AGRICULTURE AND NATURAL RESOURCES

FORESTRY SECTOR PROJECT

I. Background of the Project

Approximately 18 percent of Bangladesh's land mass (2.56 million hectares) is classified as forestland area. However, only 0.84 million hectares (or 6 percent) has acceptable forest vegetation. The rest of the forestland is treeless, and at best covered by grass or brush. With the country's population of 122 million (1997) growing at 2.2 percent per year, the pressure on the remaining forest resources is severe.

Almost three fourths of the national energy requirement come from biomass fuel which is used primarily for cooking (100 percent of rural households and 70 percent of urban households) and for lighting. Bangladesh depends on imports for most wood and wood products, although there were some minor exports in recent years. The overall balance for roundlogs is also in serious deficit. In Bangladesh, state forests contribute less than 37 percent of the total roundwood and 9 percent of bamboo produced. The rest is produced by private woodlots and homesteads.

The area and the carrying capacity of forests have both been declining continuously as a result of the increasing demand for cultivable land, wood, and forest products. As a result, forest ecosystems have collapsed in many parts of the country. Bangladesh's high and increasing rate of deforestation is approaching 3 percent annually, and this is exacerbated by continuously expanding shifting cultivation in the limited remaining natural forests. The overexploitation of forests leads to several serious problems among them being: (i) the country is suffering from general economic damage and reduced productivity from the lowered level of protection from natural hazards, and significant losses in the quantity and quality of its general natural capacity (including forestry, agriculture, and fisheries); (ii) wood, fuelwood, and other forest products are becoming increasingly scarce; (iii) soil erosion and land degradation are accelerating in

hilly areas, with consequent increase in flash flooding of adjacent floodplains; and (iv) biological diversity is diminishing. The present forestry sector crisis in Bangladesh is therefore undermining the natural and ecological balance, essential for the country's economic development.

To preserve the country's remaining natural forests, the Government has put into effect (in October 1989) a moratorium on felling, logging, extracting, and selling timber. This was followed by another order placing a moratorium on tree felling in all natural forests until year 2000. A new forest policy was promulgated in October 1994 by the Government of Bangladesh. The new policy has, among its objectives, laid emphasis on people-oriented programs to manage the environment, preserve existing values, conserve plants and animals, and maximize forest benefits to the local people. It is responsive to the recommendations of the Forestry Sector Master Plan (FSMP) whose objective is to optimize the contribution of forest resources for environmental stability and economic and social development. It is in line with these policies that the ADB approved a technical assistance to undertake a feasibility study for the Forestry Sector Project which was completed in March 1996.

II. Project Details

The Project will enhance conservation of forests in selected protected areas (national parks, wildlife sanctuaries, and watersheds); increase overall wood production; and institute sustainable management of forest resources through local community participation, institutional capacity building, and policy reform. To achieve these aims, investments are required to: (i) continue the expansion and extension of the successful models for participatory afforestation and rehabilitation of degraded forests and other underutilized government lands; (ii) enhance the capacity of the Forestry Department (FD) and nongovernment organization (NGO) delivery mechanisms and their appreciation of the environment; (iii) institutionalize community participation in forest management, thereby increasing overall wood and forest production and contributing to forest conservation; and (iv) ensure conservation and sustainability of forest resources, leading to better environment for the present and future generations.

Specific activities under the Project will include extension programs to increase the awareness of local people to the fragility of the forests, participatory management of 38,000 ha of sal[1] forests, the distribution of over 8 million tree seedlings, over 25,000 kilometers of linear plantations, afforestation of 7,800 ha of *char*[2] lands, soil conservation and afforestation of eroded gullies, the rehabilitation of 750 tanks and ponds, conservation of large areas including the replanting of buffer zones, the reforestation of large areas of unused tea plantations, and the management of 21,000 ha of hill forests in which shifting cultivators will be sedentarized.

