracts. It has become rare in Comilla, Dacca, and Rangpur. Of monkeys occurring in Bangladesh, the Rhesus Macaque or Banar (Macaca mullata) is said to be the most common, occurring in herds in villages and on the out-skirts of towns and cities. Another familiar monkey has been the Langur or Hanuman (Presbytis entellus) --regarded as a sacred creature in Hindu mythology. Now found only in restricted areas, it has been common in villages and near small towns. Other monkeys are the capped monkey (Presbytis pileatus) of the forests of Sylhet, Chittagong, and the Chittagong Hill-Tracts and the leaf monkey, another deep forest dweller found in the same areas. Of the large primates, one species of gibbon, the hoolok (Hylobates hoolok) is found within Bangladesh--in Sylhet, Chittagong, and the Chittagong Hill-Tracts-- "in fairly good number"(Husain 1974:8).

##### carnivores

About 27 types of carnivores occur in Bangladesh, including cats, civets, mongooses, badgers, otters, bears, foxes, and jackals.

##### cats

The most prominent of the cats is the royal bengal tiger or bigh (Panthera tigris). Widely distributed in Bangladesh in the 19th century and still in large numbers in forest areas such as the Chittagong Hill Tracts at the beginning of the present century, the tiger is now almost completely confined to the swamp forests of the Sunderbans. The leopard (Panthera pardus) is reported to be still widely distributed in Bangladesh. The small cats include: the jungle cat (Felis chaus), an increasingly rare animal found in grass, reeds, and sugarcane fields; the very rare leopard cat (Felis bengalensis), a forest dweller; the equally rare clouded leopard (Neofelis nebulosa), once widely distributed in northern and northeastern parts of the country; and the marbled cat (Felis marmorata) and the golden cat (Felis temminckii), both believed to occur in Sylhet, Chittagong, and the Chittagong Hill Tracts. The most common cat is the fishing cat (Felis viverrina), found in marshy areas, river banks, and swamps (Husain 1974:8-11).

##### bears

Bears are very rare in Bangladesh. Species that have been found in Bangladesh or are believed to occur within its borders are the Asiatic or Himalayan black bear (Selenarctos thibetanus), a forest

animal occurring in Sylhet; the Malayan sun bear (Helaractos malayanus) a small bear of Chittagong and the Chittagong Hill-Tracts; and the sloth bear (Melursus ursinus) (Husain 1974:11)

#### civets and mongooses

About six members of the group of mammals that includes civets and mongooses are known in Bangladesh. These are the large civet (Viverra zibetha); the small civet (V. Indica); the common civet (Paradoxurus hermaphroditus); the small toothed civet (Arctogalida trivirgata)-- common in Sylhet; the small Indian mongoose (Herpestes auropunctatus); and the common mongoose (H. edwardsi) (Husain 1974:11-12).

#### hoofed mammals

The large hoofed mammals include the gaur (Bos gaurus), once common in herds in the forest of Sylhet and Chittagong but now virtually gone from most of its former range; the banteng (Bos banteng) of the Chittagong Hill-Tracts; the buffalo (Bubalus bubalis), now found chiefly as a domestic animal but possibly still occurring in the wild state in some areas of Mymensingh; and the serow (Capricornis sumatraensis), which may still be found in the north-eastern parts of the Chittagong Hill Tracts, which along with the forest of Sylhet once served as a habitat for large numbers of its kind (Husain 1974:12-13).

At least five species of deer occur in Bangladesh but they are now restricted to the few places which provide suitable habitats. The most common deer is the spotted deer or cheetal (Axis axis), found in the Sundarbans, Sylhet, Chittagong, and the Chittagong Hill Tracts. The barking deer (Muntiacus muntjak) is also found in substantial numbers in Sylhet and the Chittagong Hill Tracts, the hog deer (Axis porcinus) in Sylhet, the swamp deer (Cervus duvaucelli) in Sylhet and the Sundarbans, and the sambar (Cervus unicolor), the largest of Asian deer, in Sylhet, Chittagong, and the Chittagong Hill-Tracts (Husain 1974:13-14).

The wild boar (Sus scrofa) is of extensive occurrence in all forested areas. Its numbers are said to have increased since the departure in 1947 of large number of Hindus, who had earlier killed them for meat (Husain 1974:14).

#### elephants

The asiatic elephant (Elephas maximus) was once found in large numbers in Bangladesh, even attaining a near nuisance status in the Madhupur Jungle near Dacca. Today the elephant has disappeared from Madhupur and is now reported to be limited to about 150 remaining individuals in two districts in the southeastern corner of the Chittagong Hill Tracts (Tiger Paper, vol. 5, no. 2, April 1978:29).

#### pangolin

Two species of pangolin, a scaled nocturnal mammal, occur in Sylhet,

Comilla, Mymensingh, Chittagong, and the Chittagong Hill Tracts: the Indian pangolin (Manis crassicaudata) and the Malay Pangolin (Manis javanica) (Husain 1974:14).

smaller mammals: bats, rodents, etc.

Nearly 28 species of bats are found in Bangladesh. The commonest and largest are the fruit bats or flying foxes, but there are also one false vampire, seven species of horseshoe, and two species of wrinkle-lipped bats (Husain 1974:15-16). Porcupines, once of general distribution, are now, like so many other animals, limited to areas where sufficient vegetation is available, namely Comilla, Chittagong, and Mymensingh; two species occur: the asiatic brush-tailed porcupine (Atherurus macrourus) and the crestless Himalayan porcupine (Hystrix hodgsoni). Squirrels include the flying squirrel, pallas's squirrel, and, particularly common in Dacca, Dommilla, and Chittagong, the Irrawaddy squirrel. Among the rats and mice are the house rat (Rattus rattus), the house mouse (Mus musculus), the fawn-colored mouse (M. cervicolor), and field and garden rats such as the bandicoot rat (Bandicota indica) and lesser bandicoot or Indian mole rat (B. bengalensis). Rats are common and responsible for destruction of crops both on the field and in storage (Husain 1974:16).

Recorded from Sylhet is the eastern or white-tailed mole (Talpa micrura). Two species of shrew are found: the familiar house shrew (Suncus murinus)--best known for its offensive odor, and the tiny pygmy shrew (S. etruscus) (Husain 1974:16).

aquatic mammals

The fresh-water dolphin (Platanista gangetica) is reported to be present in all major rivers and tributaries in Bangladesh, while the Malay dolphin (Stenella malayana, found in the Indian Ocean, has been spotted in the Sunderbans. The Indian pilot whale (Globicephala macrorhyncha) occurs in the Bay of Bengal (Husain 1974:17).

2.6.1.2 birds

Bangladesh has a large and varied bird life. There are several varieties of pheasants and partridges, while the red jungle fowl (Gallus gallus), although greatly reduced in numbers is still common in Chittagong, the Chittagong Hill-Tracts, Sylhet, Mymensingh, and the Sunderbans and remains the most valued game-bird in the country. Pigeons and doves are found throughout the country, although some varieties such as the emerald dove (Chalcophaps indica) are most common in the forested areas. Parakeets are of common occurrence, and there are several varieties of cuckoos. In marshes and tidal flats are several varieties of storks; one of these the greater adjutant (Leptoptilos javanicus), once fairly common in Bangladesh, has become very rare. There are an estimated 15 or 16 species of herons, bitterns, and egrets, the most common of which is the pond heron (Ardeola grayii), which occurs wherever there is water; the cattle egret (Bubulcus ibis) is also very common.

Bangladesh has at least a dozen species of kingfishers; as many as

seven species have been identified living side by side in the Sunderbans area. Among these are the common kingfisher (*Alcedo atthis*), the stork-billed kingfisher (*Petargopsis capensis*) and the white-breasted kingfisher (*Halcyon smyrnensis*).

There are about 23 species of waterfowl known to occur in Bangladesh but only four are resident the remainder being migrants found during the winter season. The most common of the residents is the lesser whistling teal (*Dendrocygna javanica*), while the other residents are of only rare occurrence. The comb duck (*Sarkidornis melanotos*), once a resident, now appears to be extinct.

There are nearly a dozen species of ralls, crakes, and coots, and about 47 varieties of birds of prey, including the very common whitebacked vulture (*Gyps bengalensis*), the black kite (*Milvus migrans*), and the Bahminy kite (*Haliastur Indus*).

Confined to the forest areas of the Chittagong Hill-Tracts and Chittagong are hornbills, the most common of which is the pied hornbill (*Antracoceros malabaricus*), which occurs in large flocks.

There are about 25 species of nightjars and owls, including the spotted owl (*Athene brama*) and the barn or screech owl (*Tyto alba*), both of which are said to be common throughout the country.

Also common and well distributed in forested areas are woodpeckers, represented by about 22 species, the commonest being the goldenbacked woodpecker (*Dinoplum benghalense*).

Crows are most prominently represented by the very common king crow (*Dicrurus adsimilis*) and more spectacular species such as the greater racket-tailed drongo (*Dicrurus paradiseus*), while the grackle or hill myna (*Gracula religiosa*) is common in the forested areas of Sylhet, Chittagong, and the Chittagong Hill-Tracts.

A favorite subject of Bengal poets has been the bulbul, a handsome bird represented by about nine species, of which the redvented bulbul (*Pycnonotus cafer*) is the commonest and most widely distributed.

Other birds reported to occur in Bangladesh, either as residents or migrants (with number of species in parentheses) are grebes (2) cormorants and snakebirds (4), gulls and terns (12 to 14), swifts (6) bee-eaters (4), barbets (3), pittas (5), larks (4), shrikes (4 or 5), swallows (6 or 7), orioles (1 or 2), minivets and cuckoo-shrikes (12), lora (1), chloropsals (3), fairy blue-bird (1), babblers (23), laughing thrushes (7 or 8), yuhinas and sibilas (6 or 7), flycatchers (7 or 8), warblers (nearly 50), blue-chat (1), magpie robin (1), shame (1), redstarts (4), fork-tails (4), stone chats (2), bush chats (5), rock thrushes (2), thrushes (5), tits (3), nuthatches (3), pipits and wag-tails (10), the white-eye (1), sparrows and munias (1), rosefinches, and buntlings (Husain 1974:18-34).

### 2.6.1.3 Reptiles

Snakes found in Bangladesh include the python (Python molurus), reportedly still common in the hilly and forested areas, the cobra (Naja naja), the king cobra (Naja hannah), and several poisonous sea snakes common in the Sunderbans and the Chittagong coastal area, including Kerilla jerdoni, Hydrophis nigroclinctus, and H. obscurus. At least 20 other species of snakes occur.

Among the common lizards are the wall lizard (Hemidactylus spp.), the gekko (Gekko spp.), and the calotis (Calotis versicolor). The endangered yellow monitor or yellow land lizard (Varanus flavescens) is found in Faridpur, Copmilla, Sylhet, Bogra, and Dinajpur.

In the Sunderbans are found both the snubnosed crocodile (Crocodylus holustris) and the estuarine crocodile (Crocodylus porosus); the fish-eating gharial/gavial (Gavialis gangeticus) is of decreasing occurrence in the Ganges and its tributaries.

Several varieties of fresh-water tortoises and turtles occur, as well as the giant land tortoise. Several marine turtles occur in coastal waters and use coastal islands as breeding places. Their eggs are collected in large numbers for sale in local markets. Several species of turtles and terrapins are on the endangered list for Bangladesh (Husain 1974: 35-37).

### 2.6.2 Reduction of wildlife numbers and endangered species

As is evident in the description of wildlife given above, many of the animals of Bangladesh now occur in very restricted areas of the country. Some animals once found in large numbers, such as the rhinoceros, the black buck, and the serow, have disappeared completely. By one estimate, over 8% of the mammalian species of Bangladesh have been lost over the last 100 years. Some birds such as the pinkheaded duck and the peafowl have also nearly disappeared (Husain 1974:2-3).

The most obvious reason for the loss of wildlife in Bangladesh is the loss of habitat as growing numbers of human beings have expanded their agricultural and industrial activities into areas once occupied by wild animals. The Kaptai Dam hydro-electric project in the southeast and industrial activities such as paper mills as well as highway construction and urban expansion have been blamed for damage to wildlife habitat, while the destruction of forest areas for fuelwood and timber have also played an important role (Husain 1974:41). The damage done by pesticides and air and water pollution has not yet been documented. Wild animals continue to be hunted both for their skins and furs. It has recently been reported that tiger, leopard, crocodile, and deer skins are freely available for tourists in Dacca (Dutch Bilateral...1980:5).

