FAA 118 / 119 ANALYSIS*

CONSERVATION OF TROPICAL FORESTS

AND

BIOLOGICAL DIVERSITY

IN BANGLADESH

JULY 2005

*This report fulfills the planning requirements as set out by two provisions of the Foreign Assistance Act.
Section 118(e) "Country Analysis Requirements.--Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of-- (1) the actions necessary in that country to achieve conservation and sustainable management of **tropical forests**, and (2) the extent to which the actions proposed for support by the Agency meet the needs thus identified."
Section 119(d) "Country Analysis Requirements.--Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of-- (1) the actions necessary in that country to conserve **biological diversity**, and (2) the extent to which the actions proposed for support by the Agency meet the needs thus identified."

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1. INTRODUCTION

1.1 The Biophysical Setting

Bangladesh is situated at the downstream of the watershed of a sprawling inter-linked basin of three great river systems of the world – the Ganges, Meghna and Brahmaputra. Its extensive alluvial spread, rich water resources and biological diversity makes it one of the greatest natural resources and biodiversity regions anywhere. Yet, the country has one of the world's poorest populations. The situation presents an unacceptable paradox of poverty in the midst of plenty.

The total area of Bangladesh is 147,570 km^2, an area roughly the size of the state of Wisconsin and a deltaic geomorphology similar to the state of Louisiana. Bangladesh has the highest population density (about 900 persons per km^2) of any non-city state of the world. The estimated population of Bangladesh in 1998 was about 126.5 million, up from 90 million in 1981, have reached over 135 million in the year 2000, and may not stabilize before reaching 250 million. Almost half of the population lives below the poverty line. Although the current population growth rate is just under two percent – a drop from three percent only 20 years ago – this is still a major concern because of the density and size of the existing population. Population growth increases pressure on basic resources and environment.

1.2 **Poverty-Biodiversity-Livelihood Linkages**

Overall, a large and growing population, a heavily exploited natural resource base, and poverty are integrally related and fully linked to sustainable development and environmental enhancement. With more than 130 million people, a population growth rate of 1.48%, and a population density of 834 people per square kilometre, the pressure on the nation's natural resources is tremendous. Box 1 provides more information on the future trends of Bangladesh's populations and the natural resources on which it depends.

In Bangladesh, poverty is mainly rural, and mainly among natural resource dependent and landless communities. Rural headcount poverty is 53% compared to 37% in urban areas. 77% of rural households say they are at break even or deficit status. Within this bracket, 18% comprise the hardcore poor who are always in deficit. Those lives are totally dependent on the natural capital. Inequality is continuing to grow, especially between ultra poor and the rest of society. Rising income inequality has decreased poverty reducing potential (same level of growth has less impact on poverty). Natural capital, therefore, is central to poverty alleviation.

The status of resources is largely a function of management interventions that reduce degradation and increase productivity, of rights (property rights and others which affect incentives for stewardship) and markets. The ability to create wealth and alleviate poverty is a function of the productivity and status of the resource base, the structure of

control and access to resources and the functioning of markets. The functioning of markets is related to power structures (property rights) and the nature of resources.

Box 1. The Future Scenario

In the year 2020, the estimated population of Bangladesh will be 170 million and population density, 1118 per sq km. Seventy per cent of the country's land is currently under cultivation. Land resources for agriculture consist approximately of nine million hectares which renders a per capita figure of 13 persons per ha. With the population reaching 170 million by 2020, this figure will increase to 20 persons per hectare counting the possible loss of cultivable land to alternative uses like housing, urbanization, etc. The pressure of the rising number of people on finite amounts of land, water and other natural resources has already resulted in mounting deforestation (a reduction from 10 to 6 percent in forest cover) that may become irreversible within the next 20 years, rising salinity and water logging of cultivated land, declining water tables and soil fertility and high levels of erosion in the hills. The riches of floodplain fisheries and wetlands have all been depleting precariously, caused by both natural forces and human interventions. If the negative trends cannot be reversed, they could reduce the current levels of fish production by 12 – 14 per cent. If the current two per cent per year deforestation rate is not reversed at all, the country's forests will probably disappear totally by 2020, and with them vanish the centuries old heritage of biodiversity.

Source: Bangladesh 2020: A Long-run Perspective Study (The World Bank and Bangladesh Centre for Advance Studies, 1998).

Ecosystem services form the basis of human survival. They help to meet the livelihood needs of the farmers, fisher folk, forest dwellers, craft persons and others. So, *ecological security* and *livelihood security* in Bangladesh are critically dependent on biodiversity and its components. Biodiversity in Bangladesh contributes significantly to the country's economy. The people of Bangladesh depend on biodiversity for their day-to-day sustenance as well as overall livelihood security. For example, over 60 million people are dependent on aquatic resources everyday. One million people are full-time fisher folk and another 11 million have taken to part-time fishing in the country. Fifty to sixty-five per cent of the country's protein requirement is met by the consumption of fish. The fisheries sector contributes about 3.3% of the GDP of Bangladesh, earning more than 11% or more of the total export revenue, and employs 5% of the country's total work force (Parveen and Faisal, 2001). The agriculture sector provides 63.5% of the country's employment, contributing a considerable 24% to the GDP. Of the sector's contribution to the GDP, approximately 7.1% is covered by the forestry. The various forestry-related projects in the country together generate 90 million person-days of job opportunities every year. The Sundarbans provides livelihood and employment to an estimated 112,000 people (Khan, 2001).

The contribution of biodiversity in the primary sector is immense, because a lion's share of the employment and rural livelihoods lie within formal and informal industries. Above and beyond the statistics on the primary sector's contribution to the national economy lies another striking fact that is related to the existing national focus on land use. The wetlands have been historically considered as wastelands and conversion of those lands for agricultural and other uses have been a chronic practice. This has happened because

the country has been in dire need to increase agricultural production to feed the growing populace. Side by side, infrastructure and other development activities have contributed to the destruction of productive ecosystems, without giving any consideration to the economic and ecological value of these resources. According to a USAID/UNDP study, cost of inaction in addressing ecosystem degradation is extremely high; conversely, benefit of action may be extremely rewarding. Deforestation costs .47 to 1.5 percent of GDP (1991-92). Soil degradation costs .83 to 2.1 percent of GDP. These estimates did not even consider the economic valuation of all the products and the value of the ecosystem services. A conservative study in valuating the ecosystem production and services showed that the values of wetland economic outputs are much greater for a healthy ecosystem managed sustainably.

2. THE TROPICAL FOREST AND BIODIVERSITY SETTING

Bangaldesh is biogeographically a transition between the Indo-Gangetic plains and the eastern Himalayas and, in turn, part of the Indo-Chinese sub-region of the Oriental realm. About a thousand years ago Tirumula inscription of Rajendra Cola (1012-1044 AD) described *Vangaladesa* as a land "where the rainwater never stopped …… on the shore of the expansive ocean producing pearls and the *Ganga* whose water bearing flagrant flowers dashed against the bathing places" (Chowdhury, 1967, Khan, 1993). Due to its unique biophysical setting – the juxtaposition of a large deltoid freshwater outlet and a large sea fan – Bangladesh, despite its relatively small size, is endowed with a surprisingly rich heritage of plant and animal species. Bangladesh supports a diverse set of ecosystems, notwithstanding its relatively small geographical area. It is bounded in the north and the east by the eastern Himalayan and western Myanmar hills, which are centers of plant diversity as well as locations of many biodiversity hotspots (WWF and IUCN, 1994-1995).

2.1 Ecosystem Diversity

A broad range of ecosystem types are found in Bangladesh, including tropical rain forests, mangrove forests, floodplains and Charlands, freshwater and coastal wetlands, and the littoral, sub-littoral and benthic communities of the Bay of Bengal.

As in many parts of the world, very few ecosystems in Bangladesh are really free of human interference. Nishat et al. (2002) divided Bangladesh into 12 broad bio-ecological zones, shown in Figure 1. The ecosystems of Bangladesh can be placed under 4 broad types, viz., coastal and marine ecosystem, inland freshwater ecosystem, terrestrial forest ecosystem and man-made ecosystem (Daniels, 2003).

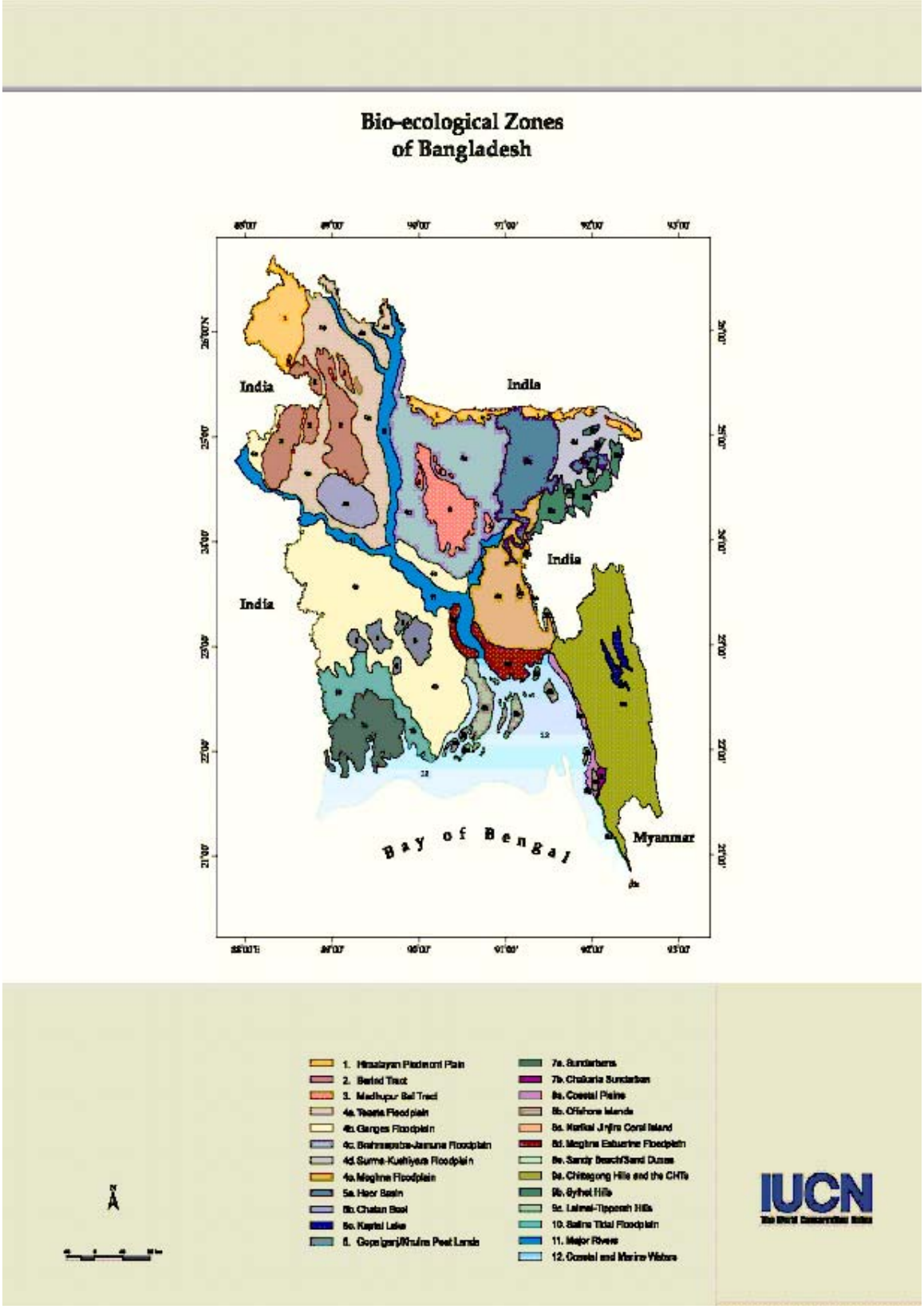


Figure 1. **Bio-ecological Zones of Bangladesh**

2.1.1 *Coastal/Marine Ecosystems*

Worldwide, Bangladesh is best known for its extensive coastal and marine ecosystems. The Sundarbans is of global importance as the largest mangrove forest in the world and the Cox's Bazar is distinguished as the world's longest beach. The Bangladesh Sundarbans is spread over an area of 7000km^2 of which 5770km^2 is classified as land and 1700 km^2 as waterbodies. It is one of the most diverse mangrove ecosystems of the world. Back in 1903, Prain had identified 334 species of plants in the Sundarbans, but currently, only 123 such species exist. Sundri (*Heretiera fomes*) and Gewa (*Excoecaria agallocha*) are the dominant species. The Sundarbans is currently the last abode of some of South Asia's threatened mega fauna including the Bengal tiger (*Panthera tigris*), Gangetic dolphin (*Platanista gangetica*), Irawaddy dolphin (*Orcaella brevirostris*), saltwater crocodile (*Crocodilus porosus*). In all, 425 species of vertebrate animals (excluding fish) have been reported from this ecosystem. Important birds include the masked finfoot (*Heliopais personata*) and the globally threatened lesser adjutant stork (*Leptoptilus javanicus*). The 176 species of fish that are known from the mangroves of the Sundarbans render this ecosystem one of the 'hot spots' of Bangladesh's fish diversity.