The formulation of the Project was preceded by a social analysis in which the needs of local residents were assessed, along with the constraints that precluded development. The criteria for selecting subprojects to be financed under the Project include: (i) interest, willingness, and potential for participation by the local communities; (ii) presence of poor, landless, and vulnerable groups; (iii) special environmental concerns as delineated in the FSMP; (iv) potential for investments in woodlots, agroforestry, linear strip plantations, and homesteads; (v) existence of forestland, other government land, natural forests, and protected areas, and the potential for their participatory development and management; (vi) potential for small-scale wood-based enterprises; (vii) no overlap with other development interventions; and (viii) continued pressure on remaining forests. The Project comprises about 17 subprojects extending over 18 of Bangladesh's 31 forest divisions (see Map). These divisions cover the entire northern, northeastern, and central part of the country but exclude areas covered under Bank and other external agency financing. Of the selected divisions, four subproject areas broadly representing the situation in the entire area covered by the 18 divisions were identified for detailed analysis.

The environmental survey of the project region reveals a richness of biodiversity that is under pressure from increased population growth. Rhinoceros and wild buffalo are threatened as their natural habitat shrinks under the pressure of deforestation. Lesser carnivores are increasingly

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1 *A valuable timber tree, Shorea robusta.*

2 *In a riverbed, an island of sediment that is used for cultivation that stabilizes as the river changes course.*

MAP Bangladesh Forestry Sector Project

fragmented and seem threatened by further expansion of population. Approximately one-third of bird species in Bangladesh are highly dependent on forest habitat; some 55 percent of the total bird species are found in the proposed conservation area of Sylhet, of which 9 globally threatened species have been recorded in Sylhet since 1980. With more than 150 species of large trees, Bangladesh had one of the most diverse forests in the world. At the present time, approximately 95-98 percent of the original habitat has been lost.

The population density of Bangladesh is the highest of any country in the world (excluding Singapore); at the present time there are approximately 750 people per square kilometer. The population is primarily rural with the attendant large families (between 5 and 7 members per household). Widespread poverty and landlessness suggest a large base of project beneficiaries from afforestation programs.

The project environmental screening indicated that nearly all components would have a positive (or an insignificant negative) effect on the Bangladesh environment. Since the project is intended to benefit the environment in several ways, this assessment is not surprising. The Project is expected to benefit the environment by rehabilitating existing sal forest stands, and the remnants of the region's tropical moist forests. The conservation components of the Project will enhance the viability of a number of threatened wildlife species and forest ecosystems. Plantations, particularly on the *char* lands, will need to be carefully planned to avoid adverse environmental impacts. A crucial element here is clarity and transparency regarding ownership of the land and of the products from afforestation activities.

The Project was estimated to cost $92 million equivalent, including $16.4 million in foreign exchange. Of the total cost, 54.3 percent ($50 million) was financed by ADB with an amortization period of 40 years, including a grace period of 10 years.

III. Analytical Methods

The economic analysis for the Project focuses on the overall project and the four subprojects which are assumed to represent the range of physical conditions of the Project areas, and affect the development and/or

rehabilitation of forestlands. Specific development activities were identified for implementation at each core subproject area and were deemed replicable for the agro-ecological zone of the subproject. Each subproject includes different levels of eight (financially tested) forestry models, subproject-specific project administration cost, and other capital investments. The economic analysis further makes assumptions with respect to: (i) foreign exchange rates, (ii) opportunity cost of labor, (iii) subproject costs, and (iv) subproject benefits. The economic analysis performed was based on comparison of the project viability against the without-project scenario.

While the official exchange rate of the taka floats relative to the US dollar, government intervention in international trade has resulted in some distortions in the prevailing rate of exchange. A shadow exchange rate factor of 1.25 has been used in the economic analysis to revalue border prices of tradable items. The opportunity cost of labor was derived by adjusting the prevailing (market) wage rate by a factor of 0.8 in line with estimated levels of seasonal unemployment, and underemployment in the Project areas. The factor of 0.8 is also consistent with other project analysis conducted in Bangladesh during the same time period.