ENDANGERED SPECIES OF BANGLADESH

S3=Animals listed on Schedule 3 of the Bangladesh Wild Life (Preservation) Order 1973 (see below).

IUCN=Mammals listed as endangered in the IUCN Red Data Book (1976)

F&W=Endangered species listed on the U.S. Fish and Wildlife Service's List of Endangered and Threatened Wildlife and Plants (1979).

MAMMALS (Fish and Wildlife List for 1979)

s3		F&W	Gibbons <u>Hyllobates</u> spp. (China, India, and S.E. Asia)
s3		F&W	Elephant <u>Elephas maximus</u>
s3		F&W	Entellus langur <u>Presbytis entellus</u>
s3	IUCN	F&W	Leopard <u>Panthera pardus</u>
s3	IUCN	F&W	Clouded leopard <u>Neofelis nebulosa</u>
s3?		F&W	Sumatran Rhinoceros <u>Didermoceros sumatrensis</u>
23		F&W	Seledang (Gaur) <u>Bos gaurus</u>
s3	IUCN	F&W	Tiger <u>Panthera tigris</u> (Temperate and tropical asia)
		F&W	Dugong <u>Dugong dugon</u> (East Africa to Ryukyu Islands)
s3	IUCN	F&W	Asiatic wild dog <u>Cuon alpinus</u>
	IUCN		Wolf <u>Canis lupus</u>

BIRDS

s3		F&W	Nordmann's Greenshank <u>Tringa guttifer</u>
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REPTILES

s3		F&W	Mugger crocodile <u>Crocodylus palustris palustris</u>
s3		F&W	Gavial (Gharial) <u>Gavialis gangeticus</u>
s3		F&W	Yellow monitor <u>Varanus flavescens</u>
		F&W	River terrapin <u>Batagus baska</u>
s3		F&W	India flap-shelled tortoise <u>Lissemys punctata punctata</u>
s3		F&W	Black soft-shell turtle <u>Trionyx nigricans</u>
s3		F&W	Peacock softshell turtle <u>Trionyx hurum</u>
		F&W	Three-keeled Asian turtle <u>Geomyda tricarinata</u>

Schedule 3 animals are those which are not to be hunted, killed or captured. These include: all mammals, reptiles and birds when immature or not fully grown (except poisonous snakes, rats, mouse, fruit bats, pipistrelles, etc.), when they endanger public life; female animals when pregnant, suckling or accompanied by their young; and all individuals of the species listed in the schedule: 67 mammals; 22 reptiles; and 465 species of birds. Virtually any animal may be hunted under a special permit, however, if its increase is declared a threat to the balance of nature or it becomes a threat to the public (man-eating tigers, rogue elephants, etc.).

### 2.6.3 Wildlife management in Bangladesh

Under the Bangladesh Wildlife (Preservation) Order, a large number of endangered species have been given protection in Bangladesh; furthermore, provisions are made for clearing certain areas as reserved for wildlife. Densely populated Bangladesh, however, lacks the space to declare large areas for wildlife reserves; total forest area, for example, by the most recent estimate occupied only some 8% of the country.

As of 1974, several areas had been tentatively selected for wildlife management. Under this program, which designates certain areas as Wildlife Sanctuaries, National Parks, Game Reserves, or Recreation Parks, about 8% of the total area of Bangladesh would come under wildlife management schemes; under the first Five-Year Plan (1973-74 to 1977-78), however, most of these areas have been kept in abeyance and only a few of these areas have been taken up for development: the Tiger Sanctuary in the Sunderbans; the Elephant Sanctuary in Kessalong; the Sangu Matamuri, Pangpani, and Rampahar sanctuaries; the areas designated as Game Reserves; the Crocodile Reserve in the Selagong River in the Sunderbans; and some of the recreation parks (Husain 1974: 52). Areas listed below are from Husain 1974 (46-52)

#### 2.6.3.1 Wildlife Sanctuaries

These areas are to be closed to hunting, shooting or trapping of birds and animals and are generally to be set aside as undisturbed breeding grounds for the protection of wildlife and their habitat, including vegetation, soil, and water. Public access is prohibited, and no exploitation of forest is allowed except for reducing fire hazards, epidemic insect attacks, etc. Most of the areas listed below are proposed, and not actual, sanctuaries.

##### Khulna District

- 1) Sunderbans East  
area: 21 square miles/54.39 square kilometers
- 2) Sunderbans West  
area: 35 sq.m./90.7 sq.k.
- 3) Sunderbans South  
area: 69 sq.m./178.71 sq.k.

##### Chittagong Hill-Tracts

- 4) Pablaikhail (Kessalong Reserve Forest)  
area: 31 sq.m./80.29 sq.k.
- 5) Sangu Matamuri  
area: 73.65 sq.m./147.3 sq.k.

##### Chittagong District

- 6) Inoni  
area: 21.02 sq.m./ 54.4 sq.k.
- 7) Rangapani  
area: 11.22 sq.m./29.04 sq.k.

### 2.6.3.2 National Parks

National parks are designated as comparatively large areas of outstanding scenic merit and natural interest, set aside with the primary object of providing opportunities for public recreation, education, and research and in which wildlife is protected. No hunting, shooting or trapping of wildlife is to be allowed except for better preservation of other wildlife. Management of the forest for a sustained yield of forest products may be allowed if it does not impair the area's function as a national park. Access roads, buildings, rest houses, and hotels may be built in these areas but they are to be carefully planned so as not to disturb the wildlife or materially alter the natural appearance of the area. Areas planned for national park development are:

#### Khulna District

- 1) Katka  
area: not indicated
- 2) Malancha  
area: 128.52 sq.m./332.9 sq.k.

#### Chittagong Hill-Tracts

- 3) Kaptal  
area: 22.4 sq. m./58 sq.k.
- 4) Shishak  
area: 29.05 sq.m./75.2 sq.k.
- 5) Thega  
area: 40 sq. m./103.6 sq.k.
- 6) Sangu-Matamuri  
area: 105.70 sq.m./273.8 sq.k.

### 2.6.3.3 Game Reserves

Game reserves are areas where wildlife is protected to encourage increases in its population. Trapping of animals is prohibited, but hunting and shooting are allowed with special permits stating restrictions as to the number of animals to be killed and the period of time for which the permit is valid. To ensure wildlife protection some parts of these areas may be completely closed for hunting, and threatened species may be protected by special prohibitions on their hunting and killing.

Game reserves cover the whole of the forest area under the control of the Forest Department, excluding the Wildlife Sanctuaries and National Parks but including the water areas of the Kaptal Reserve outside the Reserve Forests. Areas taken up for development are:

#### Chittagong District

- 1) Himcheri  
area: 9 sq.m./23.3 sq.k.

- 2) Dulahezra  
area: 7.16 sq.m./18.5 sq.k.
- 3) Thankhall  
Cox's Bazar Forest Division excluding the Inoni Wildlife Sanctuary  
area: not indicated
- 4) Kalinga  
area: 30.32 sq.m./78.5 sq.k.
- 5) West Bhangugach Reserve Forest  
area: 1057 sq.m./2,737.6 sq.k.

#### wetland game reserves

Marshy areas known as jheels, beels or haors occur in different districts of Bangladesh, but the principal areas are in Sylhet, Mymensingh, and Rajshahi. These areas are the habitat of aquatic birds and serve as temporary habitats for migratory birds; these are also important for fishing. The proposal has been made that some of these haors be completely protected as Game Reserves, while in others controlled shooting, fishing, and cultivation are to be allowed on a rotational basis. Permits would be issued by the Wildlife Management Authority.

#### 2.6.3.4 Recreation parks

In recreation parks wildlife is protected, but the public, especially youth and urban dwellers are allowed entrance with permission for educational and recreational purposes.

##### Tangail-Dacca Districts

- 1) Madhupur Park  
Madhupur Jungle  
area: 25.00 sq. miles/64.8 sq. kilometers

##### Dacca District

- 2) Saina  
Rajendrapur Forest  
area: 6 sq.m./15.5 sq.k.
- 3) Chandra (Baraipala)  
On the Dacca-Tangail Road  
area: 5 sq.m./13 sq.k.

- 4) Bishaga kuribae

- 5) Aralshaprasad

##### Comilla District

- 6) Salvan Vihara  
Adjacent to the Comilla Archaeological Museum  
area: 1 sq.m./2.6 sq.k.

## Dinajpur District

## 7) Ramsagar

Five miles from Dinajpur  
area: 100 acres

## 8) Sitakot

## Chittagong and the Chittagong Hill-Tracts Districts

## 9) Ichamatl

On the Chittagong Rangamatl Road  
area: 2 sq.m./ 5.2 sq.k.

## Sylhet District

## w 10) Satcheri

## 11) Salutikar

## 12) Tillagarh

area: 2.06 sq.m./5.3 sq.k.

2.6.3.5 Status of parks

It could not be ascertained to what extent the programs described have actually been implemented. Although the World Wildlife Fund (WWF) had reportedly been working with the government of Pakistan in the 1960's on the revamping of the parks system, there is no indication in recent publications that that organization is presently working in Bangladesh. The 1976-77 World Wildlife Yearbook of the WWF, for example, lists no activities in Bangladesh.

In its 1971 directory of National Parks and equivalent reserves, the IUCN [International Union for the Conservation of Nature], which has established standards for parks and reserves, listed two areas in what was then still East Pakistan as meeting its criteria of size, legal status, and administration (United Nations List of National Parks and Equivalent Reserves, 2nd ed., Brussels: Hayez 1971). These were the Chittagong Hill Tracts National Park and the Madhupur National Park.

As described by the IUCN, the Chittagong Hill Tracts National Park, established in 1961 was 29,500 hectares (295 square kilometers) in size, consisted on gently rolling terrain, and was characterized by marshy areas, dense bush and jungle or teak forest. Among the wildlife in the area were tigers (Panthera tigris) and various species of deer. The Park was also said to contain scattered villages and to be the scene of various activities such as fuelwood gathering and timber harvesting. As of 1971 the IUCN reported that it had been proposed to remove the park to a nearby area where some good primary forest still remained. This park is not listed on the 1974 or 1975 IUCN lists of parks and equivalent reserves.

The Madhupur National Park, located northwest of Dacca, was likewise established in 1961 and was 103.60 square kilometers in size. Located on a thickly forested plain traversed by rivers and canals, the Park contained

leopards (Panthera pardus), and various species of deer, including introduced species. The area was also the home of 3,000 members of the Garos tribe, who despite plans for their resettlement remained in the area in 1971. The IUCN described the area as "a forest reserve combined with that of a recreation/education area." This park also does not appear on the 1974 or 1975 IUCN listings.

The IUCN excluded from its list a 270 square kilometer Game Sanctuary established in the Sundarbans in 1960 because the area was heavily exploited for both game and various forest produce.

#### 2.6.3.6 Other measures

Bangladesh has banned exports of rhesus monkeys, of which it had been one of the world's major suppliers. This will mean a loss of \$3 million in foreign exchange per year (Tiger Paper, vol. 5, no. 2, April 1978). Furthermore, a total ban has been placed on the killing, hunting and trapping of clouded leopard and the export of their skins (Tiger Paper, vol. 3, no. 4, 1976, page 28).

In order to promote public awareness of wildlife and the need for its conservation, the government has declared Wild Life Conservation Week, which is observed in February. With regard to training, wildlife management training is under consideration, with the possibility of sending trainees abroad. Bangladesh has also become a member of the World Wild Life Fund (Dutch Bilateral,...1980:5).

## 2.7 Coasts and Beaches

### 2.7.1 The resource

Bangladesh has some 580 kilometers of coastline along the Bay of Bengal. Fisheries (see 2.8) are the most important economic activity along the coast.

Important features of the coastal region of Bangladesh are the mangrove swamps of the Sundarbans. These mangrove areas are of great importance to the country because they provide protection against such natural disasters as cyclones and tidal waves (Dutch Bilateral...1980:5).

### 2.7.2 Problems

Degradation of mangroves areas through exploitation for fuelwood threatens to reduce their value both as a breeding ground and as a barrier against cyclones, tidal waves, and floods (Dutch Bilateral...1980:4).