A large number of offshore islands are scattered in the Bay of Bengal. Narikel Jinjira (St. Martin's Island) is the only coral bearing island of Bangladesh, and therefore it is of significance in the context of coastal and marine ecosystems. Estuarine floodplains, sand dunes and beaches characterize the coastal ecosystems of Bangladesh. The Meghna floodplains of Noakhali and Lakshmipur districts are inundated by saltwater, seasonally, which attracts a wide variety of birds, including migratory ones. Rare species of birds including the Indian skimmer (*Rhynchops albicollis*) visit this ecosystem. The beaches and sand dunes also attract sea turtles. This extensive open water ecosystem extends southwards into the Bay of Bengal. The Bay of Bengal, the marine area of Bangladesh, is endowed with the presence of a semi-enclosed tropical basin. It is considered as a Large Marine Ecosystem. Along with the 710 km long coastline, an area of more than 166,000 km^2 of the Bay of Bengal falls under the economic jurisdiction of Bangladesh. The country's shelf area covers roughly 66,000 km^2 and coastal waters are shallow with less than 10 m depth covering about 24,000 km^2. Though the marine ecosystems have hardly been explored and investigated, some information on the species types and their interaction is available.

Nineteen species of seaweeds are found along Bangladesh's coasts. Among them, the *Hypnea spp*. is the most abundant. A total of 475 fish species have been recorded from the marine waters of Bangladesh. The fish species that are presently exploited consist mainly of the demersal fishes, shallow water estuarine species and some mid-water species. These include about 100 commercial species, of which 15 species are highly commercial, contributing about 75% of the total demersal exploitation. Generally, five species of marine turtles travel in the Bangladesh marine territory. Among them, the Olive Ridley is the major nesting species all over, from the Sundarbans to St. Martin's Island. Green Turtles nest only in a few places. St. Martin's Island is the only spot in Bangladesh where the Hawksbill comes to nest. The important species of sharks and rays

are also recorded. About 36 species of shrimps have been recorded from the marine waters of Bangladesh among which the brown shrimp *M. monoceros* contributes about 56% of the total shrimp catch.

The rich marine biodiversity not only directly contributes in maintaining the quality of the life and livelihood of the people of Bangladesh but also provide important resources base for the country. Around one million people are directly dependent on the marine resources for their livelihood.

2.1.2 *Inland Freshwater or "Open Water" Ecosystems*

The majority of the natural ecosystems of Bangladesh are wetlands. The floodplains of Bangladesh represent one of the world's most important wetlands – home to hundreds of species of fish, plants, and wildlife and critical habitat for thousands of migrating birds. Despite their uninviting appearance, the wetlands in Bangladesh had been the inexhaustible source of its wealth. The medieval travelers used to describe Bangladesh as a "hell full of bounties" (Ali, 1985, Khan, 1993). Bangladesh is endowed with an enormous network of aquatic ecosystems because of its location in the delta of three major rivers. The four million hectares of inland waters support an exceptional diversity of freshwater fish. There are an estimated 260 species of fin fish, as well as shrimps, turtles, snails, and other wetland resources. The Bangladesh fishery is the 3rd largest freshwater fishery in the world and the people of Bangladesh have an intricate, historical dependency on the floodplain system for their livelihood security.

Haors, *baors*, *beels* and *jheels* are commonly identified as freshwater wetlands in Bangladesh and they have the characteristics of four landscape units – floodplains, freshwater marshes, lakes and swamp forests. Floodplains are the areas that undergo periodic flooding as a river channel overflows with flood water. Freshwater marshes are more or less permanent shallow water dominated by reeds etc. Lakes, natural or man-made, are deeper waterbodies. Swamp forests develop in still water areas around lake margins. These landscapes do not necessarily occur in individual pattern; rather, often a wetland may contain a combination of several such units.

The *haors* in the north-eastern parts of Bangladesh are probably the most complex of seasonally inundated wetlands. They switch between a vast basin of water during the monsoon and a well-networked system of smaller wetlands including biecls and khals in the summer. Surface water is the most severely impacted natural resource in the country. The haor basin is known for its rich biodiversity. There is little doubt that the seasonally inundated wetlands are amongst the most productive ecosystems. Among the whole haors are Considering the ecological value of the haor, the Tanguar Haor has been declared a Ramsar site and an Ecologically Critical Area (MoEF, 1991, 2001). The largest haor in the country is Hakaluki Haor, which extends over 18,000ha during the rainy season, and consists of more than 80 inter-connected beels. The rich fish resources of Hakaluki support one of the largest inland fisheries in the country. Tanguar is an important "mother fisheries area", where many species breed during the rainy season.

Table 1. **Distribution of Wetlands in Bangladesh**

Type	**Area in hectare**
Permanent rivers and streams	480,000
Estuaries and mangrove swamps	610,000
Shallow lakes and marshes	120,000 – 290,000
Large water storage reservoirs	90,000
Small tanks and fish ponds	150,000 – 180,000
Shrimp ponds	90,000 – 115,000
Sesonally-flooded floodplains	5,770,000

Floodplains are the main location for agriculture in Bangladesh and are highly variable in the nature and depth of flooding. The flood plains situated close to the coasts are more influenced by the saline waters.

2.1.3 *Terrestrial Ecosystems*

Only 20% of the country's land area may be considered as terrestrial although large parts of the alluvial and coastal plains have been reclaimed for agriculture and human habitation over the years.

Hills: Of the terrestrial ecosystems, the hill ecosystem covers around 12% of the country's land area. Hills in Bangladesh are largely confined to the north, northeast and south-eastern limits of the country. The Chittagong Hill Tracts (CHTs) region is the major hill range of the country covering about 10% of the total land area. It consists of diverse landscapes from hills to water bodies. This region has unique landscapes and is also rich in flora and fauna. Botanically, Chittagong and Chittagong Hill Tracts are interesting. Phyto-geographically, it shows the admixture of Indo-Chinese floristic elements. There is no systematic account or comprehensive documentation of the flora of the region. It is noteworthy that despite having only about 10% of the country's land area, the Chittagong Hill Tracts possess one-third of the flowering plant species of the country. Although there are records of a large number of mammals in the region, at present, the only large mammals are the elephant (*Elephas maximus*), sambar (*Cervus unicolor*) and the almost extinct hog deer (*Axis porcinus*).

The Chittagong Hill Tracts are fascinating anthropologically too. It is the abode of at least 12 ethnic communities, namely, the Chakma, the Marma, the Tripura, the Tanchangya, the Khayang, the Chak, the Murong, the Pankhu, the Lushai, the Bawm, the Khumi and the Uchai possessing distinct cultures and life-styles.

The wide variety of plants and animals of the hill forests has supported the livelihoods of the hill people including dwelling, food, clothing, health care, festivals and other activities. These interactions between plants and people in the CHTs like other mountain and forested regions of the world helped develop a close linkage between them.

The hill ecosystem of Sylhet, representing 9% of the country's hills, is generally of the low elevation type. The vegetation of the hill forests has generally been classified as tropical evergreen and semi-evergreen.

Undulating Terrain: The northern undulating terrain ecosystem is part of the Himalayan Piedmont Plain Bio-ecological Zone (Nishat et al., 2002). The largest concentration of the ecosystem is in the northwest in the Tentulia-Panchgarh regions, spreading as a narrow corridor further eastwards through Jamalpur, Netrakona, Sherpur and Sunamganj along the Bangladesh-India border till about northern Sylhet. Together the Piedmont Plains may cover an area of about 6000km^2. Being an ecotone between the hills and the lowland swamps, this ecosystem is rich in biodiversity.

The Pleistocene Terraces: The Barind Tract is locally known as *Barendra Bhumi*. It is situated in the upper half of north-western Bangladesh, covering an area of 7728km^2. The original vegetation cover of the Barind Tract was dominated by the sal (Shorea robusta) and semi-evergreen species. Presently, the tract is dominated by scrubs resembling that in the semi-arid tracts. Over 260 species of birds and 40 species of mammals are known from this ecosystem. The highlands of Madhupur spread across the districts of Gazipur, Tangail and Mymensingh. Sal forests cover approximately 240km^2 of the Madhupur tract. Nineteen species of mammals, more than 170 species of birds and 28 species of reptiles are known from the Madhupur forest ecosystem.

2.1.4 *Man-made Ecosystems*

In Bangladesh, human beings have extensively modified aquatic and terrestrial ecosystems. Wherever the impact has been long-standing and sustained, the present biodiversity that inhabits the landscape has become so different that it is no longer possible to treat the ecosystem at par with any of the known natural types. Such ecosystems vary from small aquaculture ponds to large lakes as the Kaptai reservoir and amongst the terrestrial ones; they vary from the many kinds of agro-ecosystems in the hills and plains to those in rural homesteads and urban campuses. Man-made ecosystems are the home to a large number of domesticated plants and animals including plant cultivars, crops (cereals, pulses, vegetables, fruits, etc) ornamental plants, livestock, pets and fish.

2.2 Species Diversity

2.2.1 *Wild Plant Diversity*

The country has a wide range of local varieties of legumes, fruits and vegetables. The number of species of non-flowering plants excluding algae (bryophytes and pteridophytes) is still not completely known. Many species are disappearing even before they are known. Khan et al. (2001) have listed 106 species of plants as endangered including 2-3 species of ferns, 4 species of gymnosperms and the rest, angiosperms. Of these, the palm *Corypha taliera* has been considered as 'critically endangered'; the last

surviving individuals of the species in the whole world are limited to Bangladesh. Table 2 shows estimated numbers of species of wild plants in Bangladesh.

Table 2. **Recorded and Estimated Number of Wild Plant Species of Different Plant Groups**

Categories	Recorded	Estimated
Algae	3,600	6,000
Bryophytes	290	400
Pteridophytes	200	250
Gymnosperms	5	5
Angiosperms	3,000	5,000

Source: Hassan (2003)

2.2.4 *Wild Animal Diversity*

Though least known, the invertebrates form a major bulk of the faunal diversity, particularly aquatic invertebrates. Scanty information is available, mostly in scattered literature. A tentative number of taxa under invertebrates including zooplankton and protozoa, and vertebrates are provided in Table 3. Monera and Protista have also been included.

Table 3. **Number of Animal Species Belonging to the Major Taxonomic Groups**

Major Taxonomic Group		Number of species mentioned in this document
Monera (Eubacteria, etc.)		166
Protista (Protozoan, Viruses, etc.)		341
Animalia: Invertebrates	Poriferans	7
	Cnidarians	68
	Platyhelmiths	23
	Nematodes	105
	Annelids	62
	Arthropods	1547
	Molluscs	347
	Echinoderms	6
Animalia: Vertebrates	Fishes	735
	Amphibians	23
	Reptiles	136
	Birds	778
	Mammals	125
Total Species		**4,469**

Source: Rashid (2003, 2004)

The status of the various groups of vertebrates determined based on the numbers of threatened species and modified IUCN categories (IUCN-Bangladesh, 2000) are shown in (Figure 2).

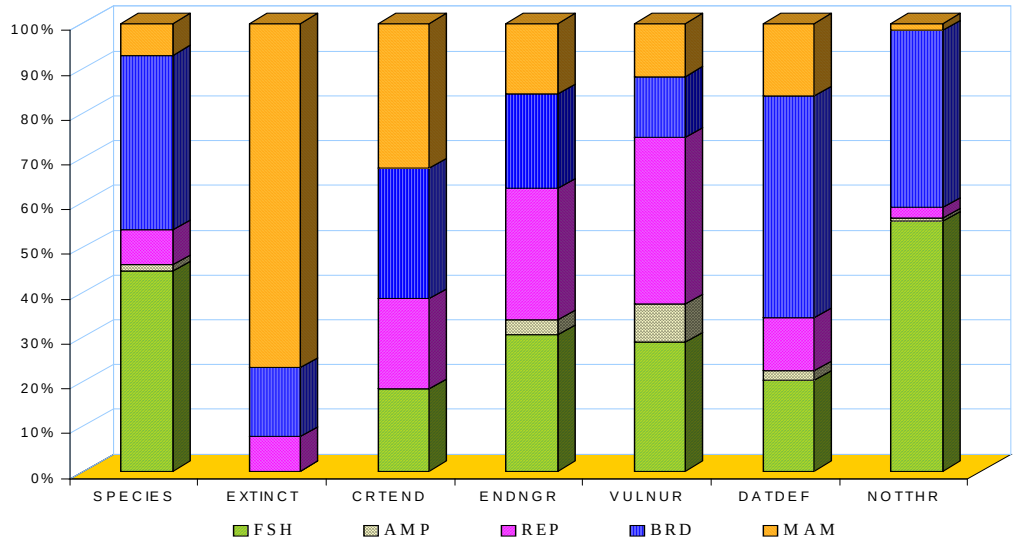


Figure 2. **Status of the various groups of vertebrates determined based on the numbers of threatened species and modified IUCN categories (IUCN-Bangladesh Red Data Book, 2000). (MAM-Mammal, BRD-Bird, REP-Reptile, AMP-Amphibia, FSH-Fish, CRTEND-Critically Endangered, ENDNGR-Endangered, VULNER-Vulnerable, DATDEF-data Deficient, NOTTHR-Not Threatened).**

2.2.5 *Invasive Alien Species*

Decision VI/23 of the Sixth Conference of the Parties (COP6) of the CBD, defines "Invasive Alien Species" as alien species whose introduction and/or spread threaten biological diversity.

