BANGLADESH:

COUNTRY REPORT TO THE FAO INTERNATIONAL TECHNICAL CONFERENCE ON PLANT GENETIC RESOURCES

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Note by FAO

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Foreword

The Bangladesh Agricultural Research Council (BARC) is pleased to make this document available to those who are interested in conservation and use of plant genetic resources. We, in Bangladesh, see this problem in the context of developing agricultural production systems capable of providing adequate food, clothing, and shelter to a population that is expected to double in the next 35 to 40 years. It is difficult to comprehend that the existing agricultural production systems, resting on a few high-yielding varieties, would be robust enough and would tolerate the enormous strain on resource bases that the enhanced demand would entail.

Ours is a risk-prone country. This means that gone are the days when we could afford to rank superiority of cultivars only in terms of high yield. Tolerance to biotic and abiotic stresses like insects, diseases, weeds, drought, waterlogging, salinity are some of the issues that would dominate research agenda in future. Developing genetically manipulated / engineered plants, capable of withstanding stresses and at the same time cost-effective and environment friendly, would only be possible if we could identify, isolate, and insert into target plants the appropriate gene(s). Old cultivars, landraces, wild relatives of crop plants or even alien plant genetic resources are the repository of those genes.

There are, however, hard realities that extend far beyond biological constraints. The recently adopted GATT/WTO accords require countries to adopt one or the other kind of intellectual property rights for plants and micro-organisms, and allow signatory states to seek retribution from states that "pirate" technology patented in other countries. For the developing countries the message is clear. They have, thus far, been generous in giving away their plant genetic resources to others including developed countries, without even thinking that these 'nature's gifts' are worth for charging payments. It is these genetic resources that biotechnology firms in developed countries may now be putting into use to produce genetically engineered plants. Patenting those plants mean that developing countries may be required to pay for the "value" added to the same raw material procured at practically no cost.

The rules of the game here may seem unfair. But this is a warning, to developing countries, of what may follow if they do not learn to value the treasure of bountiful plant genetic resources that 'Mother Nature' has endowed them with.

We are probably witnessing the dawn of an era when privatization in the name of protecting "property rights" will increasingly push back the spirit of international collaboration in the use of plant genetic resources, and to develop improved varieties in the common interest of fighting poverty and malnutrition globally. Limitations of access to advanced plant genetic material implies that developing countries will now have to be vigilant in recording their plant genetic resources, conserving them, using them, and above all, they will have to learn and understand the true market value of their genetic resources.

BARC hopes that this document, the first of its kind produced in the country, will prove useful in creating an awareness about the importance of protecting plant genetic resources and conserving species biodiversity, the basic building material for producing new types of crops to meet unprecedented demands for food, fibre, and fuel in future.

M. Sujayet Ullah Chowdhury
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Preface

The Earth Summit at Rio de Janeiro in 1992 helped create a new global awareness about collection and conservation of plant genetic resources (PGR). PGR conservation has assumed a high priority, especially in developing countries like Bangladesh, following the new GATT/WTO accords.

Bangladesh is an abode of 5,000 plant species and is the secondary centre of origin of many plant species, including a large number of cultivated plants. In the past, Bangladesh did not accord enough emphasis on conservation of its plant genetic wealth. "The access to abundant plant genetic diversity will be the key to human survival. If diversity goes, we will soon follow" - this is more applicable to Bangladesh where genetic erosion is occurring rather fast and conservation efforts are weak.

Three institutions in Bangladesh maintain genebanks: the Bangladesh Rice research Institute (BRRI); the Bangladesh Jute Research Institute (BJRI); and the Bangladesh Agricultural Research Institute (BARI). Activities of these genebanks are confined to crop plants, these institutes are mandated to deal with. There is a large number of plant species that are 'uncared for' and are subject to extinction due to rapid population increase, urbanization, deforestation and various 'development' projects. We have already lost some of our valuable 'landraces'. Already 45 plant species of the country are on the verge of extinction. There is only about 5 per cent forest cover left. Ecological risks will multiply if we cannot improve forest covers; foods from plants will be scarce if we cannot develop improved varieties using genetic diversity. All these warrant conservation and utilization of our plant genetic resources before they become extinct.

Even the activities of the existing, narrow focused genebanks suffer due to a host of problems. It is time that an integrated approach be taken to conserve the nation's wealth of PGR - field crops, horticultural crops (including fruit trees), forest species, forage crops, medicinal and floricultural plants. An integrated approach for PGR conservation is an urgent need for developing improved varieties of plants to meet the increased demand in future.

The Intellectual Property Rights, the Plant Breeders' Rights, the Patent Rights, etc. will diminish our chance of obtaining plant genetic resources from other parts of the world. It is important that we formulate our PGR strategy, not only at the national level but also at regional and global levels. Bangladesh needs to make its position clear soonest, before the International Conference and Programme for Plant Genetic Resources (ICPPGR) in 1996.

This Country Report, prepared according to the guidelines of FAO, attempts to put together, perhaps, for the first time, aspects of our PGR. The report has many deficiencies. Nevertheless we have made a beginning. We hope, the report will help create awareness about and concern for PGR conservation in the country. We also hope, we shall be richer with information on our PGR in the near future, and prepare ourselves to safeguard our natural resources not only for the present generation, but for generations yet unborn.

We are thankful to Dr. S. D. G. Jayawardena, IPGRI Expert, for his caring guidance during the preparation of the report. We are also thankful to Dr. Kenneth W. Riley, Regional Director of IPGRI for Asia, Pacific and the Oceania (Singapore) for his kind assistance in and concern for the preparation of the country report in time. The comments and the encouragement given by Dr. N. Murthi Anishetty of the FAO headquarters (Rome) contributed to the improvement of the draft report. We specially thank Professor M. Salar Khan for going through the draft critically and for making valuable suggestions.

Thanks are due to Dr. Herbert Van der Vosen of the Seed Wing, the Ministry of Agriculture for his significant contribution, and Dr. M. L. Chadha, AVRDC Expert, for providing very useful information.

Our special thanks are due to Dr. Kazi M. Badruddoza, Scientist Emeritus of the NARS of Bangladesh, for his guidance and encouragement, and Dr. M. Sujayet Ullah Chowdhury, Executive Vice Chairman, Bangladesh Agricultural Research Council (BARC) for providing all possible supports towards the preparation of the report.

We thank all our colleagues in the National Agricultural Research Systems (NARS), the teachers of universities, the BCSIR, the Association of Development Agencies of Bangladesh (ADAB - the association of NGOs in the country), and private sector agencies for providing information that helped us prepare this report.

Finally, we thank Messrs. Wasiuzzaman and Manjoor Ahmed of the Agricultural Information Centre of BARC for their prompt help in making available photocopies of numerous documents, including the draft report.

BARC, Dhaka
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CHAPTER 1
Introduction to Bangladesh and Its Agriculture

Emergence of Bangladesh

Bangladesh emerged as an independent nation in 1971 following a liberation war that shattered the already weak economy. The country has not yet prospered, but made a triumphant recovery during the last two decades. Contributions from agricultural research coupled with the toils of some 14 million small farm-households brought in sight, within two decades, the country's long cherished dream for "food self sufficiency". Food grain (cereal) production increased from about 9 million tonnes in 1960 to 19.4 million tonnes in 1991-92. The challenge the country faces now is not only to sustain the productivity in agriculture in the face of declining resource bases but also to increase production further to meet the demand of the growing population.

Geographical Location

Bangladesh has a total area of 143,999 sq. km, stretching between 20034° and 26,038° in the north latitude and between 88,001° and 92,041° east longitude. The country is surrounded by Indian territories in the west, the north, and the east, except a small strip in the south-east by Myanmar. The Bay of Bengal lies in the south.

Topography and Soil

The land mass of Bangladesh is flat, with some uplands in the north-east and the south-east. The land elevation varies from 3 m to 45 m (Mondal, 1990). In Chittagong Hill Tracts, however, the hill top reaches an elevation of about 100 m. The geo-morphology of the country comprises of a large portion of flood plains (75%), some terraces (13%) and hilly areas (12%). The Ganges-Brahmaputra-Meghna river system with its some 400 tributaries/ distributaries form a maze of interconnecting network of channels. The rich water systems used to provide an enormous variety of fresh water fish, the traditional protein source in the diet of the people. The per capita availability of fish has declined

remarkably in recent years due mainly to habitat destruction. Regular inundation of land during the monsoon season bestowed the country with highly fertile, alluvial soil. Over and/or un-judical exploitation have contributed to rapid land degradation. A declining land productivity is now evident virtually in all agro-ecological zones (AEZs). Thirty AEZs have been identified throughout the country (Figure 1).

Climate

The climate is sub-tropical monsoon, marked by sweltering temperature in summer months. Even though locally six seasons are recognized, of these four are conspicuous: winter (Dec-Feb), summer (Mar-May), monsoon (Jun-Sept) and autumn (Oct-Nov). Farmers, however, recognize two cropping seasons: Rabi for the drier-cooler months (Oct-Feb) and Kharif for the hot and wet months (Mar-Sept).

Temperature ranges from 5°C to 28°C in winter and 22°C to 40°C in summer months. Humidity ranges from 60 to 70 per cent in winter and 80 to 98 per cent during monsoon. About 80 per cent of the total rainfall is concentrated during monsoon, with occasional showers in summer, and hardly any rainfall in autumn and winter. The average rainfall varies from 1429 mm in the north and north-west parts of the country to 4338 mm in the east and south-east parts (BBS, 1994).

Bangladesh is one of the world's most risk prone areas. During the months from March to September (covering the summer and the monsoon seasons), natural calamities like cyclone, tornado, flood and tidal surge often hit the country and cause widespread damage to life and property. Also, constant changes in the courses of the rivers and their tributaries/distributaries wash away crop fields and homesteads. This river bank erosion causes a total loss of not only crops but also other plant genetic resources in affected areas, and drives hundreds of families to utter destitution, forcing them to take shelter in areas previously reserved for crops, forests or other plant genetic resources. In the interest of the country vis a vis its plant genetic resources, the devastation caused by river bank erosion deserves a serious attention.

Farmers continue to grow crops amidst such calamities, through approaches of natural selection. In the process they have selected, over millennia, crop cultivars that can withstand calamities and/or suit post calamity crop culture so that they (farmers) can procure their means of survival.

Population

The 1991 census showed a population of 106 million in Bangladesh. There are 806 persons per square kilometre. Bangla is the lingua franca and English is widely used.

Agriculture

Agriculture is the main occupation of the people. The sector employs 61.3 per cent of the labour force (BBS, 1994) and contributes around 36 per cent to the GDP (BARC, 1995).

The country's traditional agriculture has been highly diversified, with more than 160 crops grown throughout the year (Mondal, 1990). This is integrated with livestock, fisheries and homestead forestry components. Cropping intensity has now surpassed 170 per cent (BBS, 1994). However, with the increase in population and an intensive cultivation of cereal crops (HYV rice and wheat), cereal area increased at the expense of many other crops including jute, pulses and oil seeds. Recent trends in the cultivation of major crops are shown in table 1.