Since both solid and liquid wastes are discharged into rivers and eventually into the sea, the threat of marine pollution is great. To allow the government to get a better idea of the extent of marine pollution, it has been proposed that three centers be established for marine pollution control (Dutch Bilateral...1980:4).

## 2.8 Fisheries

### 2.8.1 The resource

Bangladesh has both coastal fisheries and inland fisheries, the deltaic nature of much of the country making it particularly suitable for inland fisheries development.

Of freshwater fish, 107 species belonging to 29 families have been identified; these include ruhi, katla, mrigal, kal boash, chital, kal, magur, jhagur, shall, latta, ghaora, ire balm, hilsa, prawn, lobster, and shrimps. In the estuaries of the Bay of Bengal, 120 fish belonging to 34 families have been identified. Marine fish include catfish, sharks, skates, jewfish, giant thread fins, dantina, rupchandra (pomfrets), bhetki, charing, banspata, and poa. Numerous tortoises and turtles also frequent the coastal areas of Bangladesh (Ahmad 1976:92-93).

### 2.8.2 Utilization of fisheries

Fishing is the second most important economic activity in Bangladesh, engaging, as of the early 1970's, some five million persons. The largest registered catches are from inland fisheries, which accounted for about 90% of the annual catch during the 1970's. Total catches in recent years have ranged from 814 in 1971/72 to 826 in 1976/77.

River fishing takes place during most of the year but peaks during the winter months between November and February, when the current is slow and the water depths are reduced. The important hilsa (a form of shad) catches

occur during the monsoon season, when this fish ascends the rivers for spawning.

As of 1977, the Bangladesh Fisheries Development Corporation, which was set up in 1964, to help develop the fisheries of the Bay of Bengal was exploiting the fisheries of these waters with the help of 14 small, medium, and large sized trawlers (Ministry of Finance 1977:116).

Much of the fish catch of Bangladesh is consumed locally, fish and rice being a popular diet in the country. Bangladesh also exports fish and fish preparations, which accounted for 3.1% of the value of exports in 1977/78 (Europa Yearbook 1979:1609).

### 2.8.3 fisheries plans and projects

Fisheries in Bangladesh have potential for growth, fish representing the only easily augmentable source of protein in the country. Fisheries are generally considered to be underdeveloped. Important potential for fisheries development are: ponds or tanks, about three-quarters of which are presently derelict; 808,000 hectares of rivers; 2.8 million hectares of wet rice fields; and 183,000 hectares of estuaries (Goodland, Ismail, and Strum 1978:7). Responsibility for fisheries development falls to the Bangladesh Fisheries Development Corporation and the Directorate of Fisheries of the Ministry of Fisheries and Livestock

Development plans of the Directorate of Fisheries, whose major responsibility are research, extension, training, and promotion of fisheries development, for the year 1976-77 included:

#### scheme for fish culture in public ponds in the northern districts of Bangladesh (Initiated: 1973-74)

As of 1975-76, this project, the object of which is to reclaim develop and manage some 5,000 bighas\* of derelict ponds belonging to the government, had reclaimed some 3,314 bighas of derelict ponds and had begun cultivating fish in them.

#### scheme for expansion of development and management of derelict water areas for fish production in Bangladesh

Under this scheme 40,000 bighas of water areas such as beels, haors, and ponds are to be taken up for development. Out of 25,000 bighas of water bodies, 6,800 had been taken up as of 1976-77.

#### pilot scheme for freshwater fish culture in the polder area in Khulna district

As of 1976-77, 3,000 bighas of water in polders (water areas formed by embankments) had been stocked with freshwater fish such as rui, catla, and mrigal.

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\*a bigha is a area measure equal to anywhere from 1/3 of an acre to one acre.

Other schemes under the Directorate of Fisheries include the construction of a fish seed multiplication farm to produce quality fish fry for distribution, the declaration of 25 fisheries as sanctuaries in order to allow replenishment of fish in adjacent water bodies, and a pilot project for scientific management and culture of pearl bearing mussels. Research, training, and extension work are also included in the Directorate's plans (Ministry of Finance 1977:117-120).

Many of the project of the Directorate have suffered delays because of lack of staff or funds or both (Ministry of Finance 1977:117-118).

Schemes under the Bangladesh Fisheries Development Corporation, as of 1976-77, included 6 completed projects and 11 on-going projects. Completed projects included the management and commercial exploitation of the Karnaful Reservoir Fisheries for increasing fish supply to urban areas, a fish and fish by-products processing unit at Cox's Bazaar, and an out-board motorization project. On going projects included the introduction of fishing trawlers in the Bay of Bengal and projects involving fish marketing and processing (Ministry of Finance 1977:115-116).

#### 2.8.4 environmental problems involving fisheries

Aquatic life is said to be adversely affected by pollution (Dutch Bilateral...5). At its freshwater research station at Chandpur, the Directorate of Fisheries is carrying out research on water pollution and its effects on fish (Ministry of Finance 1977:119).

## 2.9 MINERALS AND MINING

### 2.9.1 The resource

Bangladesh is poor in mineral resources. There are, however, in the eastern part of the country (Sylhet-Comilla and south of the city of Chittagong), natural gas deposits, estimated in 1974 to be as large as 566.4 million cubic meters; they have been exploited to only a small degree. Because funds are not available, it is not expected that these deposits will be processed into liquid gas for export or for fertilizer production (GSO 1977:10).

Good quality bituminous coal deposits are located in the Bogra District, reserves estimated at about 640 metric tons in a seam 50 meters wide but at from 800 to 1,100 meters in depth. About 2.8 metric tons of coal are located near the Indian border northwest of the town of Sylhet. Also in the Sylhet district are some 2.8 metric tons of subbituminous lignite, while the equivalent of 130 million metric tons of dry peat is located in eight locations in Sylhet, Faridpur, and Khulna districts (Nyrop 1975:71).

Iron ore finds have been limited to some magnetite near Cox's Bazaar and some hematite ore in the Chittagong Hill Tracts (Nyrop 1975:71).

The major limestone areas are located northwest of Sylhet and northwest of Bogra, which together have reserved estimated at about 180 million metric tons. Limestone from Takerghat in Sylhet District provides limestone for the cement factory at Sylhet. A further source of limestone has been identified on Saint Martin's Islands in the Bay of Bengal near the tip of Chittagong (Nyrop 1975: 71).

China clay in quantities of about 18 million tons has been found in the Mymensingh District (Nyrop 1975:71).

Salt is manufactured in evaporation sites as a cottage industry, but production is expensive because of the long humid season.

Radioactive minerals have been found in heavy sand along the beaches south of Cox's Bazaar; estimates place the resource at about 600 tons with a heavy mineral content of 10 to 30 percent (Nyrop 1975:71).

### 2.9.2 Utilization

Natural gas from the Sylhet field is used in the nitrogenous fertilizer plant at Fenchuganj; from the Chhatak field for power at the Chhatak cement factory; from the Titas field, for industry in Dacca; and from the Habiganj field for nearby power-generating plants.

These natural gas reserves are expected to become the country's most important natural resource.

Exploitation of coal fields has not yet begun (Dutch Bilateral...1980:6).

### 3.0 THE ECONOMY OF BANGLADESH

#### 3.1 Basic Economic Statistics

Gross National Product (FY 1978 at current prices): 7.8 billion

Per capita GNP: \$88

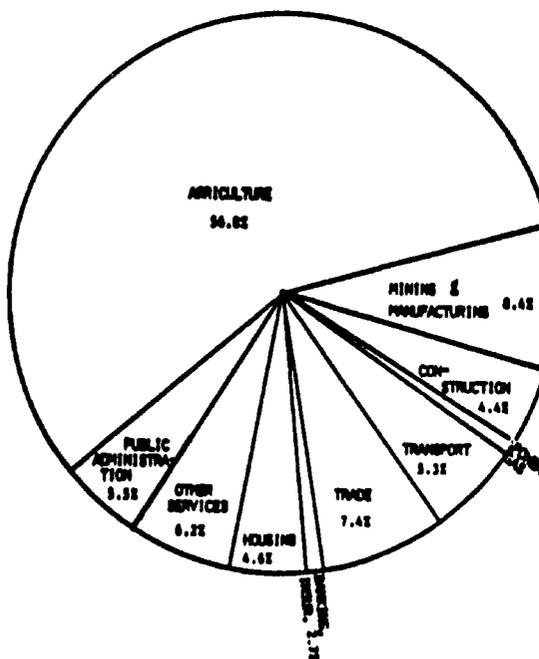
Real growth rate : 7.4% (FY 1978)

Average annual rate of inflation: 1960-70: 3.7%  
(World Bank.WDR.1979:128) 1970-77: 17.4%

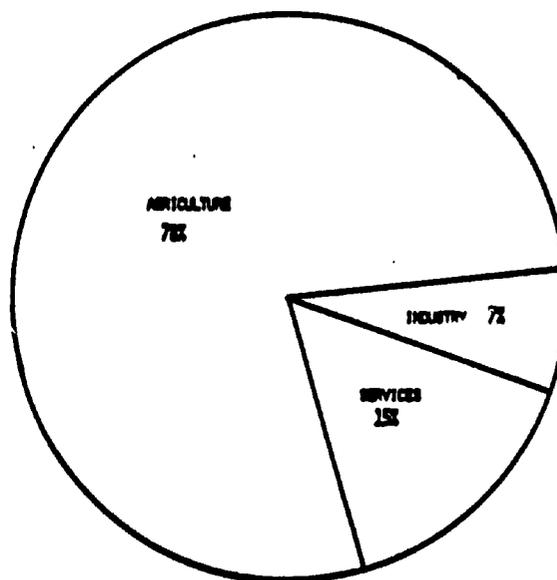
Currency and rate of exchange: taka; Taka 15.52=U.S.\$1 (February 1979)

Fiscal Year: 1 July through 30 June

GROSS DOMESTIC PRODUCT (1977-78)  
(World Bank 1979:77)



EMPLOYMENT IN BANGLADESH BY SECTOR  
(World Bank. WDR. 1979)



#### 3.2 General economic situation

Bangladesh is one of the poorest nations in the world, ranking number 3 on the World Bank's list of low income nations in 1979. Per capita income, now at \$90 per year, actually declined by 0.4% per year from 1960-76 at the same time that it increased by 0.9% per year in other low-income nations (World Bank 1979:iv).

The economy of Bangladesh continues to be dominated by agriculture, Bangladesh remaining one of the least industrially developed nations in the world.

Unemployment and underemployment, major economic problems in Bangladesh, are high in both the towns and rural areas. Furthermore, as population increases, agriculture will not be able to absorb the large numbers of people joining the labor force; nor are other sectors of the economy able to offer employment to the growing number of working age people. (World Bank 1979:24).

### 3.2.1 Economic planning

Economic planning in Bangladesh began with the first Five-Year Plan (1973-78), which aimed at an annual growth rate of 5.5 per cent and an annual increase in per capita income of 2.5%. The growth rate during this period, however, averaged only 4.0% and per capita income actually dropped. Furthermore, the share of agriculture in GDP declined only minimally: from 61% to about 59% of the GDP.

The first five year plan has been followed by a Two-Year Plan to cover the years fiscal years 1979 and 1980. There are plans to introduce long-range planning in the form of a twenty-year plan beginning in 1980. The Two-Year Plan plan calls for a growth rate in real terms of 5.7% per year. The sectoral allocations under this plan are shown below:

#### Sectoral allocation under Two-Year Plan 1979-81 (Source: World Bank 1979:23)

Agriculture	25%
Industry	22%
Power and natural resources	12%
Transport and communications	18%
Physical planning and housing	10%
Education	5%
Health	3%
Family planning	3%
Other	2%
Total	100%

### 3.2.2 Agriculture

Agriculture is the mainstay of the economy of Bangladesh. In recent years it has accounted for over 56% of the gross domestic product and has employed nearly 80% of the total workforce. Agricultural productivity, however, is among the lowest in the world (World Bank 1979:25).

Bangladesh has been unable to meet the food needs of its growing population without importing substantial quantities of food; grain imports during the period 1969/70 to 1977/78 averaged 1.66 million long tons per year, with a high of 2.74 million long tons in 1972/73 and a low of 0.81 long tons in 1976/77 (World Bank 1979:96). However, progress has been made in this area; if weather conditions hold, food aid needs for 1980 are expected to decline to 1.3 million tons of grain. Self-

sufficiency in grain is a major planning objective of the Bangladesh government.