Plants: Hassan (2003) and Hossain (2004) provide a long list of alien and invasive alien plant species found in Bangladesh. Invasive alien species (IAS) compete and suppress the survival of native species, rendering habitats vulnerable to fire and deterioration. Important IAS in Bangladesh are the following (Hossain and Pasha, 2001):

Eichhornia crassipes (Kachuri pana)
Eupatorium odoratum (Ayapan)
Mikania cordata (Assam lota)
Croton bonplandianum (Bon khira)
Lantana camara (Nak phul)
Leucaena leucocephala (Teli kadam)
Acanthospermun hispidum (Katahara)
Cassia occidentalis (Kasundi)
Ageratum conyzoides (Goat weed,ghag)
Alternanthera flocoidea (Hechi)
Atylosia scarabaeoides, Commelina obliqua (Jotakansira)
Convolvulus arvensis, Evolvulus nummularius (Bhuiokra)

Hyptis suaveolens (Bon topma)
Ipomea carnea (Dolkalmi)
Ludwigia adscendens (Keshordham)
Mimosa pudica (Lajjaboti)

Eichhornia crassipes (Kachuri pana) is a notorious weed of fresh water ecosystems; *Eupatorium odoratum* (Ayapan) and *Mikania cordata* (Assam lota) are two invaders of terrestrial ecosystems that overtop the canopy of shrubs and young tree saplings. *Croton bonplandianum* (Bon khira) and *Lantana camara* (Nak phul) grow along the edges of forest and waste lands and invade local vegetations.

Animals: Little information is available on invasive alien animal species in Bangladesh, although Rashid (2004) has given a brief review on this subject. The introduction of alien species of fauna, particularly fish, started in the early 1950s. The decision to introduce the alien species was primarily to increase productivity. Rashid (2004) reports that these decisions were either whimsical or deliberate and mentions that so far least 32 fish species have been introduced in the country. The impact of alien species on indigenous species has not yet been thoroughly studied. Among the exotics, tilapia, consisting of two species, *Oreochromis mosambicus* and *O. niloticus* are of greatest concern because these species have invaded all available habitats, including estuaries (Rashid, 2004).

2.3 Genetic Diversity

According to a study by the International Center for Integrated Mountain Development (ICIMOD), about 5,700 species of angiosperms are available in Bangladesh. Wide genetic variations occur in plants and animals both in wild and cultivated/domesticated states and the diverse agro-ecosystems of Bangladesh are rich in genetic resources of plants and animals. Local communities have selected and conserved genetic variations in plants and animals in the various agro-ecological zones for centuries. More recently, there have been organized efforts in preserving the domesticated biodiversity by both governmental and non-governmental agencies, which have built up large germplasm collections.

Plants: Domesticated plants in Bangladesh range from rice and millets to tubers such as *Dioscorea* (yam), *Colocasia* (taro), *Ipomoea batatus* (sweet potato), legumes, oil seeds, vegetables, fruits, spices and fiber (cotton and jute) (Haque, 2003). The greatest diversity in any crop is that which is known in rice (*Oryza sativa*). Six thousand varieties of rice are known to have existed in the country (Khan, 1997, Hassan, 2003, Haque, 2003, Hossain, 2004, Yusuf, 2003).

Animals: Domesticated animal biodiversity in Bangladesh is largely limited to livestock. To a very small extent, dogs, cats and ornamental fish contribute to the diversity. Other than these, there are domesticated pigs in the tribal settlements in the hills. A number of fish species are cultured throughout the country. Livestock population in Bangladesh is around 164 million comprising chicken 60%, ducks 18%, cattle 13%, goats 8%, sheep

1% and buffalo 0.4%. Essentially, poultry dominates the livestock scene (78%) (Kamaruddin, 2003).

3. CURRENT TROPICAL FOREST AND BIODIVERSITY STATUS AND TRENDS

Around 100 of the estimated 6000 vascular plant species in Bangladesh have been listed as threatened to date (Khan et al., 2001). Many others, especially medicinal plant species, are facing great pressure due to loss of habitat and indiscriminate exploitation. About 220 species of vertebrates, including fish, amphibians, reptiles, birds and mammals, have been listed in the Red Data Books of Bangladesh as they are faced with the threat of extinction. An analysis of past and present trends in animal extinctions and population declines suggests that species that are dependent on aquatic ecosystems are more vulnerable. In contrast, among plants the most threatened species are those found in terrestrial forests, where endemicity is also highest.

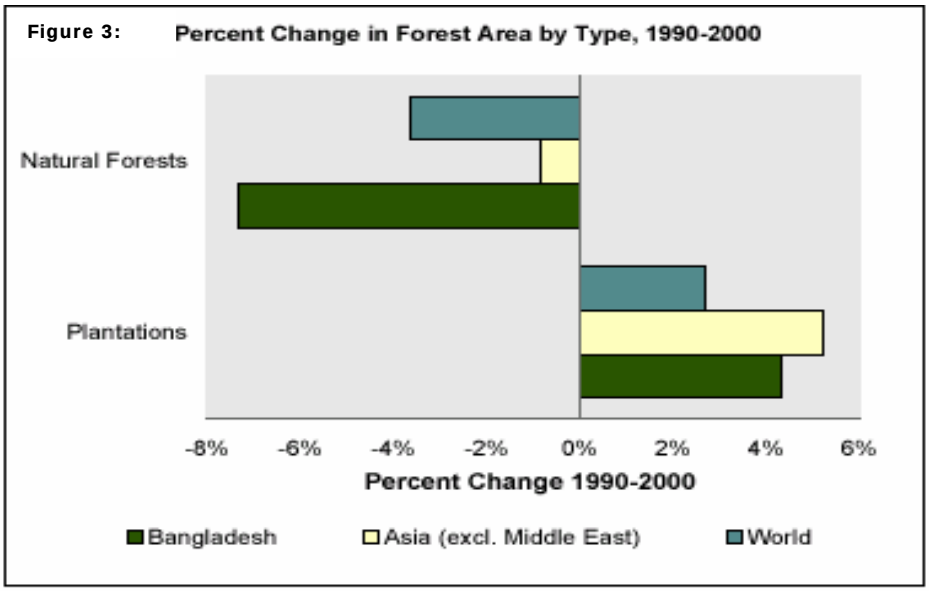
The important role of biodiversity in the economy of Bangladesh is quite evident and irreplaceable as discussed earlier. Unfortunately, due to the various pressures of development interventions, gaps in policy and legislation, and conflicting institutional mandates, vast portions of the major ecosystems have been lost or degraded in the recent past. Many species have been lost during the last 100 years, including a large number of mammals such as, the rhinoceros, gaur, banteng, swamp deer, wolf, nilgai and birds such as, the peafowl, pink-headed duck and at least one reptile--the marsh crocodile.

Forests represent one of the major sectors of renewable resources in Bangladesh, yet these forest resources are also among the most vulnerable. Under the management of the Forest Department (FD), there are three main types of forests in three separate zones: (1) tropical evergreen or semi-evergreen hill forests in southeastern Chittagong, Chittagong Hill Tracts, and northeastern Sylhet district; (2) deciduous forests in central Bangladesh; and (3) tidal mangrove forests, including the Sunderbans, in the southwestern Khulna district and the southern coastal belt. The hill forests account for 47 per cent of the forest area and supply around 40 per cent of the commercial forest production.

Reliable, up-to-date statistics on the quantity and quality of tropical forest cover in Bangladesh are hard to come by and contradictory figures are the norm rather than the exception. Recent order of magnitude data suggests that there are about 2.6 million hectares (covering 18 % of the total land surface) in the country. They include: state forest land of 2.2 million hectares composed of 1.3 million hectares of natural forests and plantations (there are extensive plantation areas on reserved forest land, particularly in the hilly regions of the country) under the jurisdiction of the Forest Department and about 0.9 million hectares of unclassified state forest administered by the Ministry of Lands (Gain, 1998). The remainder of the forest cover is in private hands, notably including the very successful homestead plantations common across the flood plain areas of the country and small tracts of natural forest and plantations on estate lands. With the exception of some of the most inaccessible areas (e.g., in the Sundarbans Reserve Forest and in the Hill Tracts), all of the remaining natural forests are reportedly under constant

pressure, have been significantly degraded and fragmented, thereby threatening their value as habitat for biodiversity conservation.

The dire situation in the forestry sector is illustrated in Figure 3. The rate of forest loss in Bangladesh has exceeded 7% in the 1990s, far exceeding the average for Asia, and even the global average. The compensatory rate of plantation establishment is insignificant, as Figure 2 shows percentage changes, and the baseline for plantation area is tiny. In any case, plantation establishment virtually never takes account of biodiversity issues.



Source:http://earthtrends.wri.org

The establishment of Protected Areas as a tool to combat deforestation has not yet had a detectable effect. The 18 localities that have been brought under the different types of Protected Areas, and which range in size from only 0.5 to 420 km^2, are not fully representative of terrestrial forest ecosystems. For example, the 300-odd wild elephant population which is largely confined to the hills of Chittagong region is not protected. The Biosphere Reserve concept, which would seem to be especially relevant to Bangladesh, has not been introduced to the country.

Even though the Ganges, Meghna and Brahmaputra carry a huge quantity of water, availability of fresh water will be the greatest challenge in the new millennium. The fragility of the Himalayan ecosystem and lack of a cooperative planning coupled with deforestation at the upper riparian and anthropogenic interference in surface water flow in all the basin countries have led to serious ecosystem degradation as well as water quality deterioration. Surface water availability in the region in general, and in Bangladesh in particular, is therefore a potpourri of excess and scarcity in the wet and dry seasons, respectively. Poor surface water distribution and the unavailability of surface water during the dry season to maintain critical ecosystems' health and, in turn, maintaining sustainable ecosystem production is the most critical environmental challenge facing

Bangladesh. This will pose tremendous consequences on the aquatic biodiversity resources of the country.

The floodplains of Bangladesh have been largely converted to rice production or used as source of fish and prawn. With an annual catch of almost 500,000 metric tons of fish and prawn, the floodplains and wetlands serve as an important source of income for millions and for the poorest members of the community, are a crucial source of nutrition and income. As a result, during the last several decades, the quality and quantity of the country's inland capture fishery has declined. Natural production has stagnated and even decreased for some species. For example, spawning of the commercially important native carps is estimated to have declined by 26% per year between 1986 and 1992. Per capita fish consumption has declined drastically. Price increases of fish in real terms have occurred at the rate of 2.8% per year and some sources have stated that open water fish supplies used to supply 80% of the animal protein consumed; it now supplies below 60%. Deterioration of the fisheries has been attributed to a number of anthropogenic and natural factors.

These impacts have a serious and direct eroding impact on the food security, nutrition and income of the poor people of Bangladesh. On top of this physical shrinkage of floodplain habitats, poor people's right to the open water and its resources has been gradually compromised by tenure and policy issues such as restrictions of access. Poor fishermen, who are the most dependent on open-capture fisheries, have lost access to the open water wetland, as private leases have become more common. Also, the increased commercial activity in the open water areas has led the water-bodies to become degraded as more emphasis is put on extracting high profits in short periods of time. The fishery sector can be sustained only if the major aquatic ecosystems are sustainably managed. The most important freshwater ecosystems are the haor, beel and baor. Unfortunately, however, these have not been adequately protected to date. The nearly 200 km^2 of this ecosystem that has been declared as 'Ecologically Critical Areas' need effective rules to be introduced. The Tanguar haor that has been declared as a Ramsar Site needs a sound management plan urgently if it has to be sustainably utilized.

Traditional systems of agriculture and the associated biodiversity are rapidly eroding due to the large-scale indiscriminate introduction of cash crops and plantations, high yielding varieties of crops and lack of incentives. The all pervading deteriorating trends in knowledge and conservation of traditional crops and domesticated livestock are not limited to the hills only. Indiscriminate use of fertilizers and pesticides, crossing of exotic livestock with indigenous breeds, and introduction of invasive alien species (IAS), especially fish have all accelerated the erosion of the country's conservation traditions.

Among the positive and redeeming trends, Bangladesh has been attracting global attention due to its civil society organizations and NGOs working on issues related to sustainable development.

4. TROPICAL FOREST AND BIODIVERSITY CONSERVATION: GOVERNMENT OF BANGLADESH POLICIES, PLANS AND ONGOING ACTIVITIES

4.1 Policy and Legislative Actions

Bangladesh has over a hundred laws that deal with various aspects of environmental issues, the most relevant of which are discussed here.. Concern for biodiversity assets in the country date back to colonial times– the **1879 Elephant Preservation Act** and the **1912 Wild Bird and Animals Protection Act**. These regulations were repealed in 1973 when the Government passed the **Wildlife (Preservation) Act**. The GOB has established in 1989 an independent Ministry, the Ministry of Environment and Forest (MOEF), to oversee environmental issues. The **Bangladesh Environmental Protection Act – ECA (1995)** followed by formulation of the **Environmental Protection Regulations (1998)** to set out the rules and regulations for compliance and enforcement. The ECA is currently the main legislative framework document relating to environmental protection. The main objectives of the ECA are focused on conservation and environmental protection, and controlling and mitigating pollution. ECA includes provisions for declaring Ecologically Critical Areas and providing restrictions on the operation and actions, which can be carried out in these areas. ECA also provides for the formulation and declaration of environmental guidelines and the regulation of pollution. The Department of Environment, a new and relatively weak department under the Ministry of Environment and Forests, has been assigned responsibility for implementing the ECA.

The **Environment Policy and Implementation Plan (1992)** emphasises the conservation and development of fisheries and the evaluation of any projects likely to impact on these resources. The **Land Use Policy (2001)** identifies issues of water body loss and degradation and emphasises the need to harmonise national agricultural and fisheries policies in order to avoid conflict and simultaneously increase agricultural and fisheries production. The policy also recognizes the perilous situation of deforestation and land degradation in terrestrial ecosystems.