FIGURE 1 AGRO-ECONOMICAL ZONES OF BANGLADESH

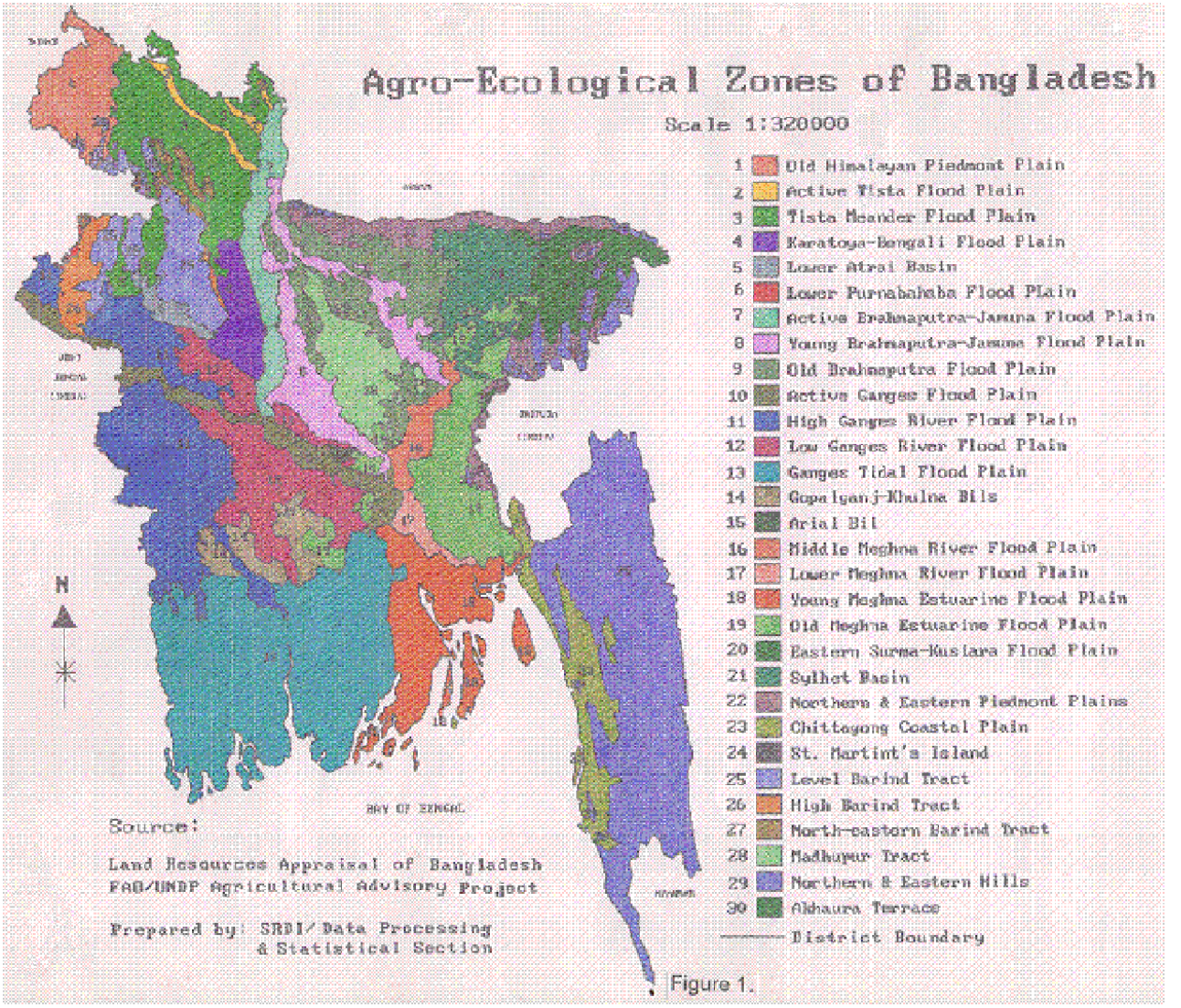


Table 1 Area (million hectares) and production (million tonnes) of major agricultural crops

Year	Rice		Wheat		Pulses		Oil seed		Jute		Sugarcane	
	ha	t	ha	t	ha	t	ha	t	ha	t	ha	t
77-78	10.03	12.77	0.19	0.34	0.84	0.58	0.43	0.36	0.73	0.96	0.15	6.67
79-80	10.12	12.54	0.43	0.81	0.81	0.56	0.41	0.34	0.76	1.07	0.15	6.34
81-82	10.46	13.36	0.53	0.95	0.78	0.55	0.43	0.35	0.57	0.84	0.16	7.14
83-84	10.55	14.42	0.53	1.21	0.76	0.53	0.42	0.46	0.69	0.95	0.17	6.96
85-86	10.46	15.04	0.54	1.04	0.71	0.51	0.51	0.46	1.06	1.57	0.16	6.64
87-88	10.31	15.41	0.61	1.05	0.63	0.44	0.59	0.44	0.51	0.85	0.17	7.21
89-90	10.42	17.71	0.59	0.89	0.69	0.49	0.55	0.43	0.54	0.84	0.19	7.42
91-92	10.25	18.26	0.58	1.07	0.69	0.48	0.57	0.46	0.59	0.98	0.19	7.45
93-94	10.31	21.15	0.62	1.11	0.74	0.52	0.55	0.43	0.61	0.94	0.18	7.51

Courtesy of Dr. H. Van der Vosen, Seed Wing, Ministry of Agriculture, Govt. of Bangladesh.

Rice, wheat, jute, sugarcane, pulses, oil seeds, potato and vegetables are principal crops. The country also produces about 40 million kg of tea and about 0.945 million tonnes of high quality jute annually (BBS, 1994). Banana, papaya, pineapple, mango, jackfruit, guava, coconut and 'jujube' are important fruits. The cultivated crops of Bangladesh with their growing seasons (Rabi or Kharif) are shown in Appendix - I.

Jute, prawns and shrimps, leather and leather products, and tea are major export crops. The major agricultural imports include wheat, pulses, edible oil and oilseeds, sugar, spices, fruits, raw cotton and cotton yarn, and tobacco products. The country is grossly deficient in timber and wood products.

Bangladesh soils have traditionally been known to be highly fertile. However, the following are the major factors that contributed to a rapid decline in soil organic matter content, both major and micro plant nutrients, and a consequent decline in agricultural productivity in recent years:

1. intensive cereal cultivation forced by the food demand of the increasing population (especially since the introduction of HYV rice and wheat);
2. changes in cropping patterns in favour of cereal (especially rice) monoculture;
3. constructions of numerous flood control embankments and 'polders' (that obstruct natural inundation of land and prevent annual deposits of silts that used to add an immeasurable amount of plant nutrients to the country's soils every year);

4. intensive crop cultivation throughout the year without adequate nutrient replenishment of soils. A study by FAO (1992) reveals that 250 - 300 kg nutrients per hectare are depleted from Bangladesh soils every year;

5. inability of capital starved subsistence farmers to procure and use balanced inputs for crop culture.

Subsistence Agriculture

Subsistence farming practices characterize Bangladesh agriculture. The average holding size per farm-household is 2.2 acres (~0.9 ha). The land holding size is highly skewed among farming families (Table 2).

Table 2 Farmers category and farm holding size

Farmers' category	Per cent of total number of farmers	Range of holding size (Acre)	Average holding size (Acre)
Small	70.34	0.05 - 2.49 Acre ~(0.02 - 1.00 ha)	0.9 ~(0.36 ha)
Medium	24.72	2.50 - 7.49 ~(1.01-3.03 ha)	4.1 ~(1.66 ha)
Big	4.94	7.50 and above ~(3.04 ha)	11.8 ~(4.78 ha)

Source: Bangladesh Bureau of Statistics, 1994

The subsistence agriculture produces barely enough for survival of the farm-household and as such it can barely make a significant contribution to economic growth. The subsistence agriculture is also an obstacle to attaining production goals through an intensive extension service as well as cost intensive modern technologies. The other challenge Bangladesh faces is how to transform its subsistence farming to commercial agriculture, without essentially driving farmers out of their lands.

Seed Production and Supply Systems

Up till now seed production and distribution have been managed in the public sector by the Bangladesh Agricultural Development Corporation (BADC). Institutions (Agricultural Research Institutes, universities and others) involved in variety development supply Breeder Seeds to BADC for production of Foundation Seeds and Certified Seeds under the supervision of their (BADC) seed personnel. The quality control of seeds is the responsibility of the Seed

Certification Agency (SCA) of the Ministry of Agriculture and the institutions that furnish the breeder seeds.

BADC can supply an estimated 5 per cent of the seed requirements. Even that is confined to a limited number of crops (rice, jute, wheat, vegetables, etc.). Sources differ widely in their estimates of seed supply by BADC (Table 3).

Table 3 Estimates of seed supply (% of requirements) by BADC

Crop	CDP-DEA (1994)	Fifth 5-Year Plan Document, MoA[1]
Rice	1.63%	3.64%
Jute	14.00%	16.00%
Wheat	15.66%	22.00%
Oilseeds	1.74%	2.20%
Pulses	0.16%	0.20%
Vegetables	0.34%	43.00%

1Courtesy of Dr. H. Van der Vosen, Seed Wing, Ministry of Agriculture, Govt. of Bangladesh

The rest of the requirements are met from farmers' own retained seeds, farmer to farmer exchanges, and from purchases in markets. There is virtually no quality control of these (non-BADC) seeds and often they are of unknown origin.

A substantial amount of seeds, especially of vegetables like cabbage, cauliflower, radish, carrot, etc. are imported and marketed by private sector seed dealers. At the moment there is no foreign seed companies involved in seed production in the country. A few NGOs and indigenous seed companies produce seeds locally but their scale of production is too small to make any significant impact. Most of the private seed companies are involved in seed import-and-sale. Even though the private sector seed companies have recently started to emerge and take interest in in-country seed production (mostly for vegetables), they are yet to develop technical capabilities and extend seed production to cover a wider number of crops.

Crop Vulnerability

Bangladesh agriculture is overwhelmingly rain-fed and highly vulnerable to floods, droughts, cyclones, tidal waves as well as river bank erosion. For example, consecutive devastating floods of 1987 and 1988 destroyed the country's major crops (rice and jute); the drought of 1989 had a heavy toll on

the country's agricultural production; the lack of rain in 1994 reduced the main rice crop (Aman rice) production by about 15 per cent. The Government now estimates that nearly one million tonnes of rice will need to be imported in 1995. Occurrences of insect and disease attacks are widespread, resulting in estimated crop losses ranging from 10-15 per cent every year.

The country nevertheless holds a great potential for agricultural development. There exists a large gap between the productivity potentials (as demonstrated in agricultural experiment stations) and what is obtained by the resource poor farmers of the country. The gaps range from 25 per cent to 80 per cent depending on crops and regions of the country. On the other hand, the country's rich reserve of plant genetic resources (including their wild relatives) provide a wide scope for crop improvement through genetic manipulations. One can therefore hardly overemphasize the importance for protection, collection and conservation of these genetic resources before they are lost forever. Collections and conservation of plant genetic resources (PGR) have assumed a greater importance especially in view of the newly introduced GATT/WTO accords.

Abundant year-round solar radiation, sub-tropical environment, small variation in diurnal and seasonal temperature, and high humidity throughout the year rendered Bangladesh rich in vegetation all round the year. There has been a reserve of genetic diversity of some 5,000 species of higher plants (Khan, 1977). This diversity imparted characteristic features to indigenous crop plants that belong to a wide array of species, genera, and families, with enormous genetic variability within traditional crop species. For example, there were over 8,000 cultivars of rice (Oryza sativa) (Haque and Mia, 1989); as far back as 1907 Burkill and Finlow observed, "There are 33 types of Corchorus capsularis under cultivation as against 5 of C. olitorius." In a recent study 1090 landraces of Deshi jute (Corchorus capsularis) and 519 of Tossa jute (C. olitorius) were reported scattered throughout the land mass of the country (Husain et al., 1988).

Bangladesh, in fact, constitutes a larger part of the South Asian Centre of genetic diversity, sharing with India. There are still today some 500 plant species that are of medicinal importance; some 130 species of fibre resources (both wild and cultivated); 18 species of bamboo, and so on (Khan, 1991). The country is the secondary centre of origin of diversity of major crops like rice and jute, a number of vegetables like egg plant, okra, the cucurbits, taros and yams, pulses and beans, oilseeds, a number of leafy vegetables, fruits like mango, jackfruit, citrus, spices like chillies, ginger, turmeric etc. In this delta once grew the unique fibre crop, the "muslin cotton" (believed to a cultivar of Gossypium arboreum) which is now extinct. Unfortunately information on

genetic erosion and/or extinction of plant species is scanty in Bangladesh. Isolated studies reveal that some 45 species of angiosperms and at least 2 species of pteridophytes are threatened in this delta (Khan, 1991; Huq and Banik, 1992). At least nine threatened species are tentatively regarded as endemic to Bangladesh (Khan, 1991).