### 3.2.2.1 land use

Because of the density of its population and consequent pressure on land, nearly all of the cultivable land in Bangladesh is already farmed. There is, therefore, little hope for bringing new land under cultivation; increase in irrigation and the use of inputs such as fertilizer offer the major hope for increased agricultural production.

The area of land used for cultivation (net cropped area) in Bangladesh is some 8,274,100,000 hectares or about 58% of the total land area of the country; total cropped area (a figure which is arrived at by counting single-cropped areas once, double-cropped areas twice, and triple-cropped areas three times) is 12,319,500,000 hectares (30,441,000 000 acres).

LAND USE: 1976-77

(Source: Monthly Statistical Bulletin... May 1978:34-35)

<u>Land types</u>	1000's of hec- tares	% of land
not available for cultivation	2,681.5	18.78%
forest*	2,205.2	15.44%
culturable waste	267.5	1.8%
current fallows	848.8	5.94%
single-cropped area	4,870.4	
double-cropped area	2,862.0	
triple-cropped area	591.7	
total cropped area	12,319.5	
net cropped area	8,274.1	57.94%
TOTAL AREA	14,278.221	100.00%

### 3.2.2.2 land tenure and farm size

The land tenure system of Bangladesh is based on the East Bengal State Acquisition and Tenancy Act of 1951, which, among other things, granted proprietary rights to peasants, set up minimum limits for land holdings of from 1.2 to 3.2 hectares and maximum limits of 13.3 hectares, and discouraged fragmentation of holdings prevalent under Islamic inheritance laws (Kurlan 1978:112).

The success of these efforts has been questionable. There is evidence that because of factors such as continued population growth, crop failures, and

\*See section 2.5.1 for differing data on forest land.

farmers' indebtedness, farm size has continued to decrease while the number of landless people has increased (World Bank 1979:18).

According to a 1977 survey, the average size of farm holdings (including tenanted land) is just under 1 hectare. However, an estimated 82% of rural households own less than this average holding, and 49% are landless or nearly landless (owning less than 0.2 hectares). There is some tenanted land, but about 80% of all tenanted land is farmed not by those who are landless but by those who own an average of 0.7 hectares of their own land. Because of the large young population and the large number of new households being formed each year, fragmentation of holdings and landlessness continue to increase rapidly (World Bank 1979:19).

### 3.2.2.3 major crops and cropping seasons

Rice is the major crop of Bangladesh, accounting for some 80% of total cultivated land. Jute and tea are the major cash crops of the country. Rice and other crops are harvested in three seasons in Bangladesh: aghani or halmantic (cold weather: November-December) includes harvests of rice as well as of sugar cane; rabi (February-March) is the period for the harvesting of dry season rice (boro) as well as of vegetables, fruits, chillies, pulses, wheat, barley, oil-seeds, tobacco, and some fodder crops; kharif (July to September) is the period for the harvesting of aus rice as well as of jute.

#### 3.2.2.2.1 Rice

Rice is the chief crop of Bangladesh. The three types of rice and their planting seasons are indicated below. Although aman rice is grown throughout the country, the major districts for its production are: Barisal, Noakhali, Khulna, Faridpur, Dacca, Sylhet, Mymensingh, and Rangpur. The leading districts for the production of aus rice are Barisal, Mymensingh, Rangpur, Jessore, Dacca, Kushtia, and Comilla. Boro rice is produced chiefly in Sylhet, Mymensingh, Dacca, Rajshahi, Comilla, and Faridpur (Ahmad 1976:66-67).

#### RICE CROPS

crop	sowing season and planting method	type of ground	moisture source	harvesting season	% of rice land	% of rice crop	average yield per acre in maunds*
<u>Aman</u>	sown in May-June; transplanted (2/3); broadcast (1/3)	lowland paddy	monsoon rains	November-January	58%	56%	11.8* 14.2 (77/78)
<u>Aus</u>	sown in March-April; transplanted	higher ground	rainfed; early rains	late June through August	32%	29%	9.4* 10.8 (77/78)
<u>Boro</u>	sown in November-January; transplanted	lower areas; marshes, swamps	irrigated	April-May	10%	20%	23.0* 24.9 (77/78)

(Source for figures: World Bank 1979:104)

\*Five year average: 1970/71-1974-75

\*\*One maund=82.28 pounds

### 3.2.2.2 Wheat

Wheat is a promising crop for Bangladesh. It is grown chiefly in the north Bengal districts: Rajshahi, Pabna, Rangpur, Faridpur, and Kushtia. At present it is limited to 3% of the volume of total grain output and it can be grown only in the dry season, but its potential for growth is felt to be large (World Bank 1979:1). According to one recent survey of the agricultural situation in Bangladesh, increased use of the dry season for wheat growing "is one of the greatest challenges and promises of agriculture in Bangladesh (World Bank 1979).

### 3.2.2.2.3 Other food crops (see tables)

### 3.2.2.3.3 Jute

Jute is the chief commercial crop of Bangladesh, jute and jute-based products continuing to supply most of the export earnings of Bangladesh--71% in 1977/78.

Jute is grown from late February to September. There are eight leading jute production districts, which together form the jute belt of the country: Mymensingh, Rangpur, Comilla, Dacca, Faridpur, Rajshahi, Pabna, and Bogra. Because jute and aus rice are grown during the same season, there is some competition between these two crops for available land, and farmers' decisions on which crop to grow are often dependent on which crop was most productive during the previous season (Ahmad 1976:65).

The area sown to jute has been increasing in recent years, and jute production for FY1979 is expected to be up considerably. Increased production has come about to some extent because of an intensive Jute Cultivation Scheme (IJCS), which covered some 1.24 million hectares in 1978. However, the world market demand for this product has been growing at a slow pace, so that increased productivity of jute could lead to overproduction (World Bank 1979:35-36).

### 3.2.2.3.4 Other commercial crops

Sugar cane is a traditional crop in Bangladesh, but the area planted to this crop has remained relatively static. The major sugar cane areas are the northern districts of Rajshahi, Dinajpur, Rangpur, Kushtia, Faridpur, Mymensingh, and Pabna, which produce about 60% of the crop. Sugar processing factories are also located in these areas (Ahmad 1976:77).

The tobacco crop is small, land planted to tobacco having decreased since the late 1940's. The chief planting areas are in north Bengal, where both climate and soil conditions are suitable, Rangpur District being the leading tobacco producing area. Other tobacco producing areas are Mymensingh, Sylhet, Faridpur, Dacca, Barisal, and Chittagong.

Tea has been grown as a commercial crop in the Bangladesh area since the middle of the nineteenth century and today still forms the basis of a substantial industry. Tea accounted for about 9% of the value of exports in 1977/78. About 95% of the tea grown in Bangladesh comes from the Sylhet District; the remainder is grown in Chittagong, the

MAJOR CROPS OF BANGLADESH  
(FAO Production Yearbook 1978. \*unofficial figure; F=FAO estimate)

CROP	year	area: 1000's of hectares	yield: kg. per ha.	pro- duction: 1000's of metric tons	CROP	year	area: 1000's of hectares	yield: kg. per hectare	prodi: 1000s metric tons
CEREALS TOTAL	1969-71	10,074	1,660	16,727	PULSES TOTAL	1969-71	367	803	293
	1976	10,124	1,769	17,908		1976	308	722	222
	1978	10,299	1,875	19,314		1978	347F	720	250F
RICE PADDY	1969-71	9,842	1,681	16,540	BEANS, DRY	1969-71	75	801	60
	1976	9,982	1,784	17,628	1976	68	717	49	
	1978	10,000	1,890	18,898	1978	69F	787	54F	
WHEAT	1969-71	121	854	103	CHICK PEAS	1969-71	71	821	58
	1976	150	1,454	218	1976	54	718	39	
	1978	202*	1,698	343	1978	57F	772	44F	
BARLEY	1969-71	32	674	21	LENTILS	1969-71	74	742	55
	1976	26	670	17	1976	66	687	45	
	1978	25	800	20F	1978	73F	658	50F	
MAIZE	1969-71	1	870	2	GROUNDNUTS	1969-71	28	1,601	45
	1976	2	897	2	1976	21	114	23	
	1978	3F	960	2F	CASTOR BEANS	1969-71		634	
MILLET	1969-71		829		1976		633		
	1976		789		1978		529		
	1978		786						
SORGHUM	1969-71	1	583	1	OIL SEEDS				
	1976	1	737	1	SUNFLOWER SEEDS	1969-71		655	
	1978	1F	800	1F	1976		500		
ROOTS&TUBERS TOTAL	1969-71	15	10,667	160	1978		500		
	1976	20	17,879	354	RAPESEED	1969-71	219	604	132
	1978	20F	12,500	250F	1976	193	578	652	
POTATOES	1969-71	85	9,863	842	1978	206	652	134	
	1976	96	9,413	903	SESAME SEED	1969-71	47	614	29
	1978	90	9,856	883	1976	49	562	28	
SWEET POT.	1969-71	72	11,357	830	1978	56*	554	31*	
	1976	72	11,050	791	LINSEED	1969-71	15	495	7
	1978	72	10,896	783	1976	14	526	7	
CASSAVA	1969-71				1978	15	505	7	
	1976		25,278	1F	COCONUTS	1969-71			1
	1978		24,863	1F	1976			2F	
					1978			2F	

area 1000s of hectares	yield: kg. per hectare	pro- duction: 1000s of metric tons
		1,248
		1,059
		1,049
6	8,432	51
6	7,562	45
6	7,967	46
9	8,841	75
8	7,510	58
8F	7,500	60F
6	7,375	6
6	6,883	38
6	6,891	39
16	8,126	128
13	7,182	93
13F	7,597	98F
33	9,510	182
33	4,321	150
33F	4,286	150F
14	3,872	53
12	3,225	33
13	3,320	42F
4	3,495	24
5	3,405	28
5F	4,980	24F
		1,481
		1,304
		1,291
		11
		9
		8
		4
		4
		2
		4
		4
		3
		3
		4
		4
		424
		271
		225
		97
		144
		142F
		645
		389
		590F

CROP	year	area: 1000's of hectares	yield: kg. per hectare	prod: 1000s of metric tons
<b>COMMERCIAL CROPS</b>				
JUTE	1969-71	878	1,289	1,114
	1976	659	1,331	877
	1978	811F	1,478	1,199
SUGAR CANE	1969-71	165	45,847	7,551
	1976	133	44,954	5,521
	1978	150F	44,667	6,700F
SUGAR, CENTRIFUGAL RAW	1969-71			90
	1976			
	1978			
SUGAR, NON-CENTRIFUGAL	1969-71			526
	1976			400F
	1978			400F
TEA	1969-71	44	356	25
	1976	43	791	34
	1978	42°	825	35°
TOBACCO	1969-71	45	659	43
	1976	49	918	45
	1978	46°	886	41°
SEED COTTON	1969-71	11	519	6
	1976	5	396	2
	1978	6F	560	3°
COTTON SEED	1969-71			4
	1976			1
	1978			2°
COTTON LINT	1969-71			2
	1976			1
	1978			1°
HEMP FIBER	1969-71	7	663	5
	1976	4	615	3
	1978	4F	636	3F
OTHER FIBERS	1969-71			9
	1976			8°
	1978			8F

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Chittagong Hill Tracts, and Comilla. Tea production was seriously affected by the war which followed Bangladesh's proclamation of independence in 1971, but in recent years tea production has equalled or surpassed earlier levels (Ahmad 1976:82-84).

Cotton, once a valuable crop grown on the plains of Bangladesh, is now grown in only limited quantities, principally in areas under shifting cultivation in the Chittagong Hill Tracts. There have been plans to start cotton cultivation under irrigation in the northern districts including Rangpur, Dinajpur, Bogra, Jessore, and Dacca (Ahmad 1976:87).

Other products with some commercial value are betelnuts or areca, grown in the southern districts of Noakhali, Barisal, Comilla, Khulna, and Chittagong, and betel vine, which, with betelnuts, formed one of the ingredients of pan leaf, a substance commonly chewed in the Indian subcontinent (Ahmad 1976:87).

### 3.2. Livestock

The status of livestock in Bangladesh is indicated in the table on page . Livestock contribute about 5% of the gross domestic product of Bangladesh. Cattle and buffalo play an important role as draft animals, and hides and skins from these animals as well as from goats and sheep are foreign-exchange earners (leather accounted for about 9% of the value of exports in 1977/78). In addition, cattle manure serves as both a fertilizer and a fuel.