Adopted in 1999, the **National Water Policy** puts emphasis on river basin management, water rights and environmental considerations. The **New Fisheries Management Policy (NFMP)**, instituted by the GOB in 1986, aims to restore access to the poor by transferring water bodies from the leasing system to a licensing system on an experimental basis in some selected water-bodies.

4.1.1 Recent Developments

Adding to the policy conflicts that already exist, one new Act and one new Policy have been proposed. The Ministry of Water Resources has enacted the **Conservation, Restoration and Filling Control Act of 2003, for Rivers, Canals, Flood Plains and**

Aquifers. The Act has been proposed "since within the country's geographic border natural resources such as water resource; development, flood control and environmental pollution control and maintaining balance is necessary, so a law concerning restoration and control of filling of all rivers, canals, flood plains, natural aquifers etc needs to be developed".

The Ministry of Water Resources proposed yet another new policy named as the **Coastal Zone Policy**. The Government considers the following three reasons for initiating the coastal zone policy:

- the coastal zone is lagging behind in socio-economic developments on many aspects;
- Poor initiatives to cope with different disasters and gradual deterioration of the environment;
- the coastal zone has the potential to contribute much to national development.

The objectives of this policy are mainly:

- to consider the coastal zone as a special management area;
- to present a framework for integrated planning acceptable to all; and
- to create an enabling institutional environment.

4.2 Commitment towards International Treaties and Conventions

Bangladesh has signed, ratified, and accessed 27 international conventions and protocols related to environment and development. Bangladesh is one of the signatories of the **United Nations Framework Convention on Climate Change (UNFCCC or Agenda 21, 1992)** and the **Kyoto Protocol (1997)**. Signed also in 1992 in Rio, the objectives of the **Convention on Biological Diversity (CBD)** to conserve biodiversity and promote sustainable use of its components, establish protected areas, integrate biodiversity in national plans and policies, protect traditional cultural activities, and a fair and equitable sharing of the benefits arising out of the use of genetic resources. Since signing the CBD, biodiversity issues have received some attention in a variety of sector policy and strategy documents since that time. Bangladesh has also been a participant in earlier global conservation initiatives before "biodiversity" became the watchword of the day. The country has ratified the **1971 RAMSAR Convention** (Convention on Wetlands of International Importance, especially as Waterfowl Habitat) on wetlands of international importance and waterfowl habitat, and as a party has taken steps to stem the encroachment and loss of wetlands. Bangladesh signed the **1972 Convention concerning the protection of World Cultural and Natural Heritage**. In a related development in ratification, the GOB has declared parts of the Sunderbans mangrove forest as a "World Heritage Site," helping ensure the protection and sustainable management of this globally important wetland forest. Bangladesh signed and ratified the **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)** in 1981 and 1982 respectively.

4.3 National Strategy and Action Plan

To implement the recommendations of Agenda 21 and address its environmental problems, Bangladesh developed developed the *Bangladesh National Environmental Management Action Plan – NEMAP (1996)* – is a product of a participatory process led by NGOs with participation by grassroots people. Bangladesh has also prepared a *National Climate Change Action Plan* and the *National Communiqué*.

The theme of biodiversity conservation is discussed in the 1995 National Environmental Management Action Plan (NEMAP), the 1997 National Conservation Strategy, and the 2000 ADB Environmental Operational Strategy. The *Bangladesh Forestry Master Plan (1994-95)* provides detailed guidelines and recommendations for developing a protected area system in Bangladesh. It includes a forestry biodiversity conservation plan. The Master Plan, however, is yet to be implemented. The legislation providing for the establishment and management of protected areas in Bangladesh (*The Wildlife Conservation Act, 1974*) puts aside areas of "outstanding scenic and natural beauty with the primary objective of protection and preservation of scenery." The most recent development towards forestry and forest biodiversity conservation is declaration and inauguration by the GoB of Eco-Parks.

In the *GOB Fifth Five Year Plan (1997-2002)*, there is a commitment on the part of the government to the implementation of International Conventions and Protocols related to the environment, as well as other national policies and plans approved by the GOB.

4.3.1 Recent Strategic Developments

Interim Poverty Reduction Strategy Paper (iPRSP, 2003) and the Poverty Reduction Strategy Paper (PRSP, 2004): The Government of Bangladesh prepared in 2003 the iPRSP – a broad policy framework for national development in which the natural resource base, the sources and means of economic growth and the mechanisms for meeting defined social and human development objectives , to an extent, clearly set out. Environment, in the iPRSP, was not considered a sector as such, but there was a short section (Section H) on 'Caring for Environment' at the end. That section clearly outlined:

- the intimate relationship between poverty and environment,
- national dependence upon sustainable utilization of natural resources, and the need to integrate environmental issues into the sectoral poverty reduction strategies.

However, environmental issues were not fully integrated into the rest of the document, and there was not a clear expression of how environmental issues should be addressed. Moreover, the only agenda in the Medium Term Policy Matrix for 2004-6 (Table 6) was to 'integrate environmental conservation into the national development strategy'. The concept was a welcome one, but again, the approach to environmental management should have been much more fundamental and broader than *conservation* alone.

The LCG Environment Subgroup worked with the concerned PRSP Thematic Group and provided substantial input to include environmental concerns into the main PRSP. USAID played a pivotal role in this process and worked closely with the LCG to make sure the environmental concerns are duly reflected in this important document. With funding from the Canadian International Development Agency (CIDA), a consultant team was deployed. The team assessed the iPRSP from an environmental perspective under the four criteria specified by the World Bank. As a result, the draft PRSP, released by the GOB in December 2004, reflects the concerns in a greater and more forceful manner.

Fisheries Sector Review and Future Development Study (2003): Almost every person in Bangladesh has a connection with the country's fisheries resources, whether catching or producing fish, supplying markets or services, or as a consumer. A growing export sector is also contributing substantially to the national economy. The review was set out to provide a strategy for fisheries, to enable priorities to be established, and to explain how investment can be placed to best effect. The review considered the facts that around one million people are estimated to fish full time, and 11 million are involved part time – and four out of every five rural dwellers are dependent to some extent on aquatic resources. These resources, from both capture fisheries and aquaculture, are estimated to supply between 60% and 80% of the animal protein needs of the country, as well as being a key source of essential minerals, vitamins and fatty acids, vital factors in child development and adult health. While recognizing that the future can be positive, it was identified that there was a clear need of a new strategy, and the future must be well guided. The review came up with a number of convincing recommendations.

National Biodiversity Strategy and Action Plan (NBSAP) (2004): Bangladesh has an obligation to develop its national strategy and programs or plans for conservation and sustainable use of biodiversity resources. Just recently, the Ministry of Environment and Forests (MOEF) with the collaboration of IUCN/Bangladesh and funding support from UNDP/GEF, Bangladesh has prepared in 2004 the *National Biodiversity Strategy and Action Plan (NBSAP)*. This initiative was taken to comply with the requirement for such a plan for each country signatory to the CBD. The overall goal of the NBSAP has been worked out as to conserve Bangladesh's biological diversity in order to ensure that its various components are utilized in a sustainable manner for attaining progress and socio-economic development of the nation and ensuring livelihood security of the people for present and future generations.

Draft Inland Capture Fisheries Strategy: Very recently, following the Fisheries Sector Review, the Department of Fisheries has drafted an "Inland Fisheries Management Strategy" based on the understanding that the management of the inland capture fisheries must balance a diverse set of demands on the resource. These demands come from various policies that are conflicting in their objectives:

- Maximizing production or managing the resource, ensuring its ability to naturally recruit and to conserve its biodiversity.
- Managing access for the wider community reliant on fisheries, or to generate maximum revenue for the government through the lease of water bodies.

The broad objective of the strategy is, "To promote biologically sustainable management of the Inland Capture Fisheries for the local fishing and user communities through collaboration of all concerned partners". The strategy correctly identified the key issues for conservation, management and exploitation of fish from inland capture fisheries. The strategy is an extremely positive move on part of the GOB towards a pragmatic approach in open water management.

4.4 Tropical Forest, Biodiversity and Ecosystem Conservation Systems

4.4.1 Protected Tropical Forest Areas (National Park, Wildlife Sanctuary and Game Reserves)

Recognizing the perilous situation of natural forests in the country, the Forest Department has established a series of protected forest areas (distinct from gazetted forest reserves), including 7 national parks, 8 wildlife sanctuaries and 1 game reserve (Figure 4). Table 4 provides a listing of these areas and a range of data and information about them. These are defined in the Act as:

- "Game Reserve means an area declared by the Government as such for the protection of wildlife and increase in population of important species where capturing of wild animals shall be unlawful".
- "National Park means comparatively large areas of outstanding scenic and natural beauty with the primary object of protection and preservation of scenery, flora, fauna in natural state to which access for public recreation, education and research may be allowed".
- "Wildlife Sanctuary means an area closed to hunting, shooting or trapping of wild animals and declared as such under Article 23 by the government as undisturbed breeding ground primarily for the protection of wildlife inclusive of all natural resources, such as vegetation, soil and water".

Figure 4. **Protected Natural Tropical Forest Areas of Bangladesh**

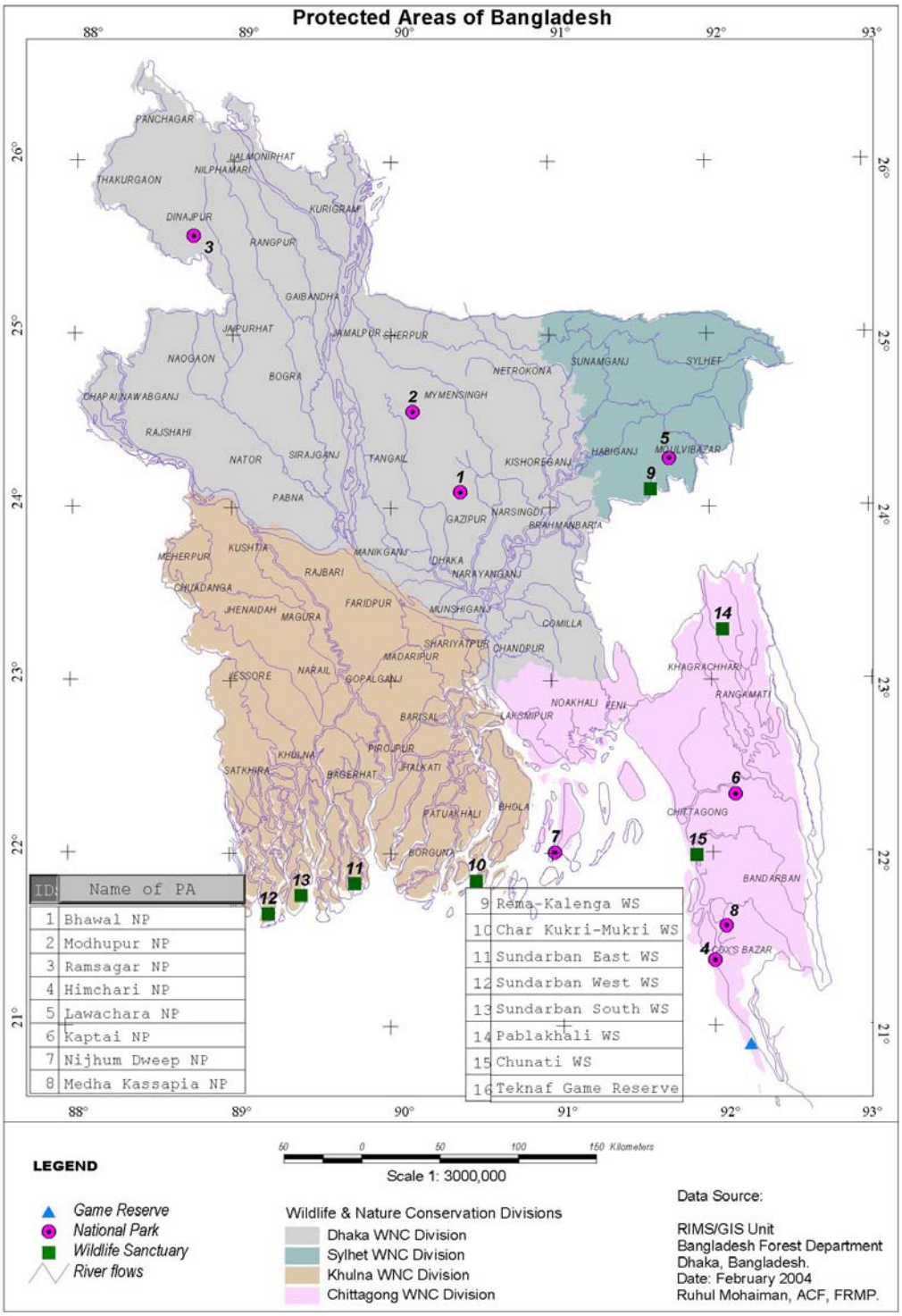


Table 4**. A Synopsis of the Protected Tropical Forest Areas of Bangladesh**

Name	Location	Year Created	Area (has)	Special Features	Present Condition
Madhupur National Park	northeastern part of Tangail Division/some in Mymensingh	legally gazetted in 1982	8,437	- one of the remaining tracts of Sal (Shorea robusta) forests - plant biodiversity still intact - known for medicinal plants - once part of the ancestral territory of the Mandis	- draft management plan prepared by FSP - larger wildlife eliminated - 20,000 people live within the park - largely degraded but some patches of dense coppice regrowth - extensive conversion to plantations
Bhawal National Park	Gazipur District near Dhaka	1982	5,022	- another tract of regenerating Sal forests - extensively used for recreational purposes, owing to ease of access from Dhaka	- Management plan prepared - new development activities including the establishment of industries pose an increasingly significant threat to the park - some areas are thinly covered in forest and being degraded
Lawachara National Park	Sylhet Division	legally gazetted in 1996	1,250	- mixed tropical evergreen forest - part of the watershed for Hail Haor	- approx. 40% of the area converted to plantations now over 50 years - approx. 20% in younger mixed plantations - monkeys and extensive bird life
Himchari National Park	Cox's Bazaar Division	legally gazetted in 1980	1,729	- steep coastal cliffs, low hills along the sea front (but not including the beach itself) - established with a view to increasing the opportunities for tourism and recreation	- high level of illegal timber harvest - numerous "illegal" settlements and housing within the area - heavy livestock grazing - periodic fires - both subsistence and commercial fuelwood and bamboo harvest
Kaptai National Park	Rangamati Hill District	1999	5,464	- serves as part of the watershed of the Kaptai Lake and power generation facility	- no management plan prepared to-date
Ramsagar National Park	eastern part of Dinajpur District	2001	(?)		- no management plan prepared to-date
Nijhum Dweep National Park	a char area in the southeastern part of Noakhali District	2001	16,352	- successfully planted with mangrove species by the Forest Department	- no management plan prepared to-date