In Bangladesh a sound national plant genetic resources (PGR) system does not exist. Also the conservation emphasis is limited mainly to rice and jute. There is an urgent need to formulate a comprehensive national PGR system, perhaps through the formation of a Bureau of Plant Genetic Resources. The proposed Bureau would not only be involved in orthodox germplasm conservation but would also serve, in the long run, as a Tissue Culture Repository, a Cryo Bank and a DNA Bank. The development of advanced facilities is important as these techniques are going to play very important roles in germplasm conservation and exchange on days ahead. In short, the development of a sound national PGR system is considered sine qua non for attaining the country's long term objectives of sustainable agricultural production.

CHAPTER 2
Indigenous Plant Genetic Resources

2.1 FOREST GENETIC RESOURCES

Bangladesh statistics show a total forest area of 1,559 sq. km or about 12.8 per cent of the total land area of 143,999 sq. km. (BBS, 1994). Estimates of other sources, however, reveal a much less area under forest cover. For examples, Gittings and Akonda (1982) estimated, a decade ago, that the forest area of Bangladesh shrank from 16.5 per cent in 1971 to 6 per cent in the early '80s. A recent study showed a forest cover of 6.5 per cent (BFRI, pers. communication). Hoque et al. (1993) puts the figure at only 5 per cent. It is estimated that forests in Bangladesh do not exceed 5 to 6 per cent of the total land area. It will not be surprising if the actual forest cover is even less. However, in addition to this reserved forest area, there are some 0.27 million hectares of village forests comprising of village-groves, mostly with multipurpose trees (MPTS), bamboo, canes and shrubs.

The forest resources of Bangladesh have been classified as:

1. mangrove forest (0.67 m ha),
2. hill forest (0.67 m ha),
3. plain land forest (0.12 m ha),
4. unclassified state forest (0.73 m ha),
5. village groves (0.27 m ha) (Chowdhury and Hussain, 1989).

An estimated 73,000 hectares of Bangladesh forest have been lost through encroachment for aquaculture and agriculture during the last two decades (BFRI, pers. communication). It is also estimated that a loss of about 8,000 hectares of forests occurs annually due to homestead establishment, urbanization, deforestation, etc. Furthermore, poachers damage forest genetic resources more than the loss through fire, diseases, insects or other natural calamities like tidal surges, droughts, etc. (BFRI, pers. communication).This, at the same time, points to the adverse impact of the loss of forests on the wildlife composition.

Bangladesh National Herbarium (BNH) started its plant exploration since 1972 and began publishing the 'Flora of Bangladesh' series which has now reached its 47 the number of fascicles. However, isolated studies provide some information on the important species of the country's natural forests (Das, 1990; Zabala, 1990). These are shown in Appendix - II. Some important forest species, especially those identified as endangered by the Bangladesh Forest Research Institute (BFRI), have been collected and planted in *ex situ* conservation plots of the Institute (Huq and Banik, 1992). The endangered species are shown in Table 4 from two different sources (Huq and Banik, 1992; Khan, 1991).

It is interesting to note that the two sources (see Table 4) had, among the endangered species, only one species (Aquilaria agallocha Roxb.) in common. Based on these, it would appear that not less than 45 species are currently endangered. Khan (1991), in his list, identified some endemic species among those threatened. This means that the loss of these species is a loss not only to Bangladesh but to the entire mankind.

However, with a view to addressing the wanton destruction and the rapid depletion of forest resources, the Government of Bangladesh created a 'Ministry of Environment and Forest' in 1989; updated the Forest Act of 1927; imposed a ban on killing wildlife, on export of frog legs, reptile skins, and felling of trees in high forests. While the impacts of these are yet to be assessed, the Government has recently drawn up a Twenty-year Forestry Master Plan for development and expansion of forests in the country.

Among the forest species a good number, either growing wild or under-utilized, produces edible fruits (Das, 1987). These are shown in Appendix 2.

Table 4 A tentative list of threatened angiosperms in Bangladesh

Source: Huq and Banik (1992)		Source: Khan, M. S. (1991)	
Scientific names	Local name	Scientific name	Local name
Adina cordifolia Hook	Haldu, Rangkat Petpuria, Kelikadam,	*Aglaonema clarkei* Hook.f.	Habinishak
Aphanamixis polystachya (Wall) R. N. Park	Pitraj	*Aldrovanda vesiculosa* L.	Malakkha Jhangi
Aquilaria agallocha Roxb.	Agar	*Aquilaria agallocha* Roxb.	Agar
Bassia latifolia Roxb.	Mohua	*Cirrhopetalum roxburghii* Lindl. (endemic)	
Bauhinia malabarica Roxb.	Kesujya, Nanki, Jhanki, Karmai	*Cymbopogon osmastoni* I R.N.P.	Ajay Ghas, Rukhs Ghas
Castanopsis tribuloides A. DC.	Batna, Barahingorik ,Khami, Hingra	*Debregeasia dentata* Hook.f.	
Couroupita guianensis Aubl.	Nagalingam, Siblingam	*Ealeocarpus lucidus* Roxb.	Bamun
Derris robusta Benth.	Lohasirij, Koroi	*Hippocratea marcantha* Korth.	Katha paharia
Diospyros cordifolia Roxb	Tomal, Maheshkanda	*Homalium schlichtii* Kurz.	
Garuga pinnata Roxb	Garua,Ghogar Kharapata, Bhadi, Dabdubi	*Justica oreophylla* Clarke	Gulancha, Basakpata, Chhota arusa
Hydnocarpus kurzii (King) Warb.	Chalmugra, Bolgachh, Hiddigachh	*Knema bengalensis* De Wilde (endemic)	
Lophopetalum fimbriatum Wt.	Raktan, Serajang	*Limnophila cana* Griff. (endemic)	Karpur
Mesua ferrea L. *(M. nagassirium* (Burm. f.)) Kost	Nageswar. Nagchampa	*Mantisia spathulata* Schutt. (endemic)	
Mitragyne parvifolia (Roxb.) Korth.	Dakroom, Phutikadam. Kelikadam	*Marsdenia thyrsiflora* Hook.f.	Jitti, Reyong
Podocarpus nerifolia Don.	Bansh pata, Jinaru	*Ophiorrhiza villosa* Roxb.	Ganja kuli
Pterospermum acerifolium Willd.	Kanakchampa,Moos, Muchigandha	*Phrynium imbricum* Roxb.	Pitul pata
Pterygota alata (Roxb.) R. Br.	Narikeli, R, KasmiriBadam, Pagla Gachh	*Quercus acuminata* Roxb.	Kantabatana, Kalibatna
Schleichera oleosa (Lour) Oken	Joyenda, Kusum, Joyna, Lakkha	*Rotala simpliciuscula* (S. Kurz) Kuhne (endemic)	
Sterculia foetida L.	Box Badam, Jangli Badam	*Semecarpus subpanduriformis* Wall. (endemic)	Bhela, Bhelatuki, Beula,Bhalao, Bhelama
Swintonia floribunda Griff.	Civit, Amchundul	*Sonneratia griffithii* Kurz	Lemchi, Lemshi
Tamarindus indica L.	Tentul	*Spatholobus listeri* Prain (endemic)	Palaya lata
		Tournefortia roxburghii Clarke	
		Typhonium listeri Prain	Ghet kachu
		Vatica scaphula Dyer (endemic)	
		Vernonia thomsoni Hook.f.	

2.2 MEDICINAL PLANTS

A majority of the people in Bangladesh use herbal medicines, manufactured by indigenous institutions. These institutions use many forest/wild plant resources. The Government is deeply concerned about the rapid depletion of forest resources that include, inter alia, medicinal plants. However, information on medicinal plants, their proper identification and ecological niches, and their conservation measures are yet to be included under scientific studies and documented. The revised list of medicinal plants by the National Herbarium exceeds 500 species (Khan, 1991). However, a list of medicinal plants, identified by the Bangladesh Forest Research Institute (Rashid et al., 1976) is given in Appendix 3.

2.3 OTHER WILD SPECIES AND WILD RELATIVES OF CROP PLANTS

Bangladesh has been, as stated above, the abode of 5,000 angiosperm species (Khan, 1977) and of these only some 160 species are used as crops (Mondal, 1990). Virtually all of the rest are left to grow in the wild. This reflects the country's traditional rich reserve of wild plant genetic resources on the one hand, and the need for their conservation on the other. A preliminary list of available plant species, that are relatives of/allied to crop plants, in Bangladesh is given in Appendix 4.

2.4 LANDRACES ("FARMERS' VARIETIES") AND OLD CULTIVARS

Landraces and old cultivars still play a dominant role in Bangladesh agriculture. However, no serious studies on the significance of landraces have yet been undertaken in the country. Farmers grow and retain these cultivars mainly due to:

a. non-availability of improved varieties and/or their seeds,

b. low input requirements by traditional varieties,

c. their adaptability to specific ecological niches (e.g. deep water rice, salinity tolerant varieties of crops, etc.),

d. their resistance to pests,

e. their specific quality(ies) like finer grain, aroma, specific tastes, etc.

It is significant to note that traditional varieties suited subsistence farming which is still, as stated earlier, the very feature of Bangladesh agriculture. A list of old cultivars of selected crops that are still grown in the country is given in Table 5. It is noted that the varieties shown in the table (Table 5) include, in the main, varieties approved by the National Seed Board and/or those that are widely known. There are numerous other varieties scattered throughout farmers' fields. It has not been possible to include them all here.

It is also important to note that R&D activities on traditional varieties are either very much limited or totally absent. The major policy emphasis so far has been on increased yield, especially of a few major crops. In doing so, quality factors inherent in traditional varieties have often been ignored. As regards horticultural crops (both fruits and vegetables), legumes and oilseeds, traditional varieties play the most dominant role in providing food security of the people.

Under poverty stricken subsistence farming systems, farmers are committed to conservation of traditional varieties, in so far as superior varieties suitable to their socio-economic and ecological conditions, are not available to them. Farmers would be committed to conservation of traditional varieties only if it pays them economically.

However, farmers' methods of conservation and storage have not been a matter of serious study in Bangladesh, and as such these methods have not been documented. It can however be stated that retention of traditional varieties by farmers is not essentially guided by their commitment to conservation, rather by the survival mechanisms adopted by farmers. Equally important is the fact that market oriented agricultural production systems suited to the farming community of the country does not exist. Often a bumper production of a crop leads to a fall in the market price of the produce and thus works against farmers' interests.

Apart from a limited effort to protect some forest areas, land use policies, either to protect plant genetic resources (PGR) or for sustaining agricultural production, have not yet been formulated in the country. Rather, the drive for increasing the food grain production (by promoting HYV rice and wheat), has threatened both minor cereals as well as non-cereal crops. These contributed significantly to genetic erosion of land races. For examples, high quality rice varieties like Bashful, Biroi, etc. are hardly grown these days by Bangladesh farmers, even though the market demand for these is there.

Such a situation is leading to changes/imbalances in cropping patterns, causing soil sickening in many areas, especially in areas devoted to rice monoculture and/or rice-wheat cropping systems. Such an alarming situation could well be averted by developing superior varieties and by broadening the genetic base of such varieties. The first step towards this would be a thorough inventory of indigenous germplasm, their characterization, evaluation, conservation and followed by their utilization in plant breeding programmes.