Livestock breeding in Bangladesh is hampered by a lack of natural grasslands and by heavy pressure on land for food production rather than for grazing. Livestock are fed mostly on chopped paddy straw and small grass patches (Ahmad 1976:92); lack of fodder had generally been a cited as the reason for the low numbers of livestock as well as for their low productivity.

### 3.2. Irrigation and use of fertilizers and pesticides (see also 2.3.3)

Because Bangladesh is already exploiting most of its cultivable land, the increases in agricultural production necessary to meet the food needs of the country's growing population can be met through increased cropping intensity to be achieved principally through the provision of irrigation water. Given the present low level of double and triple cropping in Bangladesh, there appears to be great potential for increasing production through the provision of irrigation water, particularly during the dry season (World Bank 1979:29). It has been estimated, for example, that the shallow tubewell project in Northwest Bangladesh, which covers some 150,000 acres, would lead to an increase in foodgrain production of about 117%; the project also calls for increased use of pesticides and high yield variety seeds (World Bank 1979:29). It has been calculated

(O-UND) figures cited in World Bank 1979 place the level of irrigated acreage at 2.7 million in FY76. The government of Bangladesh in one of its statistical bulletins issued in mid-1978, claimed 3,003,020 irrigated acres for FY76. According to FAO estimates irrigation reached 3.2 million acres as of 1977.



### fertilizer and pesticides

Both fertilizers and pesticides are subsidized by the government, such subsidies representing as much as 40% of expenditures under the government's Annual Development Program in 1976. Fertilizers are both procured and distributed by the Bangladesh Agricultural Development Corporation (BADC); pesticides are procured by BADC but distributed by the Plant Protection Directorate of the Ministry of Agriculture. The BADC also supplies improved seed to farmers. Very often pesticides, fertilizers, and improved seed are used in conjunction with irrigation projects. According to a World Bank assessment, however, increases in crop production in recent years, are due more to the use of fertilizers than to increased irrigation (World Bank 1979:30).

Demand for fertilizer has increased in recent years, partially because of government subsidies and partially because of promotional efforts involving the distribution of demonstration kits, the provision of credit, and increased assistance from extension services. Fertilizer use in FY78 came to 711,000 tons, 40% more than in FY77, and sales for FY79 have been projected at 800,000 tons, although demand is expected to be higher. To meet FY1979 the government was relying on 600,000 tons of imported fertilizer and domestic production of some 250,000 tons (World Bank 1979: 3).

Records for FY78 indicate that 29% of fertilizer was used for the aman rice crop, 45% for the boro crop, and 26% for the aus rice crop. Urea accounted for 67% of fertilizers used, TSP (triple super phosphates) for 27%, and MP for the remaining 25% (World Bank 1979:100). No data was found on the extent to which animal dung is used as fertilizer.

Bangladesh government figures show that between July 1977 and May 1978 2,463.1 metric tons of pesticides were distributed in Bangladesh. Breakdown by type of pesticide use was as follows:

Borer group	
conventional	14.0%
granular	55.0
Pest complex	16.3%
Swarming, earcutting caterpillar group	5.2%
Soil treating chemicals	0.65%
Acaricides	0.006%
Fungicides	
fuller	7.0%
seed-treating	0.78%
Rodenticides	0.14%
Weed killers	0.66%

FAO figures for 1977 indicate that the following types of pesticides

that meeting the agricultural production targets set by the Ministry of Agriculture for fiscal year 1985 will involve extending irrigated agriculture from an irrigated acreage as low as 2.7 million in FY76 to some 4.8 to 5.5 million acres by FY1985 (World Bank 1979:30).

According to Bangladesh government figures, the most heavily irrigated crop is boro (dry season) rice, which accounted for 67% of irrigated area in 1976-77. Other irrigated crops and their share in irrigated agriculture for the same period were: aman rice (6.9%); aus rice (6.3%); wheat (5.9%); potatoes (4.6%); vegetables (3.1%); sugar cane (0.74%); oil seeds (0.32%); cereals other than the above (0.2%); pulses (0.09%); cotton (0.002%); and other crops (4.5%) (MSBoB May 1978).

The share of irrigated area by division and district for 1976-77 is indicated below (source MSBoB May 1978:46).

<u>Division/District</u>	<u>% of total irrigated area</u>
<u>Dacca Division</u>	
Dacca	8.7%
Kishoregonj	12.1%
Mymensingh	6.1%
Tangail	2.7%
Faridpur	2.1%
<u>Chittagong Division</u>	
Chittagong	8.3%
Ctg Hill T.	0.97%
Noakhali	5.3%
Comilla	9.3%
Sylhet	10.1%
<u>Rajshahi Division</u>	
Rajshahi	7.5%
Dinajpur	3.4%
Rangpur	5.4%
Bogra	3.1%
Pabna	2.2%
<u>Khulna Division</u>	
Khulna	2.0%
Barisal	2.9%
Patuakhali	0.79%
Jessore	2.7%
Kushtia	3.7%

were used: aldrin and similar compounds, toxaphene, malathion, dinitro compounds, other pesticides, copper compounds, dithiocarbamates, 2,4-D, and miscellaneous rodenticides.

### 3.3.2. Shifting agriculture

Shifting agriculture, locally known as jhuming, is practiced by the tribesmen of the Chittagong Hill Tracts of southeastern Bangladesh. Forest areas are usually cut in February and burnt and cleared before the rains begin. Planting takes place after the first rains. Crops

include melons, yams, vegetables, rice, and cotton. In the past plots were worked for one or perhaps two years, after which the farmers moved on, allowing the land to lie fallow for about ten years. More recently, however, population increases and consequent shortages of land have worked together to reduce fallow periods to about three years. Crop production on jhum plots has therefore diminished (Ahmad 1976:111-12).

Jhuming is said to have had various adverse effects, particularly because it is practiced on slopes. As summarized by Nafis Ahmad (1976:111), these effects include injured slopes, denuded of vegetable matter that has been burnt. "On terraced hill slopes," Ahmad continues, "...the water run-off resulting from over 80 inches of rainfall in three months plays havoc with the soil cover. Enormous quantities of soil are washed into small channels which then carry it into bigger streams. This...method of agriculture seems incompatible with the principles of forest conservation. Besides agricultural operations, river navigation and port facilities of Chittagong are all adversely affected in various ways" (Ahmad 1976: 111-12). In some areas, erosion has become so bad that nothing will grow any longer (Ahmad 1976:112).

### 3.4 Industry

The industrial sector of Bangladesh is still largely undeveloped, mining and manufacturing together accounting for only 8.4% of the Gross Domestic Product in 1977-78 and for about 7% of the labor force in recent years.

The most important industrial activity is jute processing. This industry declined somewhat in the 1970's after experiencing an upsurge in the 1960's, but the last two years of the 1970's saw some improvement of the prospects for the industry; consequently, the government has been taking steps to raise production (Economist Intelligence Unit 1979:23).

Other major industrial operations include a steel mill at Chittagong with an installed capacity of 750 tons of ingots per day, several cotton textile mills, paper and sugar mills, and chemical and fertilizer factories based on natural gas. There are also two urea fertilizer plants with a combined capacity of about 400,000 tons; two additional plants, scheduled to open in 1980, will raise capacity to 1.6 million tons, thus allowing a substantial surplus for export. There is one oil refinery (at Chittagong), with a processing capacity of 1.5 million tons; however, production has never exceeded 1.15 million tons in any single year (Economist Intelligence Unit 1979:24).

Small scale industrial plants manufacture or assemble a range of industrial and consumer goods, including matches, cigarettes, soap, bicycles, footwear, tires and rubes, batteries, pumps, and diesel engines.

In 1972 the government of Shaikh Mujib nationalized about 85% of the large scale industries in the country, including jute mills, cotton textiles, and sugar mills. The present government of Bangladesh has retained most industries under state control, but has been pursuing a policy of disinvestment by selling some nationalized plants back to their original owners or to private business people. It has also been encouraging foreign and domestic investment in the private sector and has reactivated the Dacca stock exchange, which had been closed in 1971 (Economist Intelligence Unit 1979:24).

Industrial production (from Economist Intelligence Unit 1979:24)  
(thousands of tons except where otherwise indicated)

	<u>1975/76</u>	<u>1976/77</u>	<u>1977/78</u>	<u>1978/79*</u>
Jute textiles	478	490	546	534
Cotton cloth (millions of yds)	76	68	84	100
Cotton yarn (millions of lbs)	91	82	107	115
Cement	157	308	339	335
Steel Ingots	90	102	120	...
Petroleum products	900	1,070	1,060	1,100
Paper	20	26	30	29
Newsprint	20	17	32	36
Fertilizer	337	343	401	...
Sugar	87	139	175	131

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\*estimated

## 4.0 ORGANIZATIONS WITH INTEREST IN ENVIRONMENT AND NATURAL RESOURCES

### 4.1 CENTRAL GOVERNMENT ORGANIZATIONS

#### 4.1. Central government structure

The People's Republic of Bangladesh, from 1947 to 1971 the Pakistan province of East Pakistan, proclaimed its independence from Pakistan in March 1971 and, after a period of warfare with Pakistan, established an independent parliamentary democracy under Prime Minister Sheikh Mujib in 1972. Instability led to the fall of this government and the establishment first of a presidential form of government and later of a military dictatorship. It was not until June 1978 that presidential elections under universal suffrage were held. They were won by now president Ziaur Rahman, whose party also triumphed in the parliamentary elections that followed in February 1979.

As of January 1980 the government of Bangladesh consisted of a President and Vice President, a Prime Minister and two Deputy Prime Ministers, thirty-five ministries with specific concerns such as Industries, Food, etc., and ten Ministers of State Without Portfolio.

Many government agencies have functions relating to environment and natural resources. These are considered in such detail as was available below. With regard to policy, the state has declared a continuing policy 1) to create, develop, maintain and improve conditions under which man and nature can thrive in productive and enjoyable harmony with each other; 2) to fulfill the social, economic and other requirements of present and future generations of Bangladesh; and 3) to insure the attainment of an environmental quality that is conducive to a life of dignity and well-being (Dutch Bilateral...1980:2).

#### 4.1.1 Non-ministerial organizations and organizations whose affiliation could not be determined

##### 4.1.1.1 Environmental Pollution Control Board (ESCAP 1978) Established: 1977

Functions: To coordinate inter-ministerial activities relating to the environment; to establish environmental policy; to review and make suggestions for improvements in environmental legislation. Among its concerns are both all forms of pollution, including water, air, marine, and noise pollution (ESCAP 1978:30).

Specific functions as stated in the Environment Pollution Control Ordinance 1977 are:

- 1) to formulate policies for the control, prevention and abatement of environmental pollution;
- 2) suggest measures for the implementation of its policies;

To carry out these functions the board may:

- a) require persons to furnish specific information;
- b) call for a report from the Director of the implementing cell on the existing and potential problems of environmental pollution;
- c) appoint such expert committees as it may consider necessary.

The chairman of the Board is to be the member in charge of Physical Planning and Housing of the Planning Commission; under him are high level representatives of the Ministries of: Local Government, Rural Development and Cooperatives; Agriculture and Forests; Industries; Home Affairs; Power, Water Resources, and Flood Control; Public Works and Urban Development; Fisheries and Livestock; and Health and Population Control. Also included are representatives of the Bangladesh Inland Water Transport Authority and the Bangladesh Meteorological Department. The implementing arm of the Board is the Pollution Control Cell under the Ministry of Local Government, Rural Development, and Cooperatives (see 4.1.2.4).

The Board is to meet a times determined by the Chairman or in response to an appeal initiated by persons aggrieved by the actions of the Pollution Control Cell.

The Board also serves as the focal point for the UNEP Infoterra Program; as such it has responsibility for information related to environmental programs.

#### 4.1.1.2 Water Pollution Control Board (ESCAP 1978)

Food Directorate Bldg.  
16 Abdul Ghani Rd.  
Dacca

The Board is responsible for making policies for the control, prevention and abatement of water pollution (Dutch Bilateral...1980:14).

#### 4.1.1.3 Laboratory of Water Pollution Control Project

DIT Building, 3rd Floor  
Dacca

Among the concerns of the laboratory are analysis of water for inorganic constituents, water quality surveys, and planning and implementation of pollution control measures. The laboratory also conducts studies on the effects of industrial effluents on fish (Dutch Bilateral...1980:15).