Name	Location	Year Created	Area (has)	Special Features	Present Condition
Rema-Kalenga Wildlife Sanctuary	Sylhet Division	gazetted in 1981; expanded in 1996	1,095 and then 1795	- largest remaining block of natural forest in Sylhet Division - serves as watershed for nearby wetlands - mixed tropical evergreen forest - some riparian habitat	- high closed canopy forest still occupies 80% of area - extensive conversion to plantations - one forest village (Tripura peoples) w/i the Sanctuary plus bordering villages
Chunati Wildlife Sancturary	Chittagong Division	mid-1980's	7,764	- existing small population of endangered Asian elephants - extensive studies of flora and fauna - potential for linkage to nearby reserved forest areas - endangered serow thought to still exist w/i the area	- ease of access has led to use as open access resource - includes deeded agricultural lands and Forest Villages - very conflictive situation with local population - nearby brickfields openly use it as a fuel source
Pablakhali Wildlife Sanctuary	Khagrachari Hill District	1983	42,087		- no management plan to-date
Char Kukri Mukri Wildlife Sanctuary	southern part of Bhola District	1981	40		- no management plan to-date
Hazarikhil Wildlife Sanctuary	northeastern part of Chittagong Division	pro-posed as a W.S. in 1974 but not yet legally gazetted	pro-posed to include 2.908		- yet to be notified formally - draft management plan prepared by FSP
Sundarbans East Wildlife Sancturary	southern part of Bagerhat District	1996	31,226	- mangrove forests (part of the Sundarbans Reserve Forest) of rich bioidiverity - high degree of social, economic and ecological value - rich in wildlife including the Royal Bengal Tiger (*Panthera tigris*), spotted deer, wild boar, and unexplored fisheries biodiversity assets	- management plans prepared for these three areas - all three declared as Ramsar Sites - all three declared as UNESCO World Heritage sites - Sundarbans Biodiversity Conservation Project with ADB/GEF/Dutch support is under implementation
Sundarbans South Wildlife Sanctuary	southern part of Khulna District	1996	36,970		

Name	Location	Year Created	Area (has)	Special Features	Present Condition
Sundarbans West Wildlife Sanctuary	southern part of Satkhira District	1996	71,502		
Teknaf Game Reserve	Cox's Bazaar Division	legally estab-lished in 1983	11,610	- wet evergreen and semi-evergreen forest - modest number of endangered Asian elephants widely distributed in the area - very diverse habitat conditions considered to be area of high biodiversity - potential for significant expansion w/ nearby reserve forest areas	- incursions of Rohingya refugees and local population pressure have severely degraded the forest - subject to impact of cyclones - some efforts to convert it to plantations - livestock grazing problem

In short, it would appear that, outside the Sundarbans and the two protected char areas, Bangladesh has only approximately 84,000 hectares (840 square kilometers) of "relatively intact, upland tropical forests" left within these protected areas, or less than one percent of the national territory. There are doubtless other areas of natural forest left, both within the Reserved Forest system managed by the Forest Department or an ungazetted state forest lands (for example, Satchuri Reserved Forest in Habiganj District, is thought to contain about 500 hectares, out of 1760 total, in natural forest). This particular forest has been proposed for inclusion in the list of protected areas. The status of these forests is not well known and many may have already been the subject of conversion to plantation favored by the Forest Department. Furthermore, none of these areas are immune from the threats of constant human pressure from local communities seeking to meet their basic needs and from occasional illegal logging operations. This figure of 100,000 hectares of intact natural forest does not include the extensive mangrove forest ecosystem of the Sundarbans (approximately 600,000 hectares in one contiguous block found in the southwest of the country in the Sundarbans Reserved Forest) or the possibility of intact natural forest in the hilly areas of the extreme southeast of the Bandarban Hill Tracts (e.g., in the Sangu and Matamuhuri Headwaters Reserves) of which very little is actually known. These areas are the last refuges of terrestrial biodiversity in the country although many of the larger mammalian species (leopards, wild dogs, sambar, bear, rhinos, Indian bison, and wild buffalo) have been extirpated. Doubtless, there have also been serious inroads into the floral species native to the country but in general, the picture there offers more hope.

At an estimated 0.5 percent of the country's surface area, the PA network in Bangladesh is the smallest in Asia, in both percent of surface area and area per capita.1 Neighboring Sri Lanka has over 10 percent of its surface area in protection, while India has an estimated 5.1 percent of total surface area in protection. Per international guidelines,

1 Data from the EarthTrends Database at http:// www.earthtrends.wri.org, jointly funded by UNEP, UNDP, WRI and other donors. Figure includes data from IUCN Protected Area Categories I-V.

minimum surface area allocated to protection should be at least 5 percent of surface area, so Bangladesh is well below the international standard. And the distribution of PAs supply shortage varies by region of the country. It is more serious for those in the western side of the country than it is for those in the eastern side of the country. Apart from the Madhupur National Park in the Tangail District, there isn't a single declared Protected Area over 50 hectares west and north of the Sunderbans. Some 50-70 million people are living without any access to PAs in their vicinity.

4.4.2 Protected Tropical Forest Areas (Eco-Park)

In recent years, the Government has acted to increase the supply of PAs, principally through the creation of a number of Eco-Parks and Safari Parks on Reserve Forest land. These newly created PAs, however, are extremely small by comparison to the standard classes of PAs, and are designed to serve a "nature recreation" need rather than a large scale nature conservation need.

Table 5**. The Eco-Parks and Safari Parks**

No.	Name of the Protected Area	Declared Status	Area in ha	Year of Notification
1	Dulhazara	Safari Park	600	1999
2	Banshkhali	Eco-Park	n/a	2003
3	Madhabkunda	Eco-Park	125	2001
4	Sitakunda	Botanical Garden and Eco-Park	1000	2000
5	Mirpur	Botanical Garden	84	1961

4.4.3 Ecologically Critical Areas

There has been another recent development related to the concern for biodiversity and the sustainability of the natural resources base with the declaration of ecologically critical areas (ECA). The Bangladesh Environmental Conservation Act of 1995 includes a provision whereby if the Government is concerned that the degradation of an ecosystem has reached "a critical state" or is so threatened, it may declare the area to be an ECA by notification in the official gazette. In April 1999, this authority was exercised for the first time by the Director General of the Department of the Environment in officially notifying the establishment of six separate wetland areas covering approximately 40,000 has as ECA's. During the course of preparation of a GEF project, two more sites were added to the list of notified ECA's; the eight sites now so declared are the following:

Table 6. **List of Ecologically Critical Areas (ECA's)**

Name	Location	Year Estab-lished	Area (has)	Present Condition/Remarks
Sundarbans	Ten kilometer buffer zone around the Sundarbans Reserved Forest in the Districts of Satkhira, Khulna and Bagerhat	1999 (?)	un-known	Initially (April 1999) whole of the Sundarbans Reserved Forest with its approx. 3/4 million hectares was declared an ECA. However, later an amendment was made in line with the objections of the Forest Department. - area is presumably partly covered by the Impact Zone of the Sundarbans Biodiversity Conservation Project
Cox's Bazaar-Teknaf Sea Beach	Teknaf, Ukhia, Ramu and Cox's Bazaar District	1999	10,645	Will be managed as part of UNDP/GEF/DOE Coastal and Wetland Biodiversity Management Project which has been recently approved and for which implementation is expected to start soon.
St. Martin's Island	Teknaf Upazilla, Cox's Bazaar District	1999	590	Will be managed as part of UNDP/GEF/DOE Coastal and Wetland Biodiversity Management Project which has been recently approved and for which implementation is expected to start soon.
Sonadia Island	Moheshkhali Upazilla, Cox's Bazaar District	1999	4,916	Will be managed as part of UNDP/GEF/DOE Coastal and Wetland Biodiversity Management Project which has been recently approved and for which implementation is expected to start soon.
Hakaluki Haor	Barolekha and Kulaura of Moulvibazar District and Fenchuganj, Golabganj Upazillas of Sylhet District	1999	18,383	Will be managed as part of UNDP/GEF/DOE Coastal and Wetland Biodiversity Management Project which has been recently approved and for which implementation is expected to start soon. Certain activities are already underway with support from SEMP and execution by IUCN/CNRS.
Tanguar Haor	Taherpur and Dharmapasha Upazillas of Sumanganj District	1999	9,727	- Declared as a RAMSAR Site - Environmental Management Plan prepared - MOEF is trying to obtain approval for funding of this plan from NORAD under the NCS Implementation Project 1
Marzat Baor	Kaliganj Upazilla of Jhedaidah District	1999	200	- no work to-date on the area
Gulshan-Baridhara Lake	Dhaka City Corporation of Dhaka District	2002	(?)	- a truly urban setting with both aesthetic and recreational value but under considerable pressure as a result of local urbanization.

4.5 Tropical Forest, Biodiversity and Ecosystem Conservation Programs and Projects

For the management of protected areas, a "Wildlife and Nature Conservation Circle (WNCC)" was recently established. The WNCC is headed by a Conservator of Forests (CF), reporting directly to the Chief Conservator of Forests (CCF). The WNCC has four Divisions: Dhaka, Chittagong, Khulna and Sylhet. However, the existing staffing pattern is not keeping with the PA/ Biodiversity/Wildlife management systems. The WNCC and for that matter the FD, does not have any institutional strategic planning for PA management. No organogram has been developed for PA management yet. Currently each PA is not an "operational unit", rather they are managed through the territorial Forest Divisions. Only the CF office, and Chittagong and Khulna Divisions are in operation. Other than PAs of Khulna WNCD, only Chunati WS has so far been handed over to WNCC for management. PAs are not properly staffed and are being "managed" with insufficient staff at all levels from PA to CF office. There is no research staff or other technical back up at Division or PA level.

4.5.1 The Nishorgo Program

The **Nishorgo** Program was conceived by the Bangladesh Forest Department (FD) as a strategic response to the crisis of PA management. The Nishorgo Program is the Protected Area Management Program of the FD. As a sign of early success in forest co-management, USAID has gained the commitment and sense of "ownership" of the FD that culminated in the launching of a national, broad-based protected area (PA) management program – *Nishorgo*. The Program aims to ensure protection and improved management of these places of natural beauty before they are forever gone. The Nishorgo Program supports six complementary components:

Co-management and Partnership: The Program recognizes that the Government cannot ensure protection of nature without the collaboration of local and national stakeholders. To this end, the Program is establishing co-management agreements by which participants support conservation. Newly constituted Co-management Councils and Committees at pilot PAs set new standards for transparency and openness, and allow a local voice in Area management.

Alternative Income Generation: The Program is working to identify and introduce viable alternative options for local stakeholders that may have relied on forests. One important option is community-friendly eco-tourism. Others include tree nurseries, handicraft enterprise development, alternative energy use, livestock fattening, rice processing, and other agricultural activities.

Policy Change and New Constituencies for Protected Areas: The Program is working to improve policies for PAs. The Wildlife Act, 1974, is being revised. A vision statement entitled Nishorgo Vision 2010 sets out ambitious goals and a new orientation for PA management. The Program also works to build constituencies to support PA conservation.

Institutional Capacity Development: The Program supports a variety of training and capacity building efforts focused principally on the local stakeholders and the FD staff and systems itself.

Infrastructure and Visitor Services: The Program has already developed hiking trails and accompanying brochures for five initial PAs. Future improvements will include improved signs, visitors' centers, staff quarters, access and parking facilities.

Ecosystem Regeneration and Rehabilitation: Bangladesh is blessed with very fast growing forests. In most cases, if the logging and fuel wood collection can be stopped, the forests will return naturally. But where natural regeneration needs an extra push, the Program will work to rehabilitate sites through selected planting.

The Forest Department has set out its vision for change in ***Nishorgo Vision 2010***. Expected changes include these leading institutional improvements:

- The PA will become an integrated, recognizable and accessible System
- PA managers will be partners in local and regional development
- At each PA, visitors will be able to receive an orientation about what can be observed or learned from there
- Visitor facilities will be made available at each Protected Area.

These improvements, and others, will lead to changes in the quality of our PAs:

- In targeted PAs, illegal felling will cease
- Biodiversity will increase, as evident in indicator bird species
- Forests loss will reverse, and forests will begin to regenerate.