Table 5 Some old cultivars of selected crops of Bangladesh

Crop	Old cultivars	Remarks
	Rice	
Early Aus rice	Hashikalmi, Dharial, Dular, Kataktara, Morichboti, Holoi, Shaita, etc.	adapted to drought prone areas
Medium to Deep Water Aman rice	Shada Pankaiz, Gabura, Malibhangor, Goda Laki, Dud Laki, Lal Aman, Chamara, Balam, Kaika, Dhepa, Baran Dhan, etc.	used for medium to deep water area due to lack of modern varieties.
Transplanted. Aman rice	Rajashail, Nonashail, Hogla Pata, Nonakuchi, Patnai-23, etc.	adapted to coastal saline areas; no improved variety for these area are yet available.
Transplanted Aman rice	Nizershail, Jhingashail, Kartik Shail, Dadkhani, Kataribhog, Kalijira, Chinigura, Khash Kani, Tulshi Mala, etc.	Grown in specific areas for quality/ aromatic grains; no improved varieties with such qualities are yet available.
Boro (Winter) rice	Tepi Boro, Akhni Shail, Poshu Shail, Lokhai Boro, Rata Boro, Gopal Veri	early taller plant types that can withstand early flood
	Other Cereals and Millets	
Wheat	Kheri	-
Maize Foxtail Millet Prosso Millet	Barnali, Shuvra, Khai Bhutta, Mohar Titas Tushar	- - -
	Jute	
Deshi Jute (*Corchourus capsularis*)	Meghnal, Bhoisha, Tebri, Sachi, Kai, Naris, Deora, Bang, Amarjani, Nut, Boron, Kaizdai, Meghi, Kazuli, Shimul, Kalchit, Chungi, and Amonia.	These are used for adaptability /suitability to local cropping patterns. The government neither encourages nor discourages their use.
Tossa Jute (*C. olitorius*)	Vely, Cheng, Satnala, Moshra, Boupagli, Githanaris, Sadajori, Kochan, Japani, Lalsha, Mashranga.	

Crop	Old cultivars	Remarks
Sugarcane (*Saccharum officinarum*)	Akash Dhar Dhar, Chandan, Chini Kushail, Fata Kushail, Chini Champa, Aat Kushail, Misrilal, Misridana, Kazla etc. are still being cultivated by farmers, especially outside the mill zones.	Traditional varieties degenerate with time producing low cane and sugar yields, with higher susceptibility to pests.
Tea (*Camellia spp.*)	Raj Ghar, Monipuri, Burma, Tingamaria, Ayebheel, Duilia, Dum-Dum,Delinkot, Kyang and Boh-most.	Old tea plants are uprooted each year from hundreds of acres of plantations without prior scrutiny or retaining materials of special interest. Immediate steps are necessary to save germplasm of interest.
Pulses		
Lentil	Utfala (L-5),	-
Grasspea	Local Khesari	-
Chickpea	Sabur-4, Hyrpochhola	-
Mungbean	Sona Mug, Mubarik, Kanti, BINA Mung-1	-
Blackgram	Baromashi Mashkalai,	-
Oilseeds		
Mustard	Tori-7, Rai-5, Shonali Sharisha (SS-75) Daulat (RS-81), Dholi (BARI Sharisha), BARI-7, Bari-8, Shampad (BAU), Kalyania TS-72), Agrani, TS-72, BINA-1, BINA-3, Shafal, Shampad, Shambal	-
Sesame	T-6, T58007	-
Garjan Til	Shova (Guji-1)	-
Linseed	Nila (Lin-1)	-
Niger	Shova (Nig-1)	-
Groundnut	Dhaka-1 (Maizchar Badam)	-
Soybean	Devis	-

Crop	Old cultivars	Remarks
	Tuber crops	
Potato	Lal Pakri, Lal Shill, Ausha, Challisha, Shada Guri, Dohazari Sada, Dohazari Lal, Bograi, Deshi Lal, Deshi Sada, Hagrai, Hira (P501), Marin, Origo	-
Taro	Bilashi (Mukhi Kachu), Latiraj (Pani Kachu), Kath Kachu, Bash Kachu, Narkeli Kachu, Magan Kachu, Kham Kachu, Garo Kachu, Dudh Kachu	-
Sweet Potato	Daulatpuri, BARI -SP4, BARI -SP5, Kamala Sundari, Tripti, Shaheb Alu, Ranga Alu, Lamba Alu	-
	Vegetables	
Brinjal	Uttara (Rajshahi-3), Suktara (F-1), Tarapur (F-1), Khat khatia, Islampuri Begun, Gafargaon Begun, Bichi Begun	-
Country bean	Baromasi Shada Seem, Baromasi Beguni Seem, HC 0084, HC 0010, BARI Seem	-
Cowpea	BARI Felon-1, Barbati, Nabila	-
Tomato	Manik, Ratan	-
Bottle gourd	BARI Lau	-

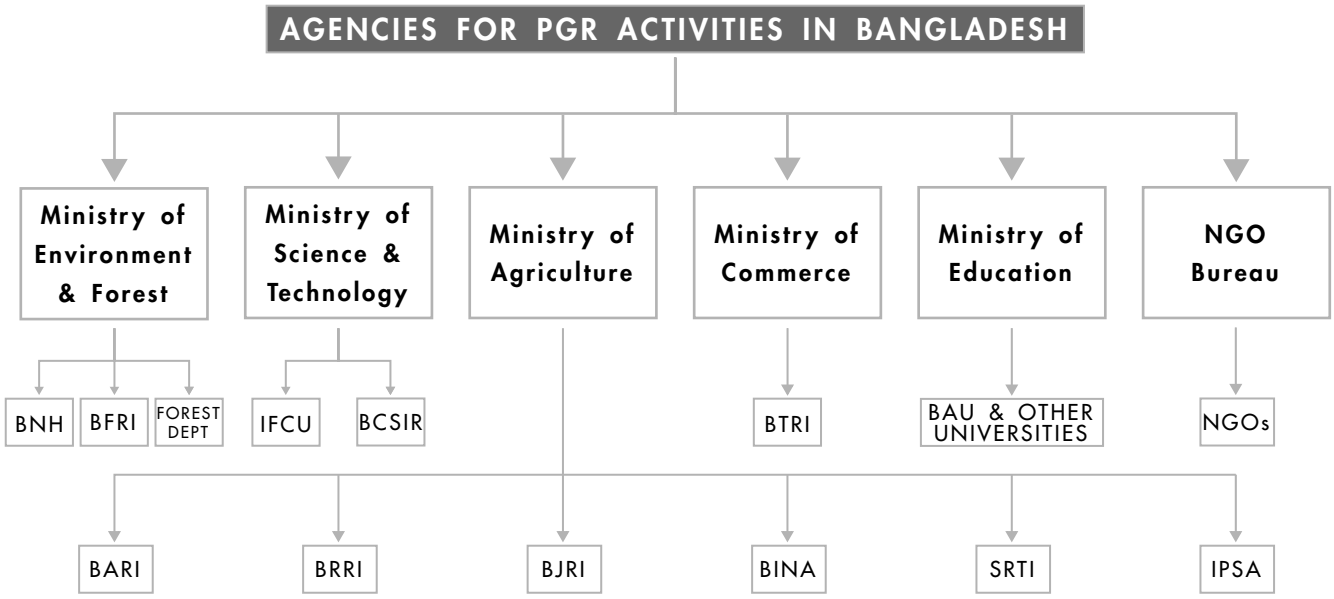
Crop	Old cultivars	Remarks
	Fruits	
Papaya	Shashi Papaya, Shahi, Koinbator, Washington, Honeydew, Kurgo Honeydew, Rachi, Pusa, Solo, Shimla	-
Banana	Amrit Sagar, Shabri, Kabri, Champa, Mahersagar, Chini Champa, Augnisar, Dudsar, Dudsagar, Chadam, Aita, Singapuri, Behula, Mandira, Bier Bati, Bichi kala, Ghima Kala, Anazi Kala	-
Guava	Sahrup Kathi, Kanchan Nagar, Mukundupur	-
Jujuba	Narikeli Kul, Comilla Bell Boroi, Satkhira Narikeli	-
Mango	Lengra, Gopal Bhog, Fazli, Khirhapat, Ashina, Surjapuri, Bombai, Himsagar, Kishanbhog, Aushina, Rajbhog, Brindabani, Kuapahari, Mohanbhog, Misuribhog, Shreedham, Dudhia, Gooti, Boishakhi, Sinduri, Ashari	-
Pineapple	Ghorashal, Giant Kew, Honey Queen	-
Jackfruit	Gala, Khaja, Chaila, Neisha	-
Litchi	China-3, Bombai, Mozaffarpur, Mangalbari, Rajshahi Local	-
Lemon	Kagzi Lebu, Seedless Lemon, Ghora Labu	-
Coconut	Tipica Sabuj, Tipica Badami, Dudhea	-
Watermelon	Goalanda, Patenga, Padma	-
	Spices	
Chillies	Dhani Marich, Kalo Morich, Lamba Marich	-
Turmeric	Dimla (T-027), Sinduri (T-004)	-
Black pepper	Jointa Golmarich	-

CHAPTER 3
National Conservation Activities

Prior to the '70s limited efforts were made to maintain landraces, primarily as active or live materials, and mainly by plant breeders. That even were confined to major crops like rice, jute, sugarcane, potato, etc. Conservation attempts somewhat intensified after the liberation of Bangladesh in 1971. Organized attempts for conservation started with the establishment of the genebank at the Bangladesh Rice Research Institute (BRRI) in 1974. This was followed by the establishment of genebanks at the Bangladesh Jute Research Institute (BJRI) in 1982 and the Bangladesh Agricultural Research Institute (BARI) in 1986.

Small scale conservation activities (with active materials) are being undertaken at Bangladesh Forest Research Institute (BFRI), Sugarcane Research and Training Institute (SRTI), Bangladesh Tea Research Institute (BTRI), Bangladesh Agricultural University (BAU) and a few other universities, Institute of Forestry of Chittagong University (IFCU), Institute of Postgraduate Studies in Agriculture (IPSA), Bangladesh Institute of Nuclear Agriculture (BINA), and Bangladesh National Herbarium (BNH) maintains specimen of collected materials (Fig. 2). In addition some NGOs have also, in recent years, been making efforts to acquire and conserve germplasm. These are, however, scattered efforts at different institutes/ organizations spread over different ministries.

Figure 2 Ministries and institutes involved in PGR activities in Bangladesh



Legend:
BNH- Bangladesh National Herbarium;
BFRI- Bangladesh Forest Res. Inst.;
IFCU- Inst. of Forest, Chittagong Univ.;
BCSIR- Bangladesh Council for Industrial Res.;
BTRI- Bangladesh Tea Res. Inst.;
BAU- Bangladesh Agr. Univ.;
NGOs- Non-Govt. Organizations; BARI- Bangladesh Agr. Res. Inst.;
BARI- Bangladesh Agr. Res. Inst.;
BRRI- Bangladesh Rice Res. Inst.;
BJRI- Bangladesh Jute Res. Inst.;
BINA- Bangladesh Inst. for Nuclear Agr.;
IPSA- Institute for Postgraduate Studies in Agr.

3.1 *IN SITU* CONSERVATION ACTIVITIES

Only the Bangladesh Forest Research Institute (BFRI), in collaboration with the Department of Forestry, has plans for *in situ* conservation. Under this, specific areas in natural forests where valuable indigenous forest genetic resources occur, have been demarcated. The attempts include Selection and Conservation of Provisional Plus Trees (PPTs) and Selection and Conservation of Seed Stand of Tree species, including those in mangrove forests.

So far BFRI has selected 950 PPTs of the following:

Forest tree species:

Species	Local name
Anthocephalus chinensis (Lamk) Rich ex Walp	Kadam
Artocarpus chaplasha Roxb.	Chaplash, Chambal
Chikrassia tabularis Juss.	Chikrass, Dalmara
Dipterocarpus turbinatus Gaertn.	Kali garjan
Hopea odorata Roxb.	Telsur, Tersol
Lagerstroemia speciosa (L.) Pers.	Jarul, Kantajarul
Swintonia floribunda Griff.	Civit, Amchandul
Swietenia macrophylla (L.) Jacq.	Bara Mehogini
Syzygium grande (Wt.) Wall.	DhakiJam
Tectona grandis L. f.	Segun
Toona ciliata J. Roem.	Toon. Pia, Piyas
Xylia spp.	Lohakath

The conservation of seed stand is the first step for the supply of superior planting materials. Up till now such activities are limited to Dipterocarpus turbinatus, Syzygium grande, Lagerstroemia speciosa, Heritiera fomes, Eucalyptus camaldulensis and Acacia auriculiformis species.