#### 4.1.1.4 Air Pollution Control Project

House No. 242, Road No. 22  
Dhanmondi  
Dacca

Concerns of the project include: control of sources of polluting emissions; measurement methods including monitoring of air quality; legislation; and standardization (Dutch Bilateral...1980:15).

## 4.1.2 GOVERNMENT MINISTRIES

### 4.1.2.1 MINISTRY OF FLOOD CONTROL, POWER, AND WATER RESOURCES Dacca

#### 4.1.2.1.1 Bangladesh Water Development Board(BWDB)

The BWDB is one of the chief agencies concerned with water resources and their development in Bangladesh. It is entrusted with the responsibility for solving problems related to the overflow of water during the monsoon and low flow during the postmonsoon seasons. It is also responsible for the overall development and optimum utilization of potential water resources by providing flood protection measures, removal of drainage congestion, prevention of ingress of saline water in crop lands, and the provision of irrigations facilities (Bangladesh. Ministry of Finance 1977:216). In 1976 the BWDB supplied irrigation water for some 110,000 acres; by fiscal year 1985 it is expected that it will be supplying water for a area ranging from 350,000 to 1,240,000 acres (World Bank 1979:32).

### 4.1.2.2 MINISTRY OF AGRICULTURE AND FORESTS

#### 4.1.2.2.1 Forest Department

Headed by a Chief Conservator of Forests, the department is charged with regulating and exploiting forest resources under its control (ESCAP 1978:29). Also charged with wildlife preservation and management. The appropriate organization for wildlife preservation is reported to be still in the process of development; progress in this area is impeded by a lack of expertise and training facilities as well as by lack of public education and awareness of the problem (ESCAP 1978:30)

#### 4.1.2.2.2 Department of Plant Protection 75 Kakrail Road Dacca

The Department handles plant protection and all kinds of pesticides. It carries out work involving quality control, residue biodegradation resistance, insect toxicology, and mammalian toxicology. It is involved in the distribution of pesticides and in the application of pesticides by aircraft.

### 4.1.2.3 MINISTRY OF FISHERIES AND LIVESTOCK

#### 4.1.2.3.1 Directorate of Fisheries

The Directorate's main functions are research, extension, training, administration of the Fisheries Ordinance, fishermen's welfare, promotion of fisheries development, legislation, licensing certification, etc. As of 1977, the major tasks being carried out by the directorate related to a fact-finding inventory of inland fisheries resources, production oriented research, and reclamation of Government derelict

#### 4.1.2.4 MINISTRY OF LOCAL GOVERNMENT, RURAL DEVELOPMENT AND COOPERATIVES

##### 4.1.2.4.1 Directorate of Environmental Pollution Control

Covers water pollution control schemes, noise pollution, and air pollution, including pollution from mobile sources (ESCAP 1978:29).

##### 4.1.2.4.1.1 Environmental Pollution Control Cell

Headed by a Director and two Deputy Directors and employing a chemist, a research officer, and technical field officers, the Environmental Pollution Control Cell is to plan for the control, prevention, and abatement of pollution in Bangladesh. Its program includes a detailed survey of industries; compilation of monitoring data and water samples to be analyzed in the field and in laboratories; bio-assay tests to establish permissible concentrations of various toxic chemicals being discharged into water as industrial effluents; a detailed river survey for pollution abatement; the establishment of a data bank and the setting of standards for drinking water, for industrial effluents, and for other uses. The work of the Cell in carrying out these functions has been hampered by lack of money, equipment, and technical expertise (ESCAP 1978:28).

Under the current Two-Year Development Plan (1978-80), the Cell is engaged in water and air pollution control programs at a total cost of Taka 21.5 million (Dutch Bilateral...1980:3).

##### 4.1.2.4.2 Directorate of Public Health Engineering

Responsible for implementation of rural water supply and sanitation programs under funds allotted by the National Planning Commission.

##### 4.1.2.4.3 Integrated Rural Development Program (IRDP)

Shadaran Bima Sadan  
24-25 Dilkhusha C/A, DACCA

Begun on a national level in 1970, the IRDP is based on a two-tier cooperative system that is designed to build up viable rural institutions through which farmers can participate in the development activities of the central government. With expected participation in the development of 200 thanas (see 4.3 below) as of 1977, the IRDP programme involves, among other things, distribution of agricultural inputs such as fertilizers, improved seeds, and pesticides and distribution of hand tube-wells (Ministry of Finance 1977:294-95).

#### 4.1.2.5 MINISTRY OF PLANNING

##### 4.1.2.5.1 Planning Commission She-E-Bangla Nagar, DACCA

The Planning Commission has several divisions which concern themselves with environmental matters.

##### Flood Control and Water Resources Division

The Division is concerned with water resources planning, flood control problems and their appraisal, formulation of national weather and flood

control policy, assessment of manpower needs in this area, and approval of water resources and flood control schemes (Dutch Bilateral...1978:20)

#### Physical Planning and Housing Section

The Section is responsible for all matters related to physical planning and housing from the national level to the local level.

#### Transport Survey Unit

#### 4.1.2.5.2 Statistics Division

##### Bangladesh Bureau of Statistics

Publishes Monthly Statistical Bulletin of Bangladesh, with statistics covering: population and family planning; food and agriculture; meteorology; wages; prices and price indices; industry; transport and communication; foreign trade; and national income and financial statistics.

#### 4.1.2.6 MINISTRY OF HEALTH AND POPULATION CONTROL

##### 4.1.2.6.1 Directorate of Population Control and Family Planning

The Directorate is responsible for programs involving family planning, including education in contraceptive use, as well as maternal and child health (see 1.5.5).

##### 4.1.2.6.2 Directorate of Health

The chief emphasis of the government's health policy as carried out by the directorate of health is the provision to the country's predominantly rural population of a comprehensive, low-cost health package at the local level. Government plans to achieve this end called for the establishment of 356 Rural Health Centers at the union parishad level of local government and twenty-five-bed hospitals at the thana level. However, high costs and other difficulties have thwarted the achievement of this goal (Loomis 1976:47-49).

#### 4.1.2.7 MINISTRY OF SCIENCE AND TECHNOLOGY

##### 4.1.2.7.1 Meteorology Department Sher-E-Bangla Nagar Dacca

The Department records, observes, and analyzes weather, rainfall, and climate in Bangladesh. It issues weather reports as part of its routine work.

#### 4.1.2.8 MINISTRY OF EDUCATION

#### 4.1.2.9 MINISTRY OF LAW AND PARLIAMENTARY AFFAIRS

Responsible in conjunction with the Environment Control Board for reviewing and recommending improvements in environmental legislation.

#### 4.1.2.10 MINISTRY OF PETROLEUM AND MINERAL RESOURCES

##### 4.1.2.10.1 Bangladesh Mineral Exploration Development Corporation

#### 4.1.2.11 MINISTRY OF RELIEF AND REHABILITATION

Dacca

The Ministry is a permanent relief organization responsible for coordinating relief activities of the government of Bangladesh and of international and voluntary agencies and of bilateral donors. It works in close cooperation with the Bangladesh Red Cross, which carries out many warning and relief operations, particularly in the case of cyclones.

#### 4.1.2.12 OTHER MINISTRIES

Ministry of Land Administration and Reforms  
 Ministry of Jute  
 Ministry of Ports, Shipping and Inland Water Transport  
 Ministry of Civil Aviation and Tourism  
 Ministry of Labor and Industrial Welfare  
 Ministry of Industries  
 Ministry of Manpower Development and Social Welfare  
 Ministry of Public Works and Urban Development

#### 4.2 GOVERNMENT CORPORATIONS

##### 4.2.1 Bangladesh Fisheries Development Corporation (Ocean Research Index 1976)

24-25 Dilkusha Commercial Area

Motijheel

Dacca 2

Scope of Interests: The corporation has conducted a pre-investment survey

for the development of fisheries in Bangladesh in collaboration with the UN Special Fund of the Food and Agriculture Organization. The Corporation is presently engaged in fishing operations in the Bay of Bengal with mechanized fishing boats and a trawler fleet.

##### 4.2.2 Bangladesh Forest Industries Development Corporation

The BFIDC was established by the Government to deal with the extraction of timber and small wood and to develop forest-based industries. As of 1977 the BFIDC had two timber extraction projects and 13 wood based industries throughout the country (five wood-treating plants, four mechanized door and window manufacturing factories, two mechanized furniture-making factories, one plywood factory, a hard board mill, and a pulp mill) (Bangladesh. Ministry of Finance 1977:123-24).

##### 4.2.3 Bangladesh Agricultural Development Corporation (BADC)

The BADC is one of the chief agencies dealing with water resources in Bangladesh. In 1976 it supplied irrigation water for some 1.61 acres of land;

over the next six years it is expected to supply water to irrigate as many as 3.25 million acres (World Bank 1979:32). The types of irrigation provided by BADC include low lift pumps, deep tubewells, and shallow tubewells.

4.2.4 Bangladesh Chemical and Fertilizer Corporation  
91 Motijheel C.A., Silpa  
Bhaban  
Dacca

The Corporation is responsible for the establishment of chemical and fertilizer plants in the country, including effluent control for these operation (Dutch Bilateral...1980:16).

4.3 LOCAL GOVERNMENT

The basic units of regional administration are (from top to bottom) the division, the district, the subdivision, the thana, the parishad, and the village. There are four divisions (Chittagong, Dacca, Khulna, and Rajshahi), each headed by a commissioner. Under these are 19 districts, each headed by a deputy commissioner, which is the most important government representative at the local level. The districts under each division are: Dacca Division: Dacca, Faridpur, Mymensingh, Tangail; Chittagong Division: Chittagong, Chittagong Hill Tracts, Comilla, Noakhali, Sylhet; Khulna Division: Khulna, Barisal, Jessore, Kustia, Patuakhali; Rajshahi Division: Rajshahi, Bogra, Dinajpur, Pabna, Rangpur. Below the district level are a total of 62 subdivisions, divided into 418 thanas, 4,351 union parishads, and 71,291 villages. The functions of the various governments have tended to shift with various governments (Kurian 1978:109).

The functions and powers of various local governments are established under central government laws, such as the Local Government Ordinance 1976, which, among other things, assigns functions such as sanitation and provision of water supply to Union Parishads. Some functions specifically stated are: sanitation, conservancy, and other measures for the cleanliness of the union; plantation and preservation of trees in general, and plantation and preservation of trees on public ways, public streets, and public places in particular; regulation of offensive and dangerous trades; adoption of measures for preventing the contamination of the sources of water-supply for drinking; provision and maintenance of wells, water pumps, tanks, ponds and other works for the supply of water; regulation or prohibition of the watering of cattle, bathing or washing at or near wells, ponds or other sources of water reserved for drinking purposes; regulation or prohibition on various industrial activities (dyeing and tanning, operation of kilns, and quarrying) within residential areas; and provisions for management of the environment. Parishads may also make bylaws in certain areas (including prevention and abatement of nuisances and regulation of dangerous and offensive trades) and levy certain taxes. All activities of local governments are under the surveillance of the central government, which is authorized to direct local governments to carry out certain measures and to suppress measures contrary to the provisions of the Local Government Ordinance.

In Dacca, the nation's capital, the Dacca Water Supply and Sewerage Authority is responsible for both the development of the sewerage system and the development of drinking water supplies.

#### 4.4 RESEARCH AND HIGHER EDUCATION

Research and education in the fields of environment and resources are provided by the organizations listed below. Three universities (Dacca, Bangladesh University of Engineering and Technology, and the Jahangir Nagar University) offer courses on the environment, while institutions such as the Bangladesh Council for Scientific and Industrial Research carry out research related to environmental matters.

There are reported to be manpower shortages, however, both on the technical and administrative levels in these fields. Public officials are said to be ill informed on environmental matters, the capacity for forestry and wild life management is limited, and insufficient agricultural extension facilities leads to the inappropriate use of both fertilizers and pesticides. (Dutch Bilateral...1980:12).