4.5.2 Other Projects

Specific biodiversity conservation components have also been included in some of the major multilateral bank funded loan projects, including the World Bank-funded Forest Resources Management Project (FRMP) (closed out), the Asian Development Bank-funded Forestry Sector Project (FSP) (ending this year), and the Asian Development Bank-funded Sundarban Biodiversity Conservation Project (currently under suspension). Under the FSP, a series of management plans were prepared for various protected areas and the importance of biodiversity conservation in each of the country's Forest Divisions was also synthesized to guide the efforts of the Forest Department to engage in this new mandate for biodiversity conservation. These plans, however, have as yet to be acted upon and they have been used, with the blessing of the Forest Department, in the elaboration of the work plans of the current USAID program on protected area co-management. An ongoing UNDP/GEF project – the Coastal and Wetland Biodiversity Management Project (BGD/99/G31) – will be the first effort to operationalize the ECA concept, mentioned above, at two main sites: Cox's Bazaar and Hakaluki Haor (UNDP,

2001). Although a full-fledged priority-setting exercise is yet to be done, NEMAP is being followed-up through an ambitious UNDP initiative called Sustainable Environmental Management Project (SEMP), which focuses on 26 sectors covering five thematic areas. Biodiversity conservation constitutes one of the themes.

Donor funding in the environment sector is visibly trickling down. This is more so when it comes to funding for biodiversity conservation and natural resources management. Recently, however, with funding from the Canadian International Development Agency (CIDA), the Local Consultative Group's Environment Subgroup has commissioned a study team to provide input towards mainstreaming environmental issues into the PRSP.

5 TROPICAL FOREST AND BIODIVERSITY CONSERVATION: CIVIL SOCIETY INITIATIVES

5.1 Arannayk Foundation (Bangladesh Tropical Forest Conservation Foundation)

Arannayk Foundation is a civil society-led entity established for tropical forest conservation through a unique mechanism. Bangladesh is the first country to benefit from programs under the Tropical Forest Conservation Act (TFCA) of 1998 that was signed by the President in July 1998, after overwhelming bipartisan support in the U.S. Congress. This Act provides eligible countries the opportunity to reduce concessional debts owed to the United States, and at the same time generate funds to conserve or restore their tropical forests. Under the TFCA, the Government of Bangladesh (GOB) and the United States Government (USG) have signed two agreements; one to treat (reschedule) one of the outstanding debts (The Debt Agreement) that the GOB owes to the USG and the second to establish a Bangladesh Tropical Forest Fund (The Forest Agreement), following the debt-for-nature-swap provision of the TFCA. To promote tropical forest conservation under these agreements, $8-9 million, in local currency, will be available over a period of 18 years to support Bangladesh's tropical forest conservation efforts under the current agreement.

The Arannayk Foundation (AF) – a not-for-profit company without share – was established in July 2003 under the Bangladesh Companies Act of 1994 as the "Tropical Forest Fund" pursuant to the Tropical Forest Conservation Act (TFCA) of 1998. The main objective of AF is to promote activities designed to conserve, maintain or restore the natural tropical forest and forest biodiversity of Bangladesh. Arannayk will make grants to worthy applicants for projects to protect Bangladesh's tropical forests. A legally-established Board of Directors overseas the operations of the AF. The Board consists of five representatives of Bangladesh civil society, plus one representative each from the USG (USAID Mission Director) and the GoB (Joint Secretary [Development], Ministry of Environment and Forest).

Funding for Arannayk is primarily from food aid debt relief provided by the Government of the United States to Bangladesh per the terms of the debt-for-nature swap mechanism

defined in the bilateral TFCA Agreements. In addition, the AF is allowed to solicit and receive funds from other entities both public and private. The foundation has three options regarding the use of these debt relief funds: to directly support foundation administration and grant activities, to invest the debt relieve funds and operate from the interest or some combination of the two.

The activities of the Arannayk Foundation will include:

- the establishment, restoration, protection and maintenance of protected areas and reserves;
- the development and implementation of scientifically sound systems of natural resources management;
- training programs to increase scientific, technical and managerial capacities of individuals and organization involved in forest conservation;
- the restoration, protection or sustainable use of diverse animal and plant species;
- research and identification of medicinal uses of tropical forest plant life; and
- the development and support of the livelihoods of individuals living in or near a tropical forest in a manner consistent with protecting such a tropical forest.

The entities in Bangladesh which shall be eligible to receive grants from the fund are: non-governmental environmental, forestry, conservation, development and indigenous people organizations; scientific, academic and professional organizations related to forests; other appropriate forest related entities active in the country; and exceptionally, agencies of the Government of Bangladesh.

5.2 Other Initiatives

The only international non-governmental environmental organization that has a presence in Bangladesh is the International Union for Conservation of Nature (IUCN). IUCN has led the process of development of the National Conservation Strategy (NCS) and the National Biodiversity Strategy and Action Plan (NBSAP). The country has a vibrant NGO community with a critical mass of environmental NGOs that includes a number with international reputations. The following is a narrow list of NGOs and movements whose actions have been notable in the conservation of biodiversity in the country:

- Bangladesh Center for Advanced Studies
- Nature Conservation Management
- Bangladesh Unnayan Parishad
- Center for Natural Resources Studies
- Caritas Bangladesh
- Rangpur Dinajpur Rural Services
- Bangladesh Action Research Center for Indigenous Knowledge
- Community Development Center
- Bangladesh Paribesh Andolon
- UBINIG

6. ISSUES AND OPPORTUNITIES IN RELATION TO CONSERVING TROPICAL FORESTS AND BIODIVERSITY

6.1 Policy Issues

Bangladesh, at the outset, provides an extremely favorable policy climate for administering programs towards management of natural resources, although implementation advances at a snail's pace. Even a 'quick and dirty' review of the policy regime would suggest that over the last thirty years in Bangladesh:

- A large number of policies have been produced covering both national (overarching) and sectoral agendas; each and every Ministry came up with their own policies.
- As a result of the abundance of policies, there has been considerable overlap and lack of coherence between policies. For example:
    - The National Fisheries Policy poses a direct conflict with the Ministry of Land, particularly as it relates to open water management in general and the leasing policy in particular.
    - The Environmental Policy and the Environmental Conservation Act, which mandate the Department of Environment for declaring critical habitats as ECAs, are in direct conflict with the management of forest protected areas (under the jurisdiction of the Forest Department) as well as wetlands (under the administrative jurisdiction of the Ministry of Land for leasing and under the management jurisdiction of the Ministry of Fisheries and Livestock for fisheries management).
- Policy making has tended to be rather top-down, originating from central government and favoring the priorities and interests of influential elites, and without taking institutional capabilities into minimal consideration.
- Policy changes can and do take place, but there is little assessment of policy performance and minimal feedback into the policy development process.

6.2 Governance and Other Related Issues

USAID (2001) has summarized the issues related to biodiversity conservation in the terrestrial ecosystems, particularly the hilly areas. The issues identified are equally applicable for all other ecosystems. Table 7 provides the list.

Table 7. **Issues and Opportunities for Tropical Forest and Biodiversity Conservation**

Identification and Discussion of Issues	**Opportunities for Addressing the Issues**
Macro-Economic Issues	
The Economic Implications of the Culture of	- Using program-based learning to improve the

"Command and Control" Approaches to Conservation: A preference for using a regulatory approach for protection and conservation of biodiversity by creating rules and/or enforcing existing rules can lead to a perverse reaction on the part of those seeking to use them. As demand for the products of these forests is likely to remain constant, an attempt to apply regulations will limit supply and/or be perceived as curtailing supply and thus causing prices to rise or a willingness to take the risks to obtain an increasingly scarcer but needed commodity.	understanding of policy and decision makers about the realities of the macro-economics of supply and demand for natural resources. - Participatory forest management program can and should reduce the costs of public administration of the protected areas and reserved forests because the local people perceive tangible values for themselves in these forests. This in turn would reduce the unit costs of land management that a department like the Forest Department would require for their programs and allow for further program expansion.
Funding for Biodiversity Conservation: Although the larger world has recognized the global significance of biodiversity and has begun to provide considerable funding for programs of this nature, the donor community is rarely responsive in situations where the host government appears unwilling or unable to provide at least part of the financing required (at a minimum, the establishment budget requirements) because it suggests that once their funding ceases, the programs will not be sustainable. Host governments	- Host governments must recognize that the conservation of biodiversity at home has value for the country and is a worthwhile investment option. NRM accounting procedures should be instituted that begin to build a case for valuing biodiversity, in terms of its real value to the nation (e.g., as a present and future source of needed natural products or in terms of national heritage and pride) and also take account of the environmental services associated with protected areas (the watershed function, storm protection).
Illegal Activities within Protected Areas: If local communities are to be convinced to relinquish their use rights (legal or otherwise) on protected areas, government must ensure that outsiders (illegal loggers, those harvesting fuel for brickfields, those seeking to take over such lands) also do so.	- If there is demand for scarce supply, the ingredients are there for an investment program. Why not stimulate communities to make preparations to supply industry with the raw materials it needs? For example, would brick-field owners be willing to pay for fuelwood from plantations, particularly if supply is very short in the area of operations? ibid for sawmills or carpentry shops which already buy many logs from planted trees. This won't work, however, if there is a continuing perception that supply from natural areas or through illegal activities is available.
Socio-Economic Issues	
Unrelenting Demographic Pressure on Hill Forest Areas: Farmers and rural people are as aware as anybody of the limitations of the natural resources base because they live the dilemma day in and day out. However, in the absence of choices or plans to the contrary, they chose the only course of action open to them--trying to meet their basic needs wherever they can. All concerned, including the GOB agencies and the communities need to understand that the costs of NRM rehabilitation and socio-economic development in the face of widespread degradation are orders of magnitude higher than a proactive program of prevention and wise management.	- Engaging the communities in a discussion not just about the problems (awareness raising) but about the alternatives and the benefits they might derive from improved stewardship of the natural resource base. Similarly, demographic pressures on a protected area are too anecdotal in nature. There is also a real need to quantify the actual usage and value of how local people use the forests in order to determine how to proceed in alleviating the pressure. E.g., how many steres of fuelwood are being removed for subsistence use or for local sale and can these removals be met with other strategies?
Poverty and a Lack of Alternative Sources for Basic Needs and Employment Opportunities: Subsistence collection of fuelwood and poles is an economic deadend. Where there is demand for these products, however, there is scope for action as has been repeatedly demonstrated by the very successful homestead plantations so common to the flood plains.	- Local communities and local people often have priorities such as the need for basic social services and rural infrastructure that could stimulate local development far more than access to natural resources on fragile or protected areas. - production trade-offs, particularly for forest harvesters (both legal and illicit) will need to be offset by introducing alternative production and/or employment activities

Land Tenure Constraints: Two issues are prominent in this regard: in some cases, villages have been established before protected areas or even reserve forests were gazetted, often involving indigenous peoples. How can they be accommodated? Second, if neighboring khas lands are available, do they not represent an opportunity to find solutions for the landless or for those who must degrade the forests to survive?	- Can tensions with existing villages be mitigated and if so, how? What potential is there for relocation of villages, on adjacent reserve forest areas or khas lands and what would be required to get people to move? Or can resident villages be convinced to stay within their defined boundaries and if so, in return for what? Such arrangements already exist between the communities and FD which employs villagers for management operations. Can protected areas provide similar opportunities?
Lack of Local Organizational Capacity to Broker Community NRM Conflicts: Villages are rarely egalitarian social structures but there is a certain amount of social justice required to avoid conflict. Conservation programs have best succeeded where they can create local organizations to ensure that the needs of all segments of society (including landless, women, indigenous peoples) are increasingly taken into account in designing natural resources management--an inherently social (rather than technical) act involving decision-making about how to use, reserve and share resources.	- Local resource management organizations can fill the need for community understanding, conviction and consensus that it is possible to reverse these trends and acceptance of use restrictions in protected areas; and for promoting/allowing and organizing communities to participate in the decision-making about conservation/management measures.
Institutional Issues	
Conventional Single Sector/Single Agency Approach: Protected areas cannot be dealt with in isolation of their surroundings, particularly in a densely populated country. To maintain the integrity of an ecosystem often requires off-site solutions. Sharing the responsibilities for addressing the challenges among different concerned govt. partners makes better sense and lowers program costs. This requires an appropriate institutional development strategy.	- An integrated approach to dealing with the pressures on protected areas is needed but the key is planning and prioritizing. There are too many things that can be done but the challenge is to know what should be done. Departmental policies, plans, programs and budgets are made in advance so planning is the key. A much more dynamic use of the conventional Project Steering Committee approach is required, based on a secretariat type function that prepares the members of the committee to take informed decisions and track progress in achieving them.
Institutional Set-up and Capacity including Skills and Understanding: At present, all protected areas are under the mandate of the territorial staff of the concerned Forest Department Circle, Division, Range and Beat. Staff is routinely and regularly transferred among these sites and may not even be fully aware of the rationale, importance, limits or management requirements of protected areas.	- The principal paradigm of the Forest Department is production and staff have not had the training required to understand the value of protected areas and the environmental services they offer (biodiversity conservation, watershed protection, recreation and ecotourism). The recent decision to create a Wildlife and Protected Areas Division within the FD represents an opportunity to build skills important for conservation.
The Need for a Protected Area System: Experience worldwide has demonstrated that a genuine system of protected areas provides a center around which to organize and strengthen institutional capacity for conservation. Furthermore, because a protected area system targets values appreciated by society in general and not just those who consume forest products, it reaches a wider audience and can improve the image of the department responsible for providing these services. It also helps to create a national understanding and growing constituency for environmental conservation.	- A protected area system works better than isolated P.A.'s under territorial mandate, especially in terms of enhanced institutional capabilities (increased opportunities for staff specialization, learning and experience; the development of internal organizational capabilities specific to protected areas; & career development options for staff). - There is also an opportunity to distinguish between different types of protected areas and their functions including biodiversity conservation but also outdoor recreation and environmental services (watershed functions).