Apart from the above mentioned efforts by BFRI, *in situ* conservation activities is non-existent in the country. However, BRRI has identified three *in situ* conservation sites for wild relatives of rice. And only very recently horticulturists have identified a few useful fruit trees (i.e. mango and jackfruit) of interest in different localities. Measures are yet to be taken to protect these genetic resources while further explorations await. Otherwise, the valuable genetic resources that still exist will be lost in no time.

All these attempts warrant support and follow up actions without delay before these genetic resources of special interests are lost. Similarly, explorations/ expeditions have to be organized for identification of genetic resources in the wild and steps be taken for their *in situ* conservation. The more will be the delay, the greater will be the danger of losing these valuable genetic resources. We may have to pay an extremely high price to buy them back, if at all available anywhere, for their future use in the country to develop new varieties of crops, horticultural, forestry and medicinal plants.

3.2 *EX SITU* COLLECTIONS

It is important to note here that there is no national genebank in the country having overall responsibilities for conservation of genetic resources. Of the three institutional genebanks in the country, two (i.e. genebanks at BRRI and BJRI) are monocrop genebanks. The multicrop genebank at BARI cover only a limited number of crop species mandated to the institute. Furthermore, the facilities at BARI is considered inadequate to serve as a national genebank, both in terms of space and in terms of technical facilities.

These institutional genebanks were established with financial and technical assistance from donor agencies. For examples, the Asian Development Bank helped in the establishment of the genebank at BJRI; FAO/IBPGR/GTZ assisted in the establishment of the BARI genebank; and Ford Foundation and JICA financed the establishment of the BRRI genebank.

The operational costs of the genebanks are provided by the Government of Bangladesh through its Annual Development Budget. Such financial arrangements are not only meagre but also uncertain, as budgetary provisions are often subject to "pruning". Also there is no guarantee that annual development budgets will continue to support these "development projects" in the future. It is hoped that the Biodiversity Convention (1992) has contributed to a greater awareness among the country's policy makers which, hopefully, will help initiate programmes to strengthen PGR conservation activities in the country.

The collections in the institutional genebanks have been summarized in Table 6. The collections have by far been derived from in-country explorations. Some PGR collections have nonetheless been received from international institutions/organizations (AVRDC, CIMMYT, CIP, ICRISAT, IJO, IRRI, etc.) as well from other countries, under bilateral arrangements.

It is to be noted here that the genebank at the BJRI serves as the global repository for jute and allied fibres crops and their wild progenitors/relatives.

Table 6 Number of accessions in genebanks/active materials in different institutes of Bangladesh

Genebank/ Institute	Crops / species	Total No. of collections	Location
BARI	Cereals (other than rice)	1,210	GRC
	Legumes	4,474	GRC
	Oilseeds	140	GRC
	Oilseeds	996	ORC
	Vegetables	603	GRC
	Spices	126	GRC
	Fruits	10	GRC
	Tuber crops	151	GRC
	Tuber crops	650	TCRC
	Others	119	GRC
	Field materials	10	GRC
	Total	**8,489**	**GRC**
BRRI	**Rice**		Genebank
	***Oryza sativa* var. indica**		
	Traditional indica	4,400	
	Indica breeding lines	200	
	Exotic indica	150 (China, IRRI,etc.)	
	Exotic indica	2,266 (USA)	
	***O. sativa* var. japonica**		
	Exotic japonica	150 (Japan)	
	Exotic O. glaberrima	200 (WARDA)	
	Wild rice	73	
	Total	**7,439**	

Genebank/ Institute	Crops / species	Total No. of collections	Location
BJRI	*Corchorus spp. (15 spp.)*	4,081	Genebank
	Hibiscus spp. (22 spp.)	1,510	
	Allied genera (15 genera)	345	
	Total	**5,936**	
BINA	Rice (*Oryza sativa*)	101	Breeding
	Jute (*Corchorus spp.*)	29	Division
	Cotton	7	
	Mustard	16	
	Sesame	15	
	Groundnut	34	
	Lentil	10	
	Chickpea	31	
	Blackgram	13	
	Mungbean	120	
	Grasspea	8	
	Tomato	9	
	Sugarcane	6	
	Sugarcane mutants	20	
	Total	**419**	

Genebank/ Institute	Crops / species	Total No. of collections	Location
BTRI	**Tea**		Breedin
	BTRI released clones	10	Division
	BTRI non-released clones	150	
	Local garden clones	7	
	Local seedbarie collections	78	
	Introduced clones		
	Tocklai release	8	
	Other North Indian garden clones	6	
	UPASI, South Indian clones	2	
	TRI Sri Lanka clones	3	
	Kenya clone	1	
	Seed stock		
	BTRI released biclonal seed stock	2	
	Tocklai biclonal seed stock	1	
	Sri Lanka Aylsbary polyclond seed stock	1	
	Introduced general seeds	7	
	Japan - sinensis type	1	
	Malaysia - assamica type	1	
	Indonesia - assamica type	1	
	Tanzania - assamica type	1	
	Kenya - assamica type	1	
	Sri Lanka - assamica /dark Monipuri	3	
	India - assamica/Jat Dulai, Dangri, Kehang		
	Polyploids	1	
	Triploid	1	
	Tetraploid		
	Total	**285**	

Genebank/ Institute	Crops / species	Total No. of collections	Location
SRTI	Sugarcane		Breeding
	Sachharum officinarum	784	Division
	S. spontaneum	26	
	Total	**810**	
BAU	Rice		Dept. of
	Oryza alata	4	Genetics &
	O. australiensis	3	Plant
	O. barthi	9	Breeding/
	O. brachyantha	5	Dept. of
	O. eichingeri	5	Crop Botany
	O. glumaepatula	10	
	O. grandiglumis	5	
	O. granulata	4	
	O. latifoloa	8	
	O. longiglumis	3	
	O. longistaminata	8	
	O. malampuzhaensis	4	
	O. meridionalis	8	
	O. meyeriana	3	
	O. minuta	7	
	O. ridleyi	5	
	O. rufipogon	11	
	O. sabalata	9	
	O. officinalis	17	
	O. nivara	11	
	O. sativa	251	
	O. spontanea	1	
	O. Hybrid swarm: *rufipogon/ nivara*	1	
	O. brevigulata	1	
	O. glaberrima	1	
	O. perennis	2	
	O. punctata	11	
	O. rhizhomatis	6	
	Total Rice	**413**	
	Brassica		Dept. of
	B. campestris	68	Genetics
	B. hirta	72	Plant
	B. juncea	12	Breeding
	B. napus	6	
	B. nigra	1	
	B. carinata	5	
	Total *Brassica*	**164**	

Genebank/ Institute	Crops / species	Total No. of collections	Location
	Wheat	100	Dept. of
	Maize	132	Genetics
	Groundnut	125	& Plant
	Lentil	160	Breeding
	Dry bean	110	
	Country bean	40	
	Pea	30	
	Faba bean	7	
	Soybean	120	
	Tomato	318	
	Bitter gourd	25	
	Bottle gourd	19	
	Sweet gourd	33	
	Ribbed gourd	15	
	Total	**1234**	
	Agroforestry tree *species*	**34 *spp.***	CropBotany
	Herbs, shrubs & trees	**1200 *spp.***	Botanical Gardn, BAU

In general a very small amount of germplasm collections have been used by breeders/ researchers in national institutes and/or by the private sector. This is attributed to weak breeding programmes, especially in non-rice crops. Even in rice only about 10% of the rice germplasm and 5% of jute have found utilization in breeding programmes. However, a good number of germplasm have been supplied outside the country to USA, Japan, West Africa, India as well as International Agricultural Research Institutes (IARCs) like ICRISAT, IRRI, AVRDC, etc. So far the outgoing germplasm have surpassed remarkably over those that have been brought inside the country (see Table 7 below).

Table 7 The number of germplasm supplied to / received from outside Bangladesh

Crops	Germplasm sent abroad		Germplasm received	
	No.	Country/Organization	No.	Country/Organization
Lentil	30	ICARDA, MALDOVA		-
Pigeonpea	250	ICRISAT		-
Chickpea	530	ICRISAT		-
Lathyrus	20	Canada	4	India
Foxtail millet	200	USA	3	China
Okra	36	NBPGR, India		-
Barley	1	FAO, Rome		-
Eggplant	186	NBPGR, India		-
Sesame	68	NBPGR, India	2	Mayanmar
Maize	-	-	13	Thailand
Pearl millet	-	-	2	India
Sorghum	-	-	6	India
Green gram	-	-	6	Thailand
Mustard	-	-	1	India
Soybean	-	-	15	Thailand
Spinach	-	-	2	Pakistan, India
Radish	-	-	2	Pakistan, India
Amaranth	-	-	23 1	USA, Thailand
Muskmelon	-	-	1	Australia
Papaya	-	-	3	India
Gear	-	-	1	India
Winged bean	-	-	2	Thailand
Yambean	-	-	1	Thailand
Adzuki bean	-	-	2	Thailand
Moth bean	-	-	8	Thailand
Fenugreek	-	-	1	Pakistan
Chilli	-	-	4	Thailand
Squash	-	-	1	Australia
Rice:				

Crops	Germplasm sent abroad		Germplasm received	
	No.	Country/Organization	No.	Country/Organization
Oryza indica	4000	IRRI	150	IRRI
	30	India	-	-
	1062	USA	1948	
	400	Japan	150	Japan
	450	WARDA	200	WARDA
	15	Argentina	-	-
	25	Nepal	-	-
	20	Bhutan	-	-
	50	UK	-	-
Jute, Kenafand Mesta	1026	India, China, Nepal, Thailand, Indonesia	2005	Through IJO
Total	**8399**		**4557**	

The major sources of germplasm outside the country have been IRRI for rice, IJO for jute, and AVRDC, CIP, ICRISAT, CIMMYT, ICARDA, IITA for other crops.

The genebank of BARI has a reasonable collection of the diversity that exists within the country for crops like pulses, millets, yam, sesame, eggplant, okra, etc. Organized explorations, however, are yet to be undertaken for many other crops. Once crop improvement programmes in the country are taken up vigorously (which is an urgent need), all kinds of germplasm will be needed by breeders. For this a massive collection of germplasm is essential for their utilization in breeding programmes.

However, for jute and rice, the collections made so far are considered satisfactory. Even then lack of facilities like vacuum sealer, humidity control facilities, low temperature drying facilities, etc. at the genebanks hinder maintenance of germplasm according to internationally recommended standards.

In Bangladesh germplasm collection programmes are seldom well planned and mission oriented. In most cases these are opportunistic. However, in the case of jute and allied fibres, collections have been better organized and random sampling techniques have often been followed. In the case rice germplasm collections, initially mission oriented explorations were undertaken. Subsequently constraints (especially lack of funds) have weakened the programme.

Collections are usually made from fields, road sides, market places and from farmers' houses. Collections from remote areas are seldom possible due to

constraints in terms of logistic supports like transport facilities, incentives to field visits, availability of trained personnel, etc. The need for organized explorations / expeditions by PGR workers, supported with anthropological studies, can hardly be overemphasized. Since in-country collections are considered grossly inadequate, and even those that have been collected have not yet been properly characterized, evaluated and documented, all collections made so far are considered important.

3.3 *EX SITU* FIELD CONSERVATION AND FIELD GENEBANK FOR FOREST SPECIES

Bangladesh Forest Research Institute (BFRI) has established *ex situ* field conservation stands of bamboo germplasm (36 species), rattan (7 species) in its arboretum, and conservation of a number of important tree species in clonal orchards, seedling orchards, and field genebanks. The locations and the years of plantations of these conservation stands are shown in Table 7.

The *ex situ* field conservation stands of BFRI are mainly geared to supply seeds/planting materials of priority species required by the Forest Department /other organizations for their annual planting programmes. These stands include mostly indigenous materials and do not essentially include regional or global collections. Some exotic collections (like Eucalyptus camaldulensis and Acacia auriculiformis) are nevertheless included in the stands. The above species and few others like Tectona grandis and Gmelina arborea have by now reached the productive stage.