##### 4.4.1 UNIVERSITIES AND COLLEGES

##### 4.4.1.1 Bangladesh Agricultural University Mymensingh

Founded: 1961

Language of Instruction: English and Bengali

Students/teachers: 2,409/344

Faculty of Fisheries (Ocean Research Index 1976)  
Department of Fisheries Biology and Limnology

Department of Agriculture and Management

Department of Fisheries Technology

Faculty of Agriculture

Faculty of Animal Husbandry

Faculty of Agricultural Economics and Rural Sociology

Faculty of Agricultural Engineering and Technology

##### 4.4.1.2 Bangladesh University of Engineering and Technology Ramna Dacca

Founded: 1961

Language of Instruction: English

Students/teachers: 1,800;235

Faculty of Architecture and Planning

Faculty of Engineering

The Environmental Engineering Division of the Civil Engineering Department offers under-graduate and post-graduate courses in water supply, urban and rural sanitation, water treatment, water pollution, and waste treatment and disposal. The division also conducts research in these fields (Dutch Bilateral...1980:19).

Research areas: the University is involved in research on solar energy utilization and on bio-gas generation (Dutch Bilateral...1980:21).

4.4.1.3 University of Chittagong  
Chittagong

Founded: 1966

Language of instruction: Bengali and English

Students/teachers: 3,912/309(excluding 64 affiliated colleges)

Faculty of Education  
Faculty of Engineering  
Faculty of Law  
Faculty of Medicine  
Faculty of Science  
Faculty of Social Sciences  
Faculty of Arts  
Faculty of Commerce

Programs: the Department of Geography offers courses in the main branches of physical and human geography, including physical environment systems, population, and urban transportation (Dutch Bilateral...1980).

Attached Institute: Institute of Forestry

Among other things, the Institute has been studying mangrove ecology and mangrove management (Dutch Bilateral...1980:12).

4.4.1.4 University of Dacca  
Ramna  
Dacca

Founded: 1921

Language of instruction: English

Students/teachers: 68,032/825

Faculty of Arts  
Faculty of Commerce  
Faculty of Science  
Faculty of Law  
Faculty of Medicine  
Faculty of Education  
Faculty of Fine Arts  
Faculty of Social Sciences

Faculty of Biological Sciences

Within the Department of Zoology work is being carried out on parasitic diseases affecting fish and the effects of pollution on fish (Dutch Bilateral...1980:19).

Faculty of Post-Graduate Medical Sciences and Research

Environmental studies: Through its Institute of Environment Research (IER), the University performs work relating to the environment (Dutch Bilateral...1980:12).

4.4.1.5 Jahangirnagar University  
Savar  
Dacca

Founded: 1970  
Students/teachers: 920/132

Faculty of Social Sciences  
Faculty of Mathematical and Physical Sciences  
Faculty of Arts and Humanities

Environmental studies: The University is reported to offer courses in environmental matters (Dutch Bilateral...1980:12).

4.4.1.6 University of Rajshahi  
Rajshahi

Founded: 1953  
Students/teachers: 32,630/369

Faculty of Arts  
Faculty of Sciences  
Faculty of Law  
Faculty of Education  
Faculty of Commerce  
Faculty of Medicine  
Faculty of Engineering

Attached Institute: Institute of Bangladesh Studies

4.4.1.7 Other institutions providing scientific and technological training

Bangladesh Textile Institute  
Dacca

Chittagong Polytechnic Institute  
Chittagong (1,320 students)  
Founded: 1962

Dacca Polytechnic Institute  
Tejgaon Industrial Area  
Dacca

Institute of Leather Technology  
Dacca

Institute of Postgraduate Medicine and Research  
Dacca 2

**4.4.2 Scientific and technological research institutions under government agencies (autonomous agencies are marked with an asterisk\*)**

**4.4.2.1 Ministry of Agriculture and Forests**

Bangladesh Agricultural Research Council\*  
 Bangladesh Rice Research Institute\*  
 Bangladesh Agriculture Research Institute\*  
 Soil Fertility and Soil Testing Institute  
 Wheat Research Centre  
 Potato Research Station  
 Cotton Research Station  
 Tobacco Research Station  
 Horticulture Development Centre  
 Institute of Biological Control\*  
 Forest Research Institute

**4.4.2.2 Ministry of Fisheries and Livestock**

Directorate of Fisheries (Ocean Research Index 1976)  
 81 Kakrail Road  
 Dacca

Freshwater Fisheries Research Station  
 Chandpur, Comilla

The station conducts investigations on different aspects of carp culture and catfish culture, limnology and fertilization, water pollution, prawn and shrimp culture preservation, and processing of fish. The Centre has received a fisheries research vessel as a grant from Denmark to undertake fish population management studies and related ecological research in the rivers and other open waters (Bangladesh. Ministry of Finance 1977:119).

Fisheries Technological Station  
 Chandpur, Comilla

Marine Biological Laboratory  
 Veterinary Research Institute  
 Livestock Research Institute  
 Poultry Research Institute

**4.4.2.3 Ministry of Jute**

Jute Research Institute\*

**4.4.2.4 Ministry of Commerce**

Tea Research Station\*

**4.4.2.5 Ministry of Industries**

Sugarcane Research Institute  
 Jute Textile Research Institute  
 Bangladesh Industrial and Technical Advisory Centre  
 Sericulture Research Institute

**4.4.2.6 Ministry of Works and Urban Development**

Road Research Institute  
 Building Research Institute

**4.4.2.7 Ministry of Flood Control, Water Resources and Power**

Hydraulic Research Laboratory  
 Soil Research Laboratory

**4.4.2.8 Ministry of Health and Family Planning (Health Division)**

Bangladesh Medical Research Council\*  
 Cholera Research Laboratory\*  
 National Institute of Preventive Medicine  
 Institute of Diseases of Chest  
 Cancer Research Institute  
 Institute of Public Health and Nutrition  
 National Nutrition Laboratory  
 Institute of Post Graduate Medicine  
 National Institute of Population Training  
 Family Planning Welfare Visitors Training Centres (2)

**4.4.2.9 Ministry of Education**

Institute of Nutrition  
 Institute of Business Administration  
 Institute of Statistical Research and Training  
 Institute of Education and Research

**4.4.2.10 Ministry of Local Government, Rural Development and Cooperatives**

Bangladesh Academy of Rural Development  
 Comilla

**4.4.2.11 Ministry of Cabinet Affairs (Establishment Division)**

National Institute of Public Administration  
 Civil Officers Training Academy  
 Administrative Staff College

#### 4.4.2.12 Ministry of Science and Technology

Bangladesh Atomic Energy Commission

Bangladesh Council for Scientific and Industrial Research (B.C.S.I.R)

Mirpur Road

Dhanmandi

Dacca

Scope of activities: promotion, guidance, and co-ordination of all scientific and industrial research; financing of specific research schemes; utilization of research for industrial development; and establishment, maintenance and management of laboratories in Bangladesh. The B.C.S.I.R. is responsible for research on environmental effects of industrial development (Dutch Bilateral...1980:19).

Dacca Laboratories (10 divisions): Food, Technology, and Applied Nutrition; Natural Products; Glass and Ceramics; Fibre and Polymer; Fuel Technology; Leather Technology; Physical Instrumentation; Analytical; Industrial Physics; Engineering and Process Development

Chittagong Laboratories (5 divisions): Chemistry; Nutrition; Botany; Pharmacology; Microbiology

Rajshahi Laboratories (4 divisions): Lac Research; Oils, Fats, and Waxes; Fibres; Fruit Processing and Preservation.

#### 4.5 NON-GOVERNMENTAL ORGANIZATIONS

##### 4.5.1. Family Planning Association of Bangladesh

2, Naya Paltan

Dacca 2

##### 4.5.2 Wildlife Preservation Society of Bangladesh Karim Vills,

10 Elephant Road

Maghbazar, Ramna

Dacca 27

Member: IUCN

##### 4.5.3. Bangladesh National Geographical Association

Dacca

Publishes semi-annual Journal, with articles on soils, rainfall, and natural resources. Since 1973.

- 4.5.4 Soil Science Society of Bangladesh  
 Department of Soil Science  
 University of Dacca  
 Dacca  
 Founded: 1958  
 Publishes: Bangladesh Journal of Soil Science.
- 4.5.5 Zoological Society of Bangladesh  
 Department of Zoology  
 University of Dacca  
 Dacca  
 Publishes: Bangladesh Journal of Zoology
- 4.5.6 Bangladesh Academy of Sciences (not in World of Learning: 1978-79)  
 Dacca  
  
 Publishes the Journal of Bangladesh Academy of Sciences
- 4.5.7 Bangladesh Institute of Development Studies  
 Adamjee Court  
 Motijheel Commercial Area  
 Dacca 2  
  
 Founded: 1957  
 Performs basic research on development and provides training in socio-economic development and demography. Has a library of 43,300 books and 727 periodicals. Publishes The Bangladesh Development Studies, a quarterly journal, since 1973.
- 4.5.8 Bangladesh Volunteer Service  
 55 Dilkusha Commercial Area  
 Dacca 2  
  
 The organization is listed as part of the environmental education network of the Environmental Liaison Centre in Nairobi (EE Switchboard, no. 1, January/February 1978).

**4.6 MAB NATIONAL COMMITTEE FOR BANGLADESH**  
 (Source: List of MAB National Committees, July 1978)

**CHAIRMAN** Professor M. Innas ALI  
 Science Advisor to the President  
 c/o Ministry of Education  
 Bangladesh Secretariat  
 Dacca 2

**SECRETARY** Mrs. Tahira AHMED  
 Assistant Secretary  
 Bangladesh National Committee for Unesco  
 Ministry of Education  
 Bangladesh Secretariat  
 Dacca 2

**MEMBERS** Chief, Centre for Integrated  
 Environmental Studies for Development Planning

Head, Department of Marine Biology  
 Chittagong University

Dean, Faculty of Biological Science  
 Dacca University

Chief Conservator of Forests  
 Ministry of Agriculture

Division of Forests, Fisheries, and Livestock

Principal, Forest Research Institute  
 Chittagong

REPRESENTATIVES FROM;

Science and Technology Division  
 Ministry of Education

Commonwealth Human Ecology Council--Bangladesh

Water Development Board

University of Dacca

University of Rajshahi

University of Chittagong

Jahangirnagar University

Bangladesh University of Engineering and Technology

**Bangladesh Agricultural University**

**Bangladesh Agricultural University  
Mymensingh**

**Ministry of Petroleum and Mineral Resources**

**Planning Commission**

**B.C.S.I.R.**

**B.A.E.C.**

**Directorate of Meteorology**

**Geological Survey of Bangladesh**

**Directorate of Soil Survey**

**Fisheries Section  
Ministry of Agriculture**

**Livestock Section  
Ministry of Agriculture**

## 9.0 LEGISLATION DEALING WITH ENVIRONMENT AND NATURAL RESOURCES

The basic document under which Bangladesh has functioned as an independent nation has been the Constitution of 1972, which was amended in January 1975 to create a system which placed greater powers in the president, and which was subsequently changed by proclamation in April 1977 to reflect the Islamic character of the nation. A new constitution had been promised for 1979. The legal system of Bangladesh is based on English common law as adopted from the earlier British colonial regime. It could not be ascertained to what extent other more traditional legal systems are operative in the country.

Environmental legislation such as the Pollution Control Ordinance 1977 was drafted by environmental experts, processed by administrators and put in final form by the Ministry of Law and Parliamentary Affairs, which also bears responsibility, with the Environmental Pollution Control Board, for reviewing and recommending improvements in such legislation (ESCAP 1978:26). At least one major piece of resources legislation still in force in Bangladesh--the Forest Act of 1927--was promulgated during the period of British rule, and laws covering water usage also date from that era. Other legislation has been inherited from the state of Pakistan, of which Bangladesh formed a part until 1972.

The major piece of legislation for pollution control is the Environment Pollution Control Ordinance of 1977 (see 5.1.1 below). It is reported that a National Environmental Protection Ordinance is in preparation to replace this ordinance and to upgrade and cover all fields of environmental legislation (Dutch Bilateral...1980:2).

There is no legislation covering environmental impact studies, but the government has stated that such analysis is conducted as a "policy matter" (Hassan 1978:15).

As for legal education specifically touching on environmental issues, it was reported in 1978 that arrangements were being made to include environmental legislation in the syllabus of the law school in Bangladesh (Hassan 1978:13).

With regard to enforcement of environmental legislation, the government of Bangladesh, in response to a 1978 survey dealing with environmental legislation, reported that no cases had yet been adjudicated under environmental laws. Furthermore, there was at that time no government lawyer charged only with dealing with issues related to environmental management. As for the expected response of the people of Bangladesh toward environmental laws, the government reported that the society of Bangladesh "...is going to be rule-conscious and law-oriented day by day. Not yet" (ESCAP 1978:26).