The economic costs of each subproject were derived by adjusting the financial costs of different models (excluding price escalation, taxes, and duties) by the opportunity cost of labor and the shadow exchange rate. In addition, the subproject's share of projectwide costs of construction/improvement in the Project facilities, consultancy services, vehicles and equipment, and overseas training were also included in the subproject cost estimates. The economic cost of nontradable items were based on the prevailing market prices, which are then assumed to remain unchanged in real terms (at constant 1996 prices). Costs have been adjusted to reflect border prices using shadow pricing.

The value of the incremental production of timber, fuelwood, and fodder generated from the investment activities at respective subprojects comprise the benefits. Timber production was calculated based on harvested volume (measured in cubic meters [m^3] per ha per year) under specific agro-ecological conditions. The volume of fuelwood and fodder was estimated as biomass (kg/ha) produced and harvested intermittently. The economic prices of timber were derived from cost, insurance and freight (CIF) price in local currency adjusted for transport and handling costs; the

shadow exchange rate factor was applied to the border price to revalue it in terms of domestic price levels. The economic prices of nontradables were derived from converting domestic financial prices (similarly adjusted for taxes and duties) into border price equivalent, and were assumed to remain constant in real terms (in 1996 constant values). The procedure adopted by World Bank-funded *Forest Resources Management Project* was used to estimate prices for wood, fuelwood, and poles. Estimated figures are \$104.70, \$111.90 for border and domestic prices per m^3 of wood, respectively. Economic stumpage values for fuelwood, poles, and short rotation sawlogs, are \$40.19, \$30.14, and \$61.96 per m^3 respectively.

The period of analysis was set at 33 years to take account of the rotation age (or a multiple thereof) of the common tree species grown in the project area. The stumpage values of unharvested trees at year 33 were calculated and included as project benefits.

IV. Economic Evaluation of Environmental Impacts

A. Watershed Protection Benefits

The Project would generate watershed protection benefits in two ways. First, the rehabilitation and reforestation of degraded forests would benefit the surrounding communities through reduced flooding and reduced siltation of irrigation canals. Second, the establishment of the parks would prevent deforestation in the future. Although no studies of the benefits of watershed protection have been conducted in the Project area, research elsewhere has estimated watershed protection benefits of \$8 per ha annually. Similarly, the benefits from enhancement of soil fertility and improved shelter are estimated as increasing net gains from both agroforestry shelter belts and woodlots. Overall annual benefit of \$4-8 per ha was assumed as watershed protection benefits of the Project.[3] The estimated annual watershed protection benefit from the Project are \$227,000-455,000, for low and high rates, respectively.

[3] *Several studies estimate annual per hectare benefits in the \$12-15 or higher range notably Ruitenbeek, 1989 and Srivardhana, 1986.*

B. National Parks

Under this project component about 8,000 ha of tropical moist rainforestland will be developed into national parks and wildlife sanctuaries. This includes an area of about 2,580 ha of existing parks and 5,660 ha of new land to be declared as national parks. According to the forest law of the country, once it is declared as a national park, timber felling and other ecologically harmful activities will be prohibited. The Project will finance development of ecologically sound park management plans, and other infrastructure development required for the sustainable management of the proposed seven national parks.

Economic benefits from the proposed national parks cannot be fully expressed in quantitative terms. Such benefits include biodiversity protection (tropical moist rainforests are considered to have among the highest biodiversity in the world and very few such forests exist today), watershed protection, soil erosion control, recreation, and many others. It is expected that on the average, 210,000 local people visit the parks, and spend at least Tk200 per day. If they spend Tk200 per day (including travel cost, entrance fee, and other related expenses), the economic benefits can be estimated at Tk42 million per year. Currently, not many foreign tourists visit national parks except in the Sylhet area. Over time it is expected that the number of foreign tourists will increase, but for the purpose of economic analysis their contribution is considered zero. A 3 percent annual escalation factor was assumed to capture the incremental benefits from recreation.