There is the need for establishment of *ex situ* field conservation / field genebanks of:

a. major plantation species,

b. vegetatively propagated materials (such as tea, sugarcane),

c. perennial fruit crops (like mango, jackfruit, litchies, citrus, guava, etc.) and

d. annual crops (like banana, pineapple, papaya) including their wild relatives and other wild/under-utilized species that are of potential use as fruits and nuts.

Table 8 Information on ex situ field conservation/collection stands of forest PGR

	Species	Location	Year of establishment	Total area (ha)
1.	*Tectona grandis* (Segun)	Ichamati, Kaptai, Dulahazara, Hyanko, Ukhia	1979, 1980 1979, 1980-85 1980 1982 1981	94.0
2.	*Gmelina arborea* (Gamar)	Ichamati, Kaptai, Dulahazara, Hyanko, Ukhia	1979, 1980 1981, 1982 1979 1979, 1980-82 1981	47.0
3.	*Swietenia macrophylla* (Bara Mehogini)	Kaptai Borshijura	1985 1982, 1984	10.0
4.	*Eucalyptus* camaldulensis	Salna Hyauku	1983 1983	8.0
5.	*Acacia auriculiformis* (Akashmoni)	Salna Hyanko	1985 1985	4.0
6.	*Albizia procera* (Koroi)	Kaptai	1982	0.8
7.	*Dipterocarpus turbinatus* (Kaligarjan)	Borshijura	1981-84	10.0
8.	*Syzygium grande* (Dhakijam)	Borshijura	1982	4.0
9.	*Hopea odorata* (Telsur)	Ichamati, Dulahazara, Hyanko Ukhia	1985 1983-85 1984 1985	12.0
10.	*Lagerstroemia speciosa* (Jarul)	Kaptai Hyanko	1985 1985	4.0
11.	*Toona ciliata* (Pias)	Hyanko	1985	2.0
12.	*Chikrassia tabularis* (Chikrass, Dalmara)	Ichhamati, Dulahazam, Hyanko,	1985 1984 1984	6.0
13.	*Xylia dolabriformis* (Lohakath)	Salna	1984	2.0
14.	*Pinus curribaeae* (Pine)	Ichamati	1985	4.0
15.	Cane (*7 species*)	Salna BFRI HQ.	1986 1982	2.0
16.	Bamboo (36 *species*)	BFRI HQ.	1972-1993	1.0

Local names are shown in parenthesis (in bold letters)

3.4 *IN VITRO* CONSERVATION

In vitro conservation efforts are practically non-existent in the country. Tissue culture facilities, in a limited scale, have however been developed in some of the Agricultural Research Institutes/universities. These facilities need to be expanded to conservation activities (e.g. cryopreservation), especially for those species that are vegetatively propagated, have recalcitrant seeds, and for propagation of disease free materials which cannot always be ensured with seed materials.

3.5 STORAGE FACILITIES

Modest storage facilities have been established at some of the research institutes (BARI, BRRI and BJRI) for conservation of orthodox seed materials. However, maintenance of appropriate conditions (like temperature, humidity, etc.), essentially needed for seed storage, cannot be always ensured. Frequent electricity failures, mechanical failures/disturbances, lack of maintenance/replacement of spare parts in time, etc. pose as threats to materials stored in genebanks. As a result long term storage facilities that are available cannot be considered safe and reliable. More importantly, the genebank at BRRI does not yet have facilities for long term storage of germplasm, although this is the sole repository of rice collections of Bangladesh. The development of long term storage facilities at BRRI is one of the most urgent needs. Information on storage facilities currently available in

Table 9 Germplasm storage facilities in different genebanks

Institute	Long-term storage	Mid-term storage	Short-term storage	Other facilities available	Needs
BARI	Space: 30m^3; temperatur: from -18° to -20°C with automatic dehumidifier.	Space: 60m^3; temperature 4° to 6°C with automatic dehumidifier.	-	Seed cleaner; seed grader; germinator, moisture meter, balance.	*In vitro* and cryo-preservation facilities; transport facilities; computer; seed drying facilities; single plant thresher; power tillers, seed counter vacuum sealer; moisture meter; seed containers; stand-by generators; aluminium foils.
BRRI	-	Refrigerators: total number 21, each measuring about 10 cft.; temp: 0° to 5°C.	Walk-in type; space 6m x 4.5m x 3m; temperature 20° to 22°C with automatic dehumidifier .	There is a fumigation room for treatment of bulk seeds; 36 sample drier.	Long-term storage facilities; *in vitro* and cryo-preservation facilities; in-built device in refrigerators for detection faults; computers; vacuum sealer; seed containers; moisture meter; germinator; stand-by generators; aluminium foils, 10 additional refrigerators; transport facilities.

Institute	Long-term storage	Mid-term storage	Short-term storage	Other facilities available	Needs
BJRI	Space: about 5.08m x 13.52m x 2.5m. Temp.: 0° to -50° C and maintained at -20°C.	Space: about 5.08m x 13.52m x 2.5m . Temp.: +20° to -20°C and maintained +4°C with a dehumidifier that maintains constant 20% relative humidity.	-	There is a control panel with circuit breakers, magnetic relay switch and auxiliary relays. Each circuit breaker is provided with a safety device. The system has an observation panel to facilitate observation from outside, especially for temperature and humidity. There is also a smoke detector indicator light and a buzzing warning system.	*In vitro* and cryo-preservation facilities; vacuum sealer; seed containers, moisture meters; computer; germinator; aluminium foils; stand-by generator; transport facilities; low temperature and low humidity seed drier.

Institute	Long-term storage	Mid-term storage	Short-term storage	Other facilities available	Needs
BFRI	Container type cold chamber with a space 3m x 2.45m x 2.25m.	Two refrigerators of 9.5 cft. each; temperature ranges from 20° to 22°C.	Ordinary room at ambient temperature for bulk seed storage.	-	*In vitro* and cryo-preservation facilities; automatic stand-by generator; extended storage facilities for mid-term storage; P^H meter; cold incubators; stirring hot plate; thermostat control; hot air sterilizer; germinator; moisture meters, seed containers; deep freeze; thermo - hygrometer; stereo-microscope; vacuum sealer; aluminium foils; low temperature and low humidity seed drier.

the most urgent needs. Information on storage facilities currently available in the country is summarized in Table 9.
A critical look would reveal that the storage facilities at the genebanks, except at the BJRI, are not satisfactory. For examples,

1. wild rice species, some legumes and horticultural species lose seed viability rather quickly,
2. many forest and horticultural species have recalcitrant seeds,
3. many species have short growing seasons,
4. a good number of crops grown in the country are vegetatively propagated; and lack of adequate facilities for collection, temporary storage facilities and processing hinder their conservation activities.

In many of such cases, temporary storage facilities with low temperature, low humidity and quick drying facilities are necessary. It is important that such facilities be developed for processing and subsequent conservation of these materials. This warrants an urgent attention for upgrading the facilities of the existing genebanks.

Bangladesh germplasm collections are not yet duplicated anywhere within the country. This entails a great risk in the event of fire or such other calamities. Therefore, a national genebank or a Bureau of Plant Genetic Resources should be established where the collections of different genebanks can be duplicated and vice versa. The proposed national genebank or Bureau is also an urgent need to cater for crops or other plant species that the three existing genebanks do not or cannot cover (i. e. germplasm of medicinal, forestry, ornamental and other plants).

In the absence of facilities for conservation of duplicate samples within the country, BJRI and BRRI genebanks have arrangements with the Canberra Genebank, Australia and the IRRI Genebank in the Philippines respectively, for maintaining duplicate samples. Unfortunately, in some cases, the corresponding accession numbers of samples kept in overseas genebanks are not the same as in the in-country genebanks, meaning that national collections may not be traced from the overseas genebanks where duplicate samples are being conserved. It is essential that the accessioning problem with overseas genebanks be resolved, especially in view of the new WTO/GATT regulations.

It is also noteworthy that physical facilities for processing, cleaning, drying and packaging of PGR collections within the country are inadequate, and there usually is a problem of backlog of samples. These problems are due mainly to inadequate facilities in terms of infrastructure, inadequate financial support, and also lack of trained personnel in PGR activities, as highlighted earlier.

Owing to limitations in facilities, collection programmes cannot always be undertaken to correspond with growing seasons of plants and the processing capacities of the genebanks. This also makes it difficult to prioritize conservation of materials.

The storage facilities currently available at BJRI may be good enough for another decade. However, facilities at BARI and BRRI genebanks will most likely attain full capacity within the next few years. Proper storage facilities at BFRI are yet to be developed. The same is the case with fruit and vegetable species. These shortcomings point to the need for establishing a sound national PGR system, a national genebank or a Bureau of Plant Genetic Resources with facilities for accommodating the large number of crops, forest and medicinal plants that grow in the country. Meanwhile the existing institutional genebanks need improvement in storage facilities to maintain germplasm at internationally acceptable standards.

For forest species however seed orchards, clonal orchards and field genebanks are being employed as storage measures. Since these facilities are tied with both tree improvement programmes and annual planting programmes by the BFRI,

Forestry Department and other organizations, the continuous maintenance of these germplasm is a special problem and the regular flow of funds is a special need.

In order to accommodate the conservation needs for floricultural and ornamental plants, there is the need for establishment of more botanical gardens and arboreta in the country. At the same time the few existing botanical gardens need to be reorganized to serve the *ex situ* conservation purposes.

3.6 DOCUMENTATION

Documentation and information management of PGR activities are poor in Bangladesh. Some agronomic data are documented in institute annual reports. Computerized database for germplasm collections has not yet been developed in the country. None of the genebanks publishes catalogues. Information like passport data, evaluation data, characterization data are maintained manually. Also most of the data maintained at genebanks are not user-oriented, rather they fulfil the purpose of official reporting only.

In the absence of a proper documentation system, information/knowledge about samples cannot usually be provided to users at the time the samples are supplied, whether within the country or abroad. In some cases, however, information about a few characteristics, gathered from passport data and breeders records, may accompany a sample. Most of the information on germplasm is furnished out of germplasm registers (maintained manually) by the genebanks, on request by letters from or personal visits by potential users.

The establishment of an internationally acceptable and regionally compatible computerized data management system for germplasm collections and conservation can help improve documentation as well as dissemination of information, whether in the form of catalogues, news letters, bulletins or through other means. This is an area where regional and/or international assistance and collaboration would be necessary. And an improvement in the data management system and documentation facilities is expected to stimulate activities within the country and exchange/dissemination of information with users of germplasm, in-country or abroad.

A PGR networking is yet to be developed within the country and in the region. In the absence of such a network, it would be difficult, if not impossible, to make a co-ordinated database available. However, the gene bank at BJRI, through the auspices of International Jute Organization (IJO), has been networking with countries like China, India, Indonesia, Nepal and

Thailand for germplasm of jute and allied fibre crops. The success is considered commendable, resulting in mutual co-operation between jute producing countries.

The documentation of *in situ* collections should also receive priority, especially for wild rice, forest species, perennial fruits and nuts, medicinal plants, and should be supported by taxonomic studies. However, International Legume Database and Information Services (ILDIS) is one of the pioneer steps in building a species diversity systems. A Regional Inquiry Centre of South Asia (RICOSA) at the National Botanical Institute (NBRI), Lucknow in India is currently developing a computerized database of legumes of South Asia covering eight countries: Bangladesh, Bhutan, India, the Maldives, Myanmar, Nepal, Pakistan, and Sri Lanka.

In view of the poor performance in documentation of germplasm in Bangladesh, technical assistance (in the form of human resources development, computer facilities and data management systems) is urgently needed.

3.7 EVALUATION AND CHARACTERIZATION

In PGR activities a distinction between characterization and evaluation is usually made but cannot always be adhered to. This is specially true for the germplasm held at the BARI genebank.