## 5.1 General pollution control

### 5.1.1 The Environment Pollution Control Ordinance 1977

The Environment Pollution Control Ordinance is a 13-article framework law which provides the basis for the regulation of pollution of all kinds. It establishes the policy-making Environment Pollution Control Board (see 4.1.1.1) and enumerates its function and also sets up the Pollution Control Cell to implement the policies of the Board.

The Director of the Pollution Control Cell is empowered to:

- a) require any person or commercial or industrial undertaking to adopt such measures, including construction, modification, extension or alteration of any disposal system as may be specified therein for the prevention, control and abatement of existing or potential pollution of the environment;
- b) require any person, etc. to furnish such information as may be specified therein relating to wastes, sewerage system or treatment works in any land or building owned or occupied by such person or undertaking;
- c) require any person, etc. to permit any officer named therein to enter upon, inspect and search any land or building owned or occupied by such person or undertaking and to inspect and test any wastes, air, water, soil, plants, materials of disposal system found therein and to afford all reasonable opportunities to such officer for such inspection, search and test.

Orders issued to by the Director are to be complied with, although appeals against such orders may be submitted. The penalty for failure to comply with the orders is a prison term extending to one year or a fine of up to taka 5,000 or both; a further fine of taka 20 may be imposed for every day on which the offense continues (one taka=U.S. 6 cents as of Feb. 1979).

If the offending party is a commercial or industrial undertaking, every owner, director, manager, secretary or other officer or agent thereof is deemed to be guilty of the offense, unless he can prove that he made all efforts and exercised all diligence to prevent the commission of the offense.

## 5.2 Water Resources

### 5.2.1 Water resources and water use

#### Bangladesh Water and Power Development Boards Order, 1972

The Order establishes the Bangladesh Water Development Board (BWDB) and a Power Development Board to replace the East Pakistan Water and Power Development Authority.

The BWDB is to have "control over the flow of water in all rivers and channels of Bangladesh, subject to private rights, and the underground water resources of any region of Bangladesh." It may, with government approval, prescribe standards for the operation and maintenance of

all irrigation, embankment and drainage works, and may also prescribe simplification of methods of charges for the supply of water and for standardization of the supply system.

The BWDB is to prepare for the approval of the government, a comprehensive plan for the control of flood in Bangladesh and for the utilization and development of its water resources. The Board is authorized to frame schemes providing for: a) construction of dams, reservoirs and other works; irrigation, embankment, and drainage, bulk water supply to communities, and recreational use of water resources; b) flood control including watershed management; c) prevention of salinity and water congestion as well as reclamation of land; d) maintenance, improvement and extension of channels for inland water transport, including dredging of channels, except as such functions may be assigned to other agencies; e) regulation of channels to concentrate river flow for more efficient movement of water, silt, and sand. The BWDB may also direct the owners of private land to carry out measures for training of water courses passing through his land and to undertake anti-erosion operations including conservation of forests and re-afforestation.

The law also contains provision dealing with water rates and the funding of the operations of Board's operations.

#### Other legislation apparently still in force

##### The Bengal Irrigation Act 1876

#### 5.2.2 The Environment Pollution Control Ordinance 1977

The law covers pollution of all waters, including streams, coastal waters, tanks, lakes, ponds, reservoirs, marshes, watercourses, waterways, wells, springs, irrigation systems, drainage systems, and all other bodies or accumulation of waters, surface or underground, natural or public or private. (see 5.1.1 above for more detail).

A review of the situation in Bangladesh concludes, however, that because of lack of facilities, the country is "likely to experience difficulties" in implementing its programs under such legislation (Hassan 1978:22).

This law repeals the Water Pollution Control Ordinance 1970.

#### 5.2.3 Marine pollution

Bangladesh has no specific marine pollution legislation (Hassan 1978:22), but the Environmental Pollution Control Ordinance 1977 also extends to coastal waters (see 5.2.1 and 5.7).

#### 5.3 Soil and soil conservation

See provisions in the Forest Act 1927 and in the Bangladesh Water and Power Development Boards Ordinance, 1972.

#### 5.4 Forests

Bangladesh inherited the Forest Act 1927 (passed under the British colonial regime) from Pakistan; it has been altered in only minor points but has been supplemented by rules and procedures, reportedly adopted in 1973 (Hassan 1978:22). The rules could not be located for inclusion in this report.

##### Forest Act, no. 16, 1927

The act provides for three basic categories of forests: reserve forests, in which all activities are under the aegis of the forest department; village forests, in which a few activities are prohibited but all other rights are exercised by the community, and protected state forests, in which no activity is prohibited (see 2.5.3).

The Act also provides for regulation or prohibition in any forest or wasteland of: 1) clearing of land for cultivation; 2) pasturing of cattle; 3) firing or clearing of vegetation when it appears that this prohibition is necessary for a) protection against storms, winds, etc.; b) soil conservation on the ridges and slopes and in the valleys and hilly tracts; c) the maintenance of water supply in springs, rivers, and tanks; d) the protection of roads, bridges, railways, and other lines of communication; e) the preservation of public health.

The law also covers forest production, including duties on timber and forest produce, control of timber and other forest produce in transit; and the collection of drift and stranded timber.

Penalties under the act include imprisonment up to six months and fines of up to taka 500 or both.

#### 5.5 Wildlife

##### Wild Life (Preservation) Order 1973 , no. 23

The Order establishes a Wild Life Advisory Board with functions to be assigned by the government.

##### Protected animals

Three schedules of animals are appended to the order. Animals appearing in Schedule I, Part 1, are open to shooting and may be hunted on an ordinary hunting license. Animals appearing on Schedule I, Part 2 (mammals, reptiles and birds, population increase of which threatens the balance of nature of a particular locality or becomes a threat to public life) are those for which a special permit is required. Schedule II lists animals, trophies, or meat for the possession, transport, or import of which a certificate of lawful possession is required. These are 1) any live protected animal or game animals; 2) any trophy or meat derived from a protected animal; 3) horns, and tusks, etc. of deer, sambar, bison, gayal, gaur and elephants; and 4) skins of bear, otter, tiger, leopard, jungle cat, lizard, deer, sambar, pangolin, crocodile, and python. Schedule III animals are protected animals which are not to be hunted, killed or captured (see 2.6.2 for more detail).

In the interest of scientific or any public purpose, the Government may, by notification in the official gazette, allow the killing or capturing or any wild animal in particular places and by particular means.

### Hunting

Articles 6 through 22 cover conditions under which hunting and trade in animals, animals skins, and other animal produce may take place. Certain types of hunting (from vehicles, with the help of live decoys, etc.) are prohibited. It is not to be considered an offense: to kill a wild animal in self defense; for the owner of any standing crop to kill within the bounds of such crops, any wild animal causing material damage to such crops; for the owner of livestock to kill any animal causing damage to the livestock in any way within a reasonable distance of where that livestock is grazing or where it is kept for the night. Any animals killed under these circumstances belong to the government.

Hunting licenses are to specify minimum size, number of days on which hunting may take place, the number of animals to be taken, the sex of animals to be taken, etc.

### Sanctuaries, national parks, game reserves

Articles 23-24 provide for the establishment of wild life sanctuaries, national parks, and game reserves (see 2.5.3 for details). The Government, by notification in the official gazette, can declare any area as a wild life sanctuary, etc., and can modify the boundaries in a similar manner. Only such development are allowed within reserve areas as will not materially affect the ecology of the area.

### Penalties

Maximum penalties are imprisonment of up to one year and fines of up to Taka 2,000.

## 5.6 Fisheries

### The Bangladesh Fisheries Development Corporation Ordinance 1973

The Ordinance establishes the Bangladeshaesh Fisheries Development Coporation Ordinance with powers to, among other things: take measures for the development of fisheries and the fishing industry; establish the fishing industry; establish units for capture of fish and promote a better organization for exploitation of fish wealth; establish units for preservation, processing, distribution and marketing of fish and fish products; and undertake surveys and investigations of the fish resources.

## 5.7 Coastal zone management

A 1978 review of legislation dealing with the coastal zones, listed Bangladesh as "one of a large group of Asian coastal states which do not have any significant coastal zone management through legislation" (Hassan 1978:32).

### Territorial Waters and Maritime Zones Act 1974

The Act provides the declaration of: territorial waters; a contiguous zone to extend six miles from the outer limits of the territorial waters; economic zones; and conservation zones. The limits of the continental shelf are defined and its resources are declared to include mineral and other non-living resources.

Within those areas declared as conservation zones the government may "take measures...it may deem appropriate...including measures to protect the living resources of the sea from indiscriminate exploitation, depletion, or destruction." With regard to pollution the government may "with a view to preventing and controlling marine pollution and preserving the quality and ecological balance in the marine environment in the high seas adjacent to the territorial waters, take such measures as it may deem appropriate for the purpose."

Under this act the Government may make rules providing for, among other things: measures to protect, use and exploit the resources of the economic zone; conservation measures to protect the living resources of the sea; measures regulating the exploration and exploitation of resources within the continental shelf; measures designed to prevent and control marine pollution of the high seas.

Offenses against rules made under this act may be punished with fines of up to taka 5,000 or up to one year imprisonment.

## 5.8 Air pollution

### 5.8.1 The Environment Pollution Control Ordinance 1977

This is a framework law which covers all types of environmental pollution. Details of the law are provided under 5.1.1 above. "Air" in the law is defined as "the discharge into the atmosphere of foreign gases, vapors, droplets, and particles or of excessive amounts of normal constituents, such as carbon dioxide and suspended particulate matters produced by fossil fuels."

It is reported that under the ordinance arrangements are being made to regulate carbon monoxide pollution with the help of mobile laboratories (Hassan 1978:28).

### Other legislation

#### Bengal Smoke Nuisances Act 1905

## 5.9 Solid waste management

Under laws establishing local government bodies, solid waste management is a responsibilities assigned to local bodies and municipalities (Hassan 1978:31).

The Environment Pollution Control Ordinance 1977, however, also covers solid wastes which pollute or tend to pollute the environment.

### 5.10 Minerals and mineral exploitation

The mining laws of Bangladesh do not contain waste disposal provisions, nor do they require restoration measures (Hassan 1978:28).

#### The Mines Act 1923

The Petroleum Act 1974, no. 69: An Act to provide for the exploration, development, production, processing, refining and marketing of petroleum.

Petroleum is defined as any naturally occurring hydrocarbon, whether in a gaseous, liquid or solid state.

The Government is given the right to plan, promote, organize, and implement programs for exploration, development, exploitation, production, processing, refining, and marketing of petroleum.

Persons carrying out petroleum operations are required, among other things to: carry out operations in any area in a manner that does not interfere with navigation, fishing, and conservation or resources of the sea and sea-bed; consider factors connected with the ecology and environment. In particular, care is to be taken to control the flow and prevent the waste or escape in the exploitation area of either petroleum or water, etc.

#### The Bangladesh Petroleum Corporation Ordinance 1976

### 5.11 Pesticides

As of 1978, Bangladesh indicated that it had no legislation relating to the control of pesticides (Hassan 1978:39).

### 5.12 Radiation

#### Bangladesh Atomic Energy Commission Order 1973

"The functions of the Commission shall be to do all acts and things, including research work, necessary for the promotion of the peaceful uses of atomic energy in the fields of agriculture, medicine, industry, development of related technology and electronic equipment and appliances, and for the execution of development projects involving nuclear power stations and the generation of electric power thereat, and to carry out space and upper atmosphere research" (Article 6[1]). No specific mention is made of radiation control.

The Environment Pollution Control Ordinance 1977 also extends to the control of radioactive substances.

### 5.13 Land

#### 5.13.1 Land holdings

##### The Bangladesh Land Holding (Limitation) Order 1972, no. 98

The Order sets limits on land holdings: no family may hold any land in excess of 100 standard bighas (a bigha is about one-third of an acre) and must surrender land in excess of that amount to the government; no family may acquire land by any means which will bring the size of their land holdings above 100 bighas. Exceptions and conditions are stated.

#### 5.13.2 Land use and planning

There are no direct legal provisions for land use. Municipal corporations or statutory bodies handle various aspects of planning, mostly in urban areas (Hassan 1978: 19).

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