Technological Issues	
Inappropriate Land-Use Choices and Practices: The essence of natural resources management is matching land-use to land capability. The protected areas of Bangladesh are for the most part in hilly areas where the options for use are more limited because of the fragile nature of these areas. Even if the protected area can be safeguarded, actions are needed to ensure that surrounding areas of similar conditions are not degraded and depleted as this will only lead to greater pressures on remaining forest areas.	- The key to addressing inappropriate land-use lies in knowing more about the land and not just the technology. Land capability studies must be prepared but these are relatively simple, involving slope and soil depth measurements and soil typing. There are a wide variety of improved management methods for hilly areas that have not been much applied in Bangladesh. They include: soil and water conservation engineering measures for agriculture; cut and carry fodder systems; agro-forestry; composting; green manures for soil fertility improvement; etc. - Similarly, collateral development activities around existing protected areas take pressure off national biodiversity assets.
Need for Watershed Management: There is very little mention of the needs for watershed management in sector programs and even fewer program efforts (if any) to address it. Yet each year, flash floods during the early monsoon damage the boro rice crops in the Haor areas. Siltation running off of neighboring hills is causing blockages of watercourses damaging embankments and filling in fish habitat. Similarly, low season flows into the beels limit their utility as brood areas for fish.	- A lack of watershed management programs is not surprising although the country is very aware of the issue because of the damages wrought by conditions in the extra-territorial watersheds of the Bramaputra and Ganges Rivers. There are opportunities to address similar issues, albeit on a smaller scale, in the northeast and southeastern hilly regions that could mitigate the adverse impacts felt downstream. Many of the protected areas are by definition watersheds for neighboring wetlands and need attention to guarantee the sustainability of proactive, ongoing wetlands programs (MACH and others).
Knowledge Gaps about Biodiversity Assets: Good data and information about the status of biodiversity in the country is lacking, contradictory or not up-to-date which hampers sound planning for its protection.	- A good set of baseline data and information on the condition of protected areas, habitat integrity and the species found on these areas will be fundamental to sound program planning and subsequent monitoring of program performance.. - There are any number of competent professionals who could be engaged in basic survey and studies to develop targeted information on the status of biodiversity which will serve for M&E purposes but also provide the substance for awareness raising, additional program planning
Biodiversity Sensitive Choices of Forest Management Technology: Because many of the protected areas were once part of Reserved Forests, their natural stand structure has been altered by the Forest Department through production plantation programs.	- Encouraging natural regeneration of degraded protected areas should be a preferred methodology for restoration. - There may be occasional need for modest enrichment planting of keynote species important to forest ecosystems and/or wildlife that can be accomplished with minimum site disturbance.
Need for Connectivity with other Natural Areas: The long-term sustainability of certain premier animal species (e.g. elephants) may depend on their ability to move over larger areas than available under the protected area system. In some cases, it is possible to conceive of program plans that view Reserved Forest areas or even unclassified state forest as potential corridors for animal migration.	- There is some potential for promoting proactive management choices within Reserved Forest areas, particularly in the southeast of the country (CHT) that could accommodate elephant migration routes. This might reduce the present problem of crop raiding and conflicts with local villages if the animals had a forest corridor extending beyond the boundaries of the P.A.'s.

7. USAID'S CURRENT INITIATIVES IN TROPICAL FOREST AND BIODIVERSITY CONSERVATION AND MANAGEMENT

USAID has successfully pioneered an integrated, co-management approach in natural resources management through implementing a bold environmental program. While conservation of natural resources is central to implementation approaches, the environment programs work to expand broad-based economic opportunities at a landscape level, giving the poor a central role in the planning and implementation process and also encourages participation of other members of the community who have a stake in the management and utilization of natural resources, including local government and private enterprise. The objective is to take the pressure off the rapidly disappearing natural resources by providing alternate livelihood opportunities to the poor communities who depend on these resources. By its very nature, co-management also addresses issues of economic opportunity, food security and governance, in tandem with biodiversity conservation. Currently, USAID is implementing two bilateral activities: Management of Aquatic Ecosystems through Community Husbandry (MACH) and Co-management of Tropical Forest Resources in Bangladesh (now called as the Nishorgo Support Project). USAID also at the fore-front of implementation of the bilateral debt-for-nature swap agreements signed by the Governments of the United States and Bangladesh under the Tropical Forest Conservation Act (TFCA).

7.1 Management of Aquatic Ecosystems through Community Husbandry (MACH)

The Management of Aquatic Ecosystems through Community Husbandry (MACH) Project – the pioneer of natural resources co-management in Bangladesh – is an innovative program to assist local communities and local government to establish participatory management and conservation of vital open water and fisheries resources. The MACH activity was conceived as a pilot effort, testing whether an alternative model of natural resources management, involving low income resource users as key implementation agents, could effectively challenge the long tradition of a "command and control" approach to fisheries and other aquatic resources' management in the country. This program was being implemented under a Results Package Agreement between the Government of Bangladesh and USAID began in 1999. The program was eventually folded into the SOAG in 2003 by concurrently terminating the RPA. The MACH consortium is headed by Winrock International with three local associates: the Bangladesh Center for Advanced Studies (BCAS), Center for Natural Resources Studies (CNRS) and CARITAS/Bangladesh.

The program currently operates in three sites in the northeast of the country (Figure 4): Hail Haor located on the floodplains of Moulvibazar District; the Lower Turag-Bongshi River Basin in Gazipur District; and the Upper Kongshaw-Malijhee River Basin located in the wetland portions of Sherpur District. Among the environmental problems that MACH seeks to address are the following:

Water Related
loss of dry season wetlands
Padma/Ganges dry season flow reductions
loss of connections between floodplains, rivers and beels
sedimentation within water bodies

Fisheries Related
decline in inland open water fish productivity
estimated 30-40% decline in fish production with associated significant income loss
destructive over-fishing practices

Quality of Life Related
42% of children suffer from moderate to severe malnutrition

Biodiversity Related
large number of species threatened with extinction (biodiversity conservation)

Forest Related
Removal of all floodplain forests and loss of 90% of all adjacent forest cover

Pollution Related
industrial pollution affecting these wetlands and their fishery resources

In order to provide solutions for these issues, MACH has three major program objectives: to raise awareness of communities and local governments about the importance of natural floodplains resources to secure food and income security; to maintain and recover the selected natural floodplain ecosystems and associated fisheries; and to identify activities to generate alternative income that will result in a reduction of pressure from fishing and agriculture in the floodplain areas.

To date, in most cases, the programmatic results are either exceeding or almost fulfilled the targets. The following are the main features:

- 72 wetland sanctuaries created
- 42 Resource Management Organizations (RMO) established (as of December 2002)
- 217 kg/hectare fish production increased (against the target 195 kg/hectare)
- 367 ha beels converted from seasonal to perennial
- 27 km of channels rehabilitated
- 36 water bodies leased out to RMOs
- 113 communities adopted key regulations
- 215 ha of upper catchment area improved
- 360,000 people participated in environmental awareness programs
- 4,423 household participated in alternative income generating activities
- 47% increase in average alternative household income by participants

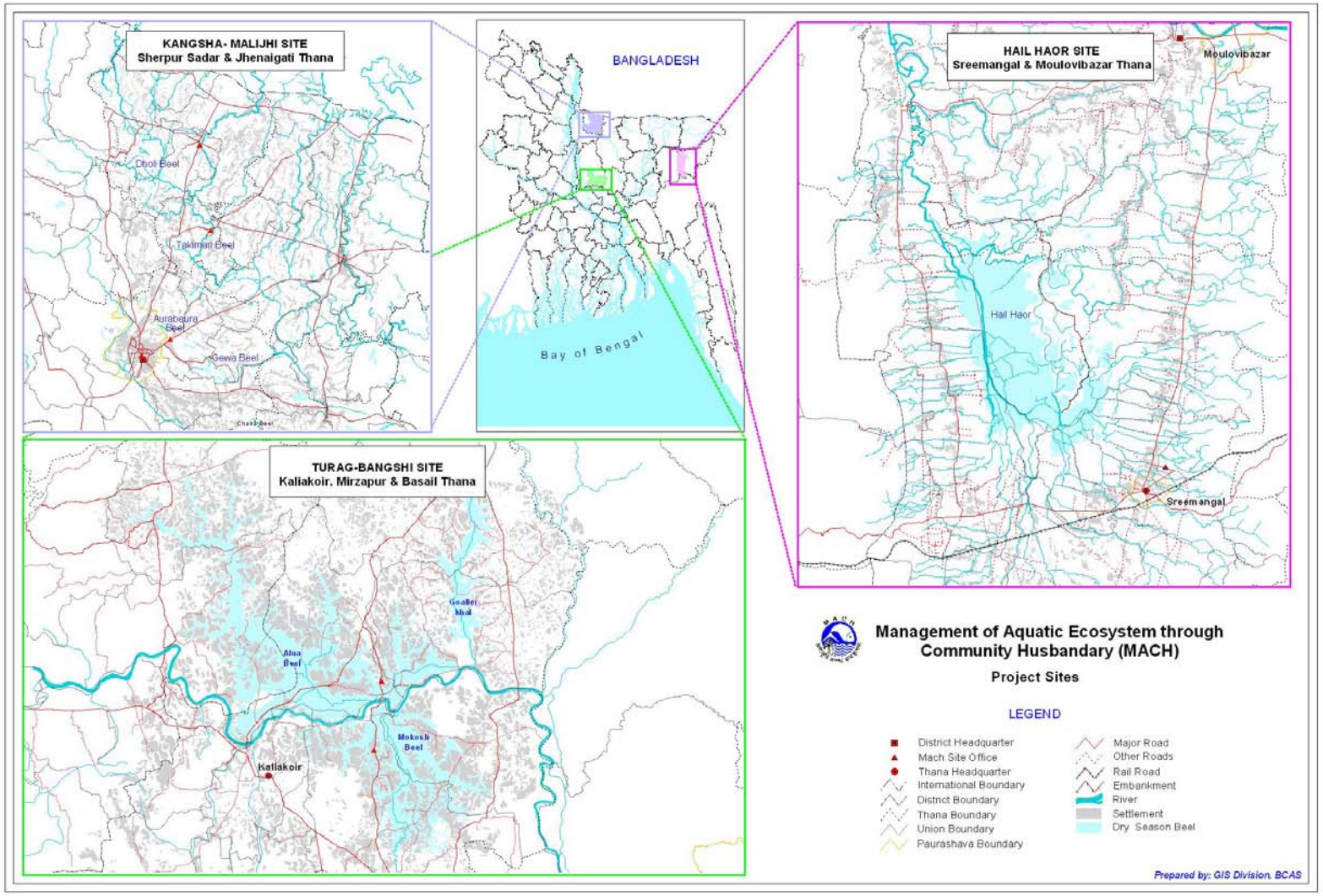


Figure 4. **The MACH Sites**

7.2 The Nishorgo Support Project (Co-management of Tropical Forest Resources in Bangladesh)

Building upon experience in co-management of open water resources, USAID in 2003 began implementing an integrated approach for conservation of Bangladesh's fast-disappearing tropical forest resources. The Nishorgo Support Project (NSP) is designed to improve the conservation and management of increasingly rare tropical forests in Bangladesh through institution of an improved governing structure at the level of Protected Areas. A more transparent, open and participatory governance of these Areas is to be led by the Forest Department, in partnership with local poor citizens. NSP fills in a programmatic gap, and USAID is playing a pioneering role by introducing the co-management approach in the protected areas. The new activity also helps in establishing the essential link between the terrestrial and aquatic ecosystems while building local capacity in both aquatic and tropical forest resources management. In conjunction with the ongoing open water activity, it will consolidate lessons learned in community-based resource management and serve as a precursor to the development of a protected area management system in Bangladesh.