The PGR workers do the job of characterization and evaluation. Respective disciplinary scientists (plant breeders, plant physiologists, plant pathologists, entomologists) are involved during characterization and evaluation. However, biochemical analysis, analysis on nutritional aspects, genetic marker study and genetic fingerprinting cannot be undertaken due to lack of laboratory facilities and also due to lack of trained personnel. For data collection, IBPGR descriptors have been followed, often with some modifications.

Farmers get involved only in the process of evaluation through on-farm testing and demonstration trials of advanced breeding materials.

About 50% of jute, 30% of rice and a negligible number of other accessions of other crops have been characterized according to international descriptors. A preliminary evaluation of about 30% of rice and 20% of jute accessions have been completed (Table 10). At the BARI genebank about 27% of the accessions have been characterized and an equal proportion evaluated. About 25% of jute accessions have been evaluated for location oriented programmes

at the locations of their collections while some accessions of rice and other crops have been evaluated in simulated conditions or in greenhouses by other (i.e. non-PGR) scientists. Characterization and evaluation data do not always include information on physiological responses and microbiological characteristics, though disease and insect susceptibility is usually recorded.

Table 10 Germplasm in genebanks with passport data, characterization and evaluation data

Genebank	Total accessions	No.with passport data		No. characterised		No evaluated	
		Total	%	Total	%	Total	%
BARI:							
Seed material	6,601	3,069	48.5	1,786	27	1,786	27
Veg. material	232	162	70	-	-	-	-
Field material	10	10	100	-	-	-	-
BRRI	4,500	450	10	1,350	30	900	20
BJRI	5,936	4,408	74	2,998	50	1,231	21
BFRI	-	-	-	-	-	-	-

Characterization and evaluation data, like the documentation data, are not published in separate documents, except for reporting in annual reports of respective institutes. Characterization and evaluation data have hardly been used to guide conservation strategies.

No formal feedback systems from users of germplasm have yet been developed by any of the genebanks. As a result, information from users has not been made available to genebanks. An effective feedback system from users of germplasm is considered essential and should be developed without delay. Information feedback should be made conditional for users of germplasm from genebanks. Data available on germplasm users are furnished in Table 11.

Evaluation of germplasm can be enhanced both regionally and globally by encouraging need-based, mission oriented collaborative programmes involving PGR workers and PGR users on the one hand, and institutes and countries in each region on the other. Often resource constraints do not permit evaluation of germplasm at genebanks. This is especially the case with characters like biochemical analysis, genetic marker studies and genetic fingerprinting.

Table 11 Users of germplasm from different genebanks

Crops	No.of users	Organization/Country
Lentil	2	Maldova, ICARDA
Chickpea	2	Maldova, ICRISAT
FoxtailMillet	1	USA
Greengram	5	IPSA, Bangladesh
Sorghum	5	Cereal Section,BARI
BitterGourd	1	IPSA, Bangladesh
Pigeonpea	1	IPSA, Bangladesh
Total	**17**	
Rice	100	BRRI
	10	BAU, Mymensingh
	5	DU, Dhaka
	4	Chittagong University
	15	IPSA
	4	BARI, Joydebpur
	50	DAE, GOB
	10	BADC
	5	NGOs
Total	**203**	
Jute:	17	Breeders, Pathologists, Agronomists, Soil Scientists, Physiologists, Entomologists of BJRI.
Total	**17**	
BFRI	50	Dept. Forests, GOB.
	5	Inst. of Forestry, Chittagong University (IFCU).
	10	Agr. Expt. Stations,
	50	NGOs: KARITAS, PROSHIKA, BRAC, Grameen Bank, etc.
	25	Tea estates
	10	Papermills, Matches Industries, etc.
Total	**150**	
GrandTotal	**387**	

However, such information could be relatively easily achieved through regional and/or bilateral collaboration, taking advantage of laboratories where such facilities have been developed.

3.8 REGENERATION

Regeneration of collected germplasm is usually carried out when germination capacity of a sample falls below 85%. However, regeneration often becomes difficult due to lack of facilities like available human resources, lack of lab and/or field spaces, lack of funds for carrying out regeneration activities or even due to non-availability of allocated funds in time. As a result, in spite of best intentions and efforts of PGR workers, often only a small fraction of accessions can in fact be regenerated. As a result PGR workers have to make compromises between the number of samples regenerated and the germination percentage of a sample.

Regeneration activities are carried out by PGR workers, plant breeders and geneticists. Efforts are made to take necessary precautions to avoid contamination, genetic drift and to maintain genetic purity of samples. However, these cannot always be ensured where a high degree of cross pollination occurs in apparently self fertilized species (like Solanum melongena, Gossypium spp., etc.) and where the knowledge about required isolation distance is often lacking. This warrants basic studies on aspects like the extent of cross pollination in such crops, required isolation distance to maintain genetic purity, minimum population size to be grown in order to avoid genetic drift, etc., as well as provision of adequate infrastructural facilities like screenhouses/ greenhouses for regeneration of samples. Such provisions are imperative in cases of cross pollinated species like Sorghum, most of the Cucurbits, the Brassicas, and many horticultural and forest species.

The possibilities of genetic drift during regeneration cannot always be ruled out, particularly for open pollinated crops. Even such crops cannot be given due priority due to lack of facilities. This often compels retention of old samples, separately. Old samples are disposed off when enough new seeds are available.

3.9 FOREST GENETIC RESOURCES

A limited number of explorations aimed to determine the natural distribution of the main native forest tree species have been undertaken by the BFRI. The main purpose in such explorations was: selection of priority species in different eco-geographic zones. The selected species have been preserved in the *in situ* and *ex situ* conservation sites of the BFRI. Special emphasis were given to those species which cover both Tropical Wet Evergreen and Tropical Semi Evergreen Forests. These species are Dipterocarpus turbinatus Gaertn ('Garjan'), Artocarpus chaplasha Roxb. ('Chaplash'), Swintonia floribunda Griff. ('Civit'), Hopea odorata Roxb. ('Telsur'), Toona ciliata Roem. ('Piays') etc. The BFRI has selected a number of Provisional Plus Trees (PPTs) of these species in both the above eco-geographic zones, and Lagerstroemia speciosa (L) Pers. ('Jarul') in Tropical Moist Deciduous Zone for *in situ* conservation.

The establishment and conservation of Seed Stands of the BFRI involve at least one main native species, representing each of the forest types of Bangladesh. As for example, the seed stands of Dipterocarpus turbinatus Gaertn. represent the Tropical Wet Evergreen Forest, those of Szyygium grande Wall. ('Dhakijam') represent the Tropical Semi Evergreen Forest, the seed stands of Lagerstroemia speciosa (L.) Pers. represent the Tropical Moist Deciduous Forest, while the stands of Heritiera fomes Buch.- Ham. ('Sundari') represent the Tropical Littoral and Swamp Forest, especially the Tidal Swamp/Sundarban Forest.

These activities are yet to be extended for conservation of more species for each of the forest types. The same is also applicable for conservation of threatened species, mentioned earlier. So far as *ex situ* conservation activities are concerned, the BFRI has established different orchards and genebanks involving 14 important species, representing most of the forest types of Bangladesh. Such *ex situ* conservation activities may also be extended to key plantation species. Moreover, suitable ecological reserves in each type of natural forests are yet to be identified and appropriate measures be taken for conservation of biological diversity of these ecological reserves.

With a view to identifying suitable fast growing tree species for increasing the production of fuelwood, veneer wood, poles, timber, food and fodder, in large scale industrial plantations and in small scale village or homestead plantations, research programmes on the evaluation of different forest tree species have been undertaken. The progress in evaluation of such species is shown in Appendix 5.

Moreover, provenance and varietal trials are being carried out to identify the best provenance/variety of tree species for a particular site or sites.

A considerable amount of work has been done on the selection of provenance Eucalyptus camaldulensis (Eucalyptus). In order to evaluate the progenies of selected PPTs and to find out the best genotypes of different forest tree species, a progeny trial of Tectona grandis L. f. ('Segun') was established in 1985. This involved 24 selected clones of this species. The latest available data show that Progenies K-130 and K-69 had maximum survival and maximum growth.

Recently studies on natural regeneration and phenology of major forest tree species in plantations as well as in natural forest areas of Bangladesh have been undertaken. In order to increase awareness about using genetically improved seed sources among the general mass, programmes have been undertaken for the establishment of demonstration plots in different parts of the country. These involve improved as well as general collections of seeds in planting. Genetic marker studies have not yet been undertaken due to lack of trained personnel.

The information system on forest genetic resources is in the process of development. The existing facilities are not sufficient to maintain internationally recommended standards. Improvement in infrastructure, laboratory and transport facilities, for field stations of the BFRI engaged in PGR activities, are urgent needs.

CHAPTER 4
In-Country Uses of Plant Genetic Resources

The research on crop improvement in Bangladesh started towards the beginning of the century, initially with selection of promising landraces. Prior to the introduction of HYV rice and wheat in the mid '60s, most crop varieties grown in the country were selected/developed out of indigenous germplasm. The breeders in agricultural research institutes collected germplasm for their own use and in doing so they developed 'small scale genebanks' at crop based research institutes.

4.1 USE OF PGR COLLECTIONS

With new emphasis on agricultural research after the liberation of Bangladesh, breeding programmes, especially on major crops, expanded and collaborations with CGIAR institutes strengthened. It is mainly through such collaborations that many exotic germplasm were introduced and evaluated (to a limited extent). The number of varieties developed and recommended for cultivation is shown in Table 12. It is to be noted that in addition to the varieties listed in the table (Table 12), farmers cultivate many indigenous varieties of fruits, vegetables, spices and condiments; and also of rice, jute, potato, and sugarcane, pulses and oilseeds.

Most of the plant genetic resources of commercial use have been derived from indigenous sources either as 'direct varieties' or through varietal developmental programmes. For examples, (i) in rice of the 62 released varieties, 23 were from indigenous genetic resources, three verities had of the parents that was indigenous and 35 varieties were derived directly from exotic sources (from IRRI), and one variety from a mutant of an indigenous material ; (ii) in jute, 20 out of 23 varieties were derived from local landraces, one variety had one exotic parent, and two varieties were developed from 'introduced materials'; (iii) in the case of leafy vegetables, an estimated 90 per cent of the varieties were from indigenous materials. The same is true for most other crops, with the exception of wheat (all varieties are from exotic materials) and potato (6 varieties are of local and 28 varieties are from exotic materials).

In the case of forest trees, only a few exotic species have found commercial use in the country. These include Eucalyptus camaldulensis ('Eucalyptus'), Acacia auriculiformis Griseb. ('Akashmoni'), Hevea brasiliensis Muell.-Arg. (Rubber), Swietenia macrophylla King ('Bara Mehogini'), Tectona grandis grandis L. f. ('Segun'), etc. In the case of fruits and vegetables, almost all adaptable cultivars are 'farmers' old varieties'.

Most collections in genebanks have commercial importance. They have however not been used frequently in the past, due partly to lack of information dissemination about these genetic resources and partly to lack of vigorous breeding programmes. The local plant genetic resources possess many useful traits such as adaptability to specific ecological niches (i.e. tolerance to drought, salinity, water submergence), and resistance to insect pests and diseases. These traits have potential use in crop improvement programmes needed for the country's crop diversification efforts.

There are no community genebanks in the country, and farmers obtain superior cultivars that are released from research institutes, through farmer to farmer exchanges and government seed distribution systems discussed below.