C. Carbon Sequestration

Carbon sequestration is the process whereby there is uptake and storage of atmospheric CO_2 by plants and trees. The increase in CO_2 in the atmosphere is believed to be a contributory factor to global warming and therefore a reduction of CO_2 creates benefits on a global scale. The potential to absorb CO_2 of tropical moist rainforests may vary from 6 to 16 tons per ha per year. Old forests do not sequester carbon as effectively as younger stands and so in this analysis it is assumed that only 6 tons of carbon can be absorbed annually. This figure is conservative but several considerations

influenced the assumption: (i) even without the Project there is some extent of vegetation in the Project areas, (ii) agroforestry models will have short-term harvesting and part of the Project period may not have green cover in the total land area, (iii) some of the short-term harvesting will release carbon into the atmosphere.

The estimation of economic benefits from carbon sequestration is even more complex. Fortunately the Intergovernmental Panel on Climate Change (IPCC) has recently developed valuation tables to assess such benefits. This analysis is based on IPCC values as documented in ADB's *Economic Evaluation of Environmental Impacts: A Workbook* (1996). The average annual climate change damages for carbon emissions (1992 $/ton) are given below:

1991 - 2000	$7.85 - 17.66
2001 - 2010	8.64 - 19.43
2011 - 2020	8.90 - 20.03
2021 - 2030	8.89 - 20.00

It is difficult to separate environmental and non-environmental benefits (costs) in most natural resouce-related development projects, unless the analyst strictly uses the definition of environmental benefits (costs) as unaccounted benefits (costs) in market transactions. From Table 1, it can be seen that traditional economic benefits alone generate an overall EIRR of 20 percent. The estimated EIRRs for the subprojects are: 23, 23, 27 and 14 percent for Bandarban, Dhaka, Rajshahi, and Sylhet, respectively. This shows the economic viability of the Project. However, the addition of the economic valuation of environmental impacts increases NPVs and EIRRs significantly. The extent of environmental impacts considered in this Project cannot be clearly defined, and it should be stressed that due to benefits which could not be quantified—the estimates are at best conservative. For example, the development of national parks and wildlife sanctuaries will have direct benefits to residents of the Project area, and it will also have far reaching benefits in terms of watershed protection and soil erosion control for those outside the Project area. Biodiversity protection and carbon sequestration are global benefits resulting from park and sanctuary development. The EIRR considering the inclusion of environmental benefits,

Table 1: Integrated Economic and Environmental Analysis ($'000)