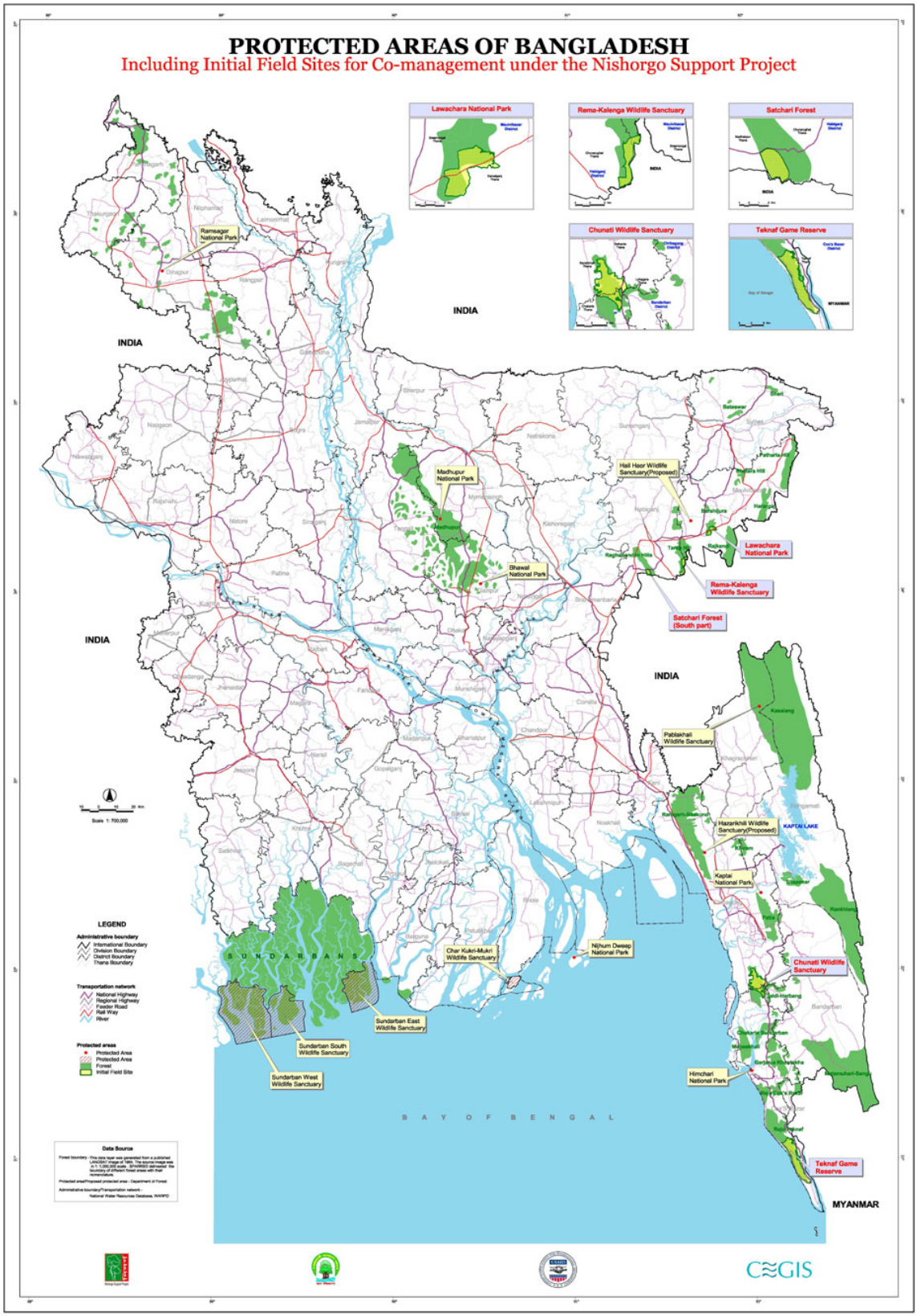
The Project seeks to develop this governance model at pilot sites that can then be replicated throughout Bangladesh's entire system of 19 Protected Areas, including National Parks, Wildlife Sanctuaries and Game Reserves. Bangladesh's Protected Area system is the smallest in the world, so protection of these areas is critical not only to the local poor living around them, but also to the 150 million citizens of the country who may never otherwise experience wild nature. In short, then, the Nishorgo Support Project seeks to ensure that tropical forest resources in Protected Areas are made available to the country's citizens via a participatory, transparent and corruption-free style of local resource governance. The International Resources Group (IRG) is implementing this $6.5 million, 5-year (2003-2008) project with three local partners: Community Development Center, Chittagong (CODEC), Nature Conservation Management (NACOM), Rangpur Dinajpur Rural Services (RDRS).

The initial pilot sites include the five landscapes around (Figure 5): the Lawachara National Park (Moulavibazar District); the Rema-Kalenga Wildlife Sanctuary in Habiganj District; the Satchuri National Park (proposed) (Habiganj District); the Chunati Wildlife Sanctuary (Chittagong District); and, the Teknaf Game Reserve (Cox's Bazar District). A sixth pilot site will be added prior to the end of year three of implementation.

The Project is progressing rapidly against targets. Among the major achievements since startup are the following:

- Public launch completed, including development of a new "Nishorgo Program" at the Forest Department
- RRA/PRA completed and stakeholder incentives identified
- Full implementation underway at all field sites, with field NGOs in place
- Identification & measurement of core baseline impact indicators
- Identification/acceptance of co-management approach at each site
- Capacity Assessment completed for Nishorgo Program of the Forest Department
- Communication and outreach strategy developed for Nishorgo Program

- Detailed needs assessment and costing for PA infrastructure, amenities and habitat management completed for eventual improvements to the pilot sites
- Partnership with the Bangladesh Boy Scouts begun
- Hiking trails identified for all five pilot Protected Areas


PROTECTED AREAS OF BANGLADESH
Including Initial Field Sites for Co-management under the Nishorgo Support Project
Lawachara National Park
Rema-Kalenga Wildlife Sanctuary
Satchari Forest
Chunati Wildlife Sanctuary
Teknaf Game Reserve
INDIA
MYANMAR
BAY OF BENGAL
SUNDARBANS
Ramsagar National Park
Madhupur National Park
Bhawal National Park
Hail Haor Wildlife Sanctuary(Proposed)
Satchari Forest (South part)
Pablakhali Wildlife Sanctuary
Hazarikhil Wildlife Sanctuary(Proposed)
KAPTAI LAKE
Kaptai National Park
Nijhum Dweep National Park
Char Kukri-Mukri Wildlife Sanctuary
Sundarban East Wildlife Sanctuary
Sundarban South Wildlife Sanctuary
Sundarban West Wildlife Sanctuary
Himchari National Park
LEGEND
Administrative boundary
Transportation network
Protected areas
Data Source
CEGIS

7.

7.3 Support to the Arannayk Foundation (Bangladesh Tropical Forest Conservation Foundation)

Starting from negotiating the debt-for-nature swap agreements to formally registering the Arannayk Foundation with the Registrar of Joint Stock Companies, USAID/Bangladesh, particularly the Environment (SO6) Team, has been fully engaged and played a pivotal role in advancing the TFCA process. The USAID Mission Director has been designated the USG representative on the Board of Directors of AF while EGFE/ENV representatives advise the Board towards making the AF operational.

For AF to be rapidly effective some preparatory work was essential. USAID has provided technical assistance to support the formation of the AF and to strategically prepare the Foundation in order to make it a viable grant-making institution. The following matrix summarizes the USAID/Bangladesh support to AF, which are above and beyond the day-to-day efforts of the Environment Team, to date:

Table 8. **Summary of USAID assistance to the TFCA process and the Arannayk Foundation**

Support	**Mechanism**	**Output**
Senior Natural Resources Specialist, September 2000 – September 2003	Part-time support through the ongoing MACH project	• Coordination of preparation of legal documents • Assisting the TA teams
Senior Advisor	Mr. Kazi Fazlur Rahman, a retired Secretary, was contracted on a short-term to advise on the establishment of the Fund	• Guidance to the TA team and USAID on options for establishing the Tropical Forest Fund
Senior Legal Advisor, January 2001 – July 2003	A senior lawyer (Barrister Fida Kamal) was contracted on a part-time basis through the ongoing MACH project	• Preparation, revision, and help negotiating with the State Department and the MOEF on finalizing the legal documents • Registration of legal documents to establish Arannayk as a not-for-profit company
Establishment of the Bangladesh Tropical Forest Conservation Fund, October 2000 – February 2001	Task Order executed by Chemonics International under the Biodiversity & Sustainable Forestry IQC (BIOFOR)	• Procedures for the establishment of the Tropical Forest Fund • Staffing pattern and position description • Investment Plan • Financial and administrative procedures • Procedures for annual audits and work plans • Bylaws and administrative procedures
Strengthening the Arannayk Foundation – Phase I, September 2001 – June 2002	Task Order executed by Chemonics International under the Biodiversity & Sustainable Forestry	• Long-term implementation strategy • Site selection, inventory and monitoring report • Curriculum for NGO training in

	IQC (BIOFOR)	conservation of tropical forest biodiversity • Public awareness strategy
Development of a Financial Management System, ongoing	Purchase Order executed by Rahman Rahman and Haq	• An automated Financial Management System
Training Component	USAID approved a $100,000 training activity for AF in 2004. The NGO members of the Board and the ED attended the EAI/TFCA Annual Meeting and RedLAC Assembly in Kingston, Jamaica.	• Preparing the Board and the Executive Director for effective operation of AF activities

8. FUTURE USAID ACTIONS PROPOSED IN SUPPORT OF TROPICAL FOREST AND BIODIVERSITY CONSERVATION

Building upon the successful pilot initiatives in pioneering the co-management approach in natural resources and biodiversity management, USAID is planning to administer a new initiative, in order to institutionalize the approach. The new initiatives, broadly defined as **Capacity Building for Protected Area Management** will address the following issues.

The Need for a Protected Area System: One of the greatest challenges is institutionalizing the approach and strategy for managing the biodiversity assets as an integrated system, as described in the previous section. Experience worldwide has demonstrated that a genuine system of protected areas provides a center around which to organize and strengthen institutional capacity for conservation. A protected area system works better than isolated PAs under sectoral/territorial mandate, especially in terms of enhanced institutional capabilities (increased opportunities for staff specialization, learning and experience; the development of internal organizational capabilities specific to protected areas; & career development options for staff). Furthermore, because a protected area system targets values appreciated by society in general and not just those who consume forest products, it reaches a wider audience and can improve the image of the department responsible for providing these services. It also helps to create a national understanding and growing constituency for environmental conservation. There is also an opportunity to distinguish between different types of protected areas and their functions including biodiversity conservation but also outdoor recreation and environmental services (watershed functions).

Ensuring Sustainability of Natural Resources Co-management as an Approach: Improving environmental management to reduce poverty requires comprehensive understanding of how local environmental conditions relate to poverty, the ability to

identify and set priorities with regard to alternative policy options and the capacity of evaluating their effectiveness and impact. The Environment program strongly relies on democratic process and uses democratic institution building as the most viable tool to promote improved management in a transparent way through giving voices to the voiceless and through empowerment of the poor and landless who would otherwise be victimized by natural resource degradation and non-sustainable use of resources that primarily benefits wealthy elites. The environment programs also address fundamental issues of inequality and risk. The "revolution in NRM" is in fact a central governance issue – governance and democracy have to deliver on the bread and butter issues for NRM to be meaningful and have substance.

Community empowerment is essential in sustaining the success of our efforts. Our interventions are helping develop and conserve natural resources at the local level. These resources are lucrative for grab by the usual power brokers in the community. Without community stewardship, these resources cannot even be kept intact, let alone sustainably managed. Even in the normal demographic course, protected areas will see increasing intractable ethnic and other social conflicts. Tension and conflict between powerful local vested interests and poorer communities, as well as between local communities and the government agencies, will increase. And ethnic conflicts will become severe, as ethnic diversity is particularly high in the traditionally forested areas that have become protected areas. A formidable challenge will be to institutionalize co-management as a national priority for natural resources and protected areas management.

USAID is clearly playing a pioneering role by introducing the co-management approach in the PAs; activities helping in establishing the essential link between the terrestrial and aquatic ecosystems while building local capacity in resources management and serving as a precursor to the development of a PA management system. USAID activities have already encouraged GOB policy-makers to consider co-management with an integrated approach as a workable means of meeting conservation goals without compromising the productivity of natural resources and poor people's livelihoods. The issues addressed by the Environment program are well recognized in GOB laws, policies, strategies (including the nascent PRSP), action plans and other commitments to international conventions and protocols. USAID has been successful to a notable extent in creating an enabling policy environment for co-management. While the challenges identified in the USAID/Bangladesh Environmental Strategy are still valid, new challenges have emerged in course of the pilot, on-the-ground implementation. More focused attention towards institutionalizing the approach is, therefore, called for.

Ensuring the Inter-Institutional and Multi-Disciplinary Cooperation Needed at the Policy Level for the Integrated Approach: Protected areas cannot be dealt with in isolation of their surroundings, particularly in a densely populated country where demographic pressure on the remaining areas of upland natural forest and wetland biodiversity is immense and growing. Sharing the responsibilities for addressing the challenges among different concerned govt. partners makes better sense and lowers program costs. This will, therefore, require the involvement of a range of different governmental organizations. The conventional steering committee approach typical of

projects and programs of this type in Bangladesh needs to be improved both conceptually and operationally. For efficient PA management, a solid coordination mechanism among various ministries and agencies to track natural resources related policy implementation must be established. The Ministry of Environment and Forest must take lead in 'enforcing' such a coordination mechanism.

Financial Realism – Sustainable Financing for PA Management: No sustainable financing programs are planned or in place for supporting any PA, although some management plans have made suggestions. Earnest efforts at cooperation are somewhat hollow if budgetary staffing and budgetary resources of the participating organizations are not flowing in support of program implementation. A sustainable PA financing strategy (strategies) should be developed for 1) the overall PA system and 2) for individual PAs to promote the sustainability of both Protected Area Management and Building Stakeholder Partnerships. NSP is taking steps for preparing the strategy; however, securing a sustainable financing system for the entire PA system will continue to be a major challenge in institutionalizing the approach.

In almost all cases, leasing systems for both the upland and wetland ecosystems are anti-poor. It is already well understood that short-term or tenuous leasehold arrangements promote destruction of natural resources or impede investments, especially for any activities such as forestry or conservation. The leasing system of 'khas' land adjacent to the protected forest areas and wetlands warrant a meticulous review aiming at developing a pro-poor policy. This would require resolving the dis-incentives for conservation and investment under current leasehold arrangements.

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