Year	Economic Cost	Economic Benefit		Environmental Benefit		Integrated Net Benefit	
		Benefit	Net Benefit	High	Low	High	Low
1997	*8,029*	*412*	*(7,617)*	*1,332*	*1,024*	*(6,285)*	*(6,593)*
1998	*2,388*	*316*	*(2,017)*	*1,723*	*1,245*	*(349)*	*(826)*
1999	*1,261*	*249*	*(1,071)*	*3,068*	*1,803*	*2,055*	*791*
2000	*607*	*980*	*373*	*6,733*	*3,447*	*7,106*	*3,820*
2001	*687*	*274*	*(412)*	*8,712*	*4,333*	*8,300*	*3,920*
2002	*740*	*218*	*(522)*	*8,793*	*4,367*	*8,272*	*3,846*
2003	*1,038*	*2,747*	*1,708*	*8,878*	*4,403*	*10,587*	*6,111*
2004	*9*	*218*	*209*	*8,968*	*4,439*	*9,177*	*4,649*
2005	*9*	*218*	*209*	*9,061*	*4,477*	*9,271*	*4,687*
2006	*9*	*218*	*209*	*9,160*	*4,516*	*9,369*	*4,725*
2007	*633*	*56,193*	*55,560*	*9,263*	*4,556*	*64,823*	*60,116*
2008	*4,953*	*412*	*(4,540)*	*2,632*	*1,577*	*(1,908)*	*(2,963)*
2009	*1,467*	*316*	*(1,151)*	*3,810*	*2,096*	*2,659*	*945*
2010	*586*	*249*	*(336)*	*8,186*	*4,048*	*7,850*	*3,712*
2011	*45*	*980*	*934*	*9,935*	*4,818*	*10,870*	*5,752*
2012	*125*	*274*	*149*	*10,067*	*4,864*	*10,217*	*5,014*
2013	*8*	*218*	*210*	*10,206*	*4,912*	*10,416*	*5,122*
2014	*307*	*2,747*	*2,440*	*10,351*	*4,962*	*12,791*	*7,402*
2015	*9*	*218*	*209*	*10,504*	*5,012*	*10,713*	*5,222*
2016	*9*	*218*	*209*	*10,664*	*5,065*	*10,873*	*5,274*
2017	*9*	*218*	*209*	*10,832*	*5,119*	*11,041*	*5,328*
2018	*633*	*56,193*	*55,560*	*11,009*	*5,174*	*66,568*	*60,734*
2019	*4,953*	*412*	*(4,540)*	*4,261*	*2,126*	*(280)*	*(2,414)*
2020	*1,467*	*316*	*(1,151)*	*5,550*	*2,675*	*4,399*	*1,524*
2021	*586*	*249*	*(336)*	*10,126*	*4,694*	*9,789*	*4,358*
2022	*45*	*980*	*934*	*11,798*	*5,410*	*12,732*	*63,444*
2023	*125*	*274*	*149*	*12,024*	*5,474*	*12,173*	*5,624*
2024	*8*	*218*	*210*	*12,260*	*5,540*	*12,470*	*5,750*
2025	*307*	*2,747*	*2,440*	*12,509*	*5,609*	*14,949*	*8,049*
2026	*9*	*218*	*209*	*12,770*	*5,679*	*12,979*	*5,888*
2027	*9*	*218*	*209*	*13,044*	*5,751*	*13,253*	*5,961*
2028	*9*	*218*	*209*	*13,332*	*5,826*	*13,541*	*6,035*
2029	*633*	*56,193*	*55,560*	*13,634*	*5,903*	*69,194*	*61,462*

	Without Environmental Impact	With Environmental Impact		Net Environmental Benefit	
		High	Low	High	Low
Net present value @10%	*18,739*	*84,827*	*51,990*	*66,088*	*33,250*
Net present value @12%	*12,304*	*65,930*	*39,524*	*53,626*	*27,220*
EIRR (%)	*20.22*	*34.85*	*29.76*		

EIRR = economic internal rate of return.

With environmental impact estimates of EIRRs exclude global impacts.

with and without global benefits (costs) were estimated at 41.29 and 29.76, respectively. It should be noted, that the contribution of global benefits from carbon sequestration amounts to 36 and 43 percent of NPV for low and high scenarios, respectively. In a timber-scare country like Bangladesh where labor cost is relatively low, reforestation brings substantially high economic returns particularly when global impacts are considered.

V. Notable Aspects

An important part of this Project is the fact that a social analysis was carried out early in the project formulation stage. This step permitted local residents to express their interests in the Project's components and to have some voice in the design and implementation of the Project. This local interest was then central to the selection of subprojects. That is, subprojects were selected on the basis of interest and the potential for participation by members of local communities, as well as by the extent of poverty and landlessness among local residents.

The Project is sensitive to the existence of endangered plant and animal species in project areas, and it recognizes the considerable importance of non-timber forest products to local people. Village residents will play an important role in participatory management of Project lands. The designation of certain areas as "parks" should aid in the protection of biomass into the future.

Project benefits arise not only from direct and tangible outputs such as timber and other forest/agroforest-based products, but also because of enhanced watershed protection, recreational opportunities, and the increased capacity for carbon sequestration. Traditionally, these were not taken into account in project economic analysis. These benefits are valued using accepted techniques in environmental economics. Methods and data from the IPCC were used to estimate beneftis from carbon sequestration. The benefits were estimated under low and high scenarios for two discount rates—10 and 12 percent. The estimated environmental benefits vary from $27 to $66 million over the entire Project period. This analysis clearly indicates that the Project substantially contributes to the improvement of the environment.