Table 12 Number of improved varieties released for cultivation

Crop	Species	Institute	Varietiesreleased
CEREALS			
Rice	*Oryza sativa L.*	BRRI	51
		BINA	3
		BAU	1
	Total rice		55+6*=61
Wheat	*Triticum aestivum L.*	BARI	16
Maize	*Zea mays L.*	BARI	4
Total Cereals			**81**
PULSES (Legumes)			
Lentil	*Lens culinaris Medik.*	BARI	1+2*=3
Mungbean	*Vigna radiata (L) Wilezck*	BARI	2+2*=4
		BINA	1
Blackgram	*Vigna mungo (L.) Hepper*	BARI	1+2*=3
Chickpea	*Cicer arietinum L.*	BARI	1+3*=4
		BINA	1
Cowpea	*Vigna unguiculata*	BARI	2
Lathyrus (Grasspea)	*Lathyrus sativus*	BARI	1
Total Pulses			**9+9*=18**
OILSEEDS			
Mustard	*Brassica spp.*	BARI	5
		BAU	2
		BINA	2
Groundnut	*Arachis hypogeaL.*	BARI	5
Sesame	*Sesamum indicum L.*	BARI	2
Soybean	*Glycine max L. Merr.*	BARI	3
Total Oilseeds			**19**
FIBRE CROPS			
Deshi Jute	*Corchorus capsularis L.*	BJRI	17
		BINA	1
Tossa Jute	*Corchorus olitorius L.*	BJRI	8
Kenaf	*Hibiscus cannabinus L.*	BJRI	1
Mesta	*H. sabdariffa L.*	BJRI	1
Cotton	*Gossypium hirsutum L.*	BARI	6
Total Fibre Crops			**34**

Crop	Species	Institute	Varietiesreleased
Beverages Tea	*Camellia sinensis L. (Kuntz)*	BTRI	8
Total Beverages			**8**
Narcotic			
Tobacco	*Nicotiana tabacum L.*	BARI	1
Total Narcotic			**1**
Vegetables Tomato	*Lycopersicon lycopersicum (L.) Karst. (L. esculentum Mill.)*	BARI	2+1*=3
Pumpkin	*Cucurbita maxima Duch.*	BARI	1*
Bottle gourd	*Lagenaria siceraria(Mol.) Stand.*	BARI	1*
Chinese cabbage	*Brassica chinensis L.*	BARI	1*
French bean	*Phaseolus vulgarisL. Schrad.*	BARI	1*
Country bean	*Lablab purpureans(L..) Sweet. (Dolichos lablab L.)*	BARI	1*
Garden pea	*Pisun sativum L.*	BARI	2*
Okra	*Abelmoschus esculentusL*	BARI	1*
Onion	*Allium cepa L*	BARI	1*
Potato	*Solanum tuberosumL.*	BARI	28
Radish	*Raphanas sativusL.*	BARI	1
Cabbage	*Brassica oleracea L.*	BARI	1
Eggplant	*Solanum melongenaWall.*	BARI	4
Watermelon	*Citrullus colocinthis (L.) Schrad.*	BARI	1
Spices:			
Coriander	*Coriandrum sativum L.*	BARI	1*
Turmeric	*Curcuma longaL.*	BARI	3*
Black pepper	*Piper nigrum L.*	BARI	1*
Total Vegetables			**37+15=52**
FRUITS			
Guava	*Psidium guajava(L.) Bat.*	BARI	1
Grand Total			**228**

* recently developed varieties

4.2 CROP IMPROVEMENT PROGRAMMES AND SEED DISTRIBUTION

Institutional breeding programmes have so far given priority to yield. Resistance to pest, tolerance to stress conditions like droughts, salinity, high or low temperatures, etc. have received considerable attention in rice and wheat, and need emphasis on other crops. At the same time, the need for widening of the genetic base and higher photosynthetic efficiency of crop varieties, quality factors like higher protein content, finer and aromatic grains (e.g. in rice), etc. deserve breeders' attention. Likewise larger fruits and bolder seeds (in coarse grain legumes), high oil content (e.g. in ground nut, mustard. etc.), keeping quality in perishable commodities (like fruits and vegetables) are some of the areas where breeding programmes require emphasis on.

Also diversification of crop production aimed at improving and maintaining soil fertility, checking soil erosion, addition of biomass to soils, tolerance to waterlogged conditions, etc. deserve high priority. In fruit crops and vegetables greater attention is needed to develop varieties either for improved yield and/or for quality. Many of the indigenous genetic resources can be useful in such breeding programmes. For effective utilization of genetic resources, varietal development programmes need to be diversified and strengthened. Plant breeding activities are practically confined to agricultural research institutes that are government funded.

The National Seed Board has the responsibility for approval of varieties developed from research institutes. The seeds of released varieties are made available to farmers mainly through the BADC, as well as the DAE and ARIs. The government seed supply is not adequate and efficient enough to meet the needs of the large number of subsistence farmers spread over nooks and corners of country.

Farmers are involved in variety evaluation programmes through On-farm Testing and Farming Systems Research (FSR) programmes. Also Farmers' Days, Farmers' Rallies are organized where farmers have the opportunity to express their opinions on varieties.

So far BADC has been the only agency for production and distribution of improved and quality seeds, but it covers, as mentioned above, only a few major crops. The agency can cover only about 5 per cent of the total seed requirements. The seed production and distribution systems in the country need strengthening both in the public and the private sector as recommended in the National Seed Policy (1992).

4.3 USE OF FOREST GENETIC RESOURCES

The Bangladesh Forest Research Institute is the only organization that deals with production and supply of improved forest genetic resources. To this end the institute has both short and long term programmes, mainly for forest tree seeds.

The short term activities are oriented to provide the initial seed sources of superior planting materials. For this the institute collects seeds from selected trees/stands and distributes them for planting. The long term activities comprise of selection of superior phenotypes, their evaluation in different orchards, and progeny testing of superior materials.

Currently the institute makes mass collections of materials from its production orchards only. The annual collection is estimated at about 3,000 kg of seeds. This covers only about 10 - 15% of the annual requirements in the country. For some species, for example Tectona grandis L. f. ('Segun'), BFRI can supply up to about 50% of the seed requirement. It is expected that when all orchards will start fruiting in the near future, BFRI's seed supply capacity will increase substantially.

The National Forest Seed Centre (NFSC), established under the umbrella of the BFRI in 1986, has the responsibility for setting up of a unified system for procurement, registration, handling, storage, testing and distribution of quality forest tree seeds. At the moment the centre has limited facilities and its activities are mainly confined to testing purity, moisture content, germination/viability of seeds, collected by the BFRI only. The centre has to be adequately staffed, and its infrastructural and laboratory facilities improved to perform its mandated jobs satisfactorily.

4.4 BENEFITS DERIVED FROM THE USE OF PLANT GENETIC RESOURCES

The indigenous plant genetic resources have been the building block for many of the varieties of rice, jute, sugarcane, pulses and oil seeds. The improved indigenous varieties contributed directly and most significantly to increased national productivity. Their use in crossing programmes has helped the breeders to develop varieties to suit in-country needs. The nation also benefits

directly from PGR when improved types/varieties are made available to areas where these have not been grown before.

Also, non-indigenous genetic materials have contributed, as indicated earlier, to variety improvement in potato, wheat, rice, jute, sugarcane and some vegetables. As a result an increased production of these crops was possible.

4.5 IMPROVING PGR UTILIZATION

An efficient use of plant genetic resources requires broadening of breeding programmes, including the use of biotechnological means. This would require human resources development, technical assistance, logistic and financial supports. Characterization, evaluation, documentation and dissemination of PGR information are also prerequisites for efficient use of plant genetic resources.

Bangladesh constitutes a larger part of the South Asian Gene Centre and its genetic resources are its national wealth. Since Bangladesh has not been able to exploit these genetic resources to any significant extent in the past in spite of its rich plant genetic resources, the potential value of indigenous PGR is considered to be immense in the long term. However, for short term use of PGR, an inventory of the total genetic resources in the country, their collection, characterization, evaluation, documentation and dissemination of PGR information are vital.

- The initial step would be strengthening the PGR activities in all crop based institutes, in universities dealing with plants, in botanical gardens and arboreta, establishment of arboreta in each of the ecological zones where these are absent.
- A close collaboration between in-country genebanks for co-ordinated and mission oriented collection should be initiated without delay.
- Regional and international collaboration should be strengthened; and for ease of work, institutes dealing with PGR should be given greater authority and freedom to deal with such matters as deemed necessary for their smooth functioning.
- Exchange of information through publication of PGR bulletins, catalogues, workshops, seminars, and exchange of scientists with other PGR centres, both within and outside the country, need not only be encouraged but also be vigorously undertaken.

- A Bureau of Plant Genetic Resources with responsibilities for conservation of orthodox and recalcitrant seeds as well as vegetatively propagated materials should be established as a matter of urgency. The proposed Bureau should have facilities for a Cryo Bank and a DNA Bank, as these are going to assume greater importance in PGR conservation, exchange and use on days ahead.
- This Bureau should also co-ordinate the PGR activities for the country and provide leadership in PGR research and development.

To achieve these, assistance is needed in the development of human resources, infrastructure, and institutional arrangements for collaborations with the CGIAR system and other centres/institutions of relevance.

CHAPTER 5
National Goals, Policies, Programmes and Legislation

5.1 NATIONAL PROGRAMMES

There is no integrated national programmes on plant genetic resources. Collection, conservation and utilization of PGR are scattered in institutes under several ministries, each mandated to deal with specified crops/plants. Several of these institutes, dealing with conservation of PGR in one form or other, are monocrop institutes (i. e. BRRI, BJRI, SRTI and BTRI). Only BARI and BINA deal with multicrop species while BFRI, BCSIR and IFCU are involved with non-crop plant genetic resources (i.e. forest and medicinal plants). BNH has a regular programme of collecting and preserving plant genetic resources from the wild. There is the need for integration of PGR activities at the national level, between and among institutions including universities, the private sector and NGOs.

National awareness on plant genetic resources is still incipient. There has been no legislation to prevent the erosion of PGR, except a ban on rampant use of trees as fuels for brick making industries and a ban on felling trees in high forests. But the impact of these 'bans' has been minimal, if any.

However, after the Biodiversity Convention (1992), there appears to be a greater awareness and a keen interest on PGR at the policy level. Programmes are under way to study the implications of the Biodiversity Convention, to seek participation of scientists and other organizations and citizens to advise the government on matters related to the implementation of the Convention.

Up till now the agricultural policy of the country focused primarily on:

- food security;
- self reliant economy;
- employment generation (both on- and off-farm);
- development of agro-based industries and value added products;
- export augmentation;
- crop diversification.

Bangladesh Agricultural Research Council (BARC) have the responsibility to coordinate agricultural research in the country vis a vis a larger share of the responsibility to conserve biodiversity. Steps are underway to ratify the Biodiversity Convention in the National Parliament and to take follow up actions. The involvement of the private sector and NGOs in matters related to the Biodiversity Convention has so far been minimal, but is considered crucial for the success of PGR conservation.

The Heads of PGR programmes in an institute are answerable to the Institute Head, who, in turn, is accountable to the concerned Ministry (i.e. the Ministry of Agriculture in the cases of BARI, BRRI, BJRI, SRTI, BINA and IPSA; the Ministry of Commerce in the case of BTRI; the Ministry of Environment and Forest in the case of BFRI and BNH; the Ministry of Science and Technology in the cases of BCSIR and IFCU, and the Ministry of Education in the cases of the Universities). And it is the concerned Ministry which holds the power to abolish or establish the post in a Division or a Department. In all research institutes the positions of PGR scientists are vulnerable.

Similarly the institutional programmes and budgets are also controlled by the concerned Ministries, the Ministry of Planning as well as the Ministry of Finance. There is no separate budget line for PGR activities in the country. The funds for such activities, without exception, come from the Annual Development Budget. The development budget funds are often subject to 'pruning'. As such funds for PGR are insecure.

Bangladesh is yet to formulate legislation to protect its PGR wealth. It is practically the PGR workers who have been concerned about genetic resources and who consider them as valuable national assets. For all practical purposes, an understanding of the importance of PGR at the policy level has so far been rather low.

It is important and urgent that PGR activities in the country are streamlined with trained personnel and their career opportunities, with infrastructural facilities, with authority vested on technical personnel to make decisions on technical matters, and at the same time making them responsible/accountable for their performance.

5.2 TRAINING

The PGR programmes, in general, are understaffed and lack sufficient trained personnel. In most cases such activities are carried out by personnel drawn from other disciplines. Currently about 30 scientists and 15 technicians are directly involved in PGR activities. In addition, many more are working in germplasm evaluation, seed processing, genebank management, data management, etc., but without proper training in relevant fields. The priority areas for PGR training are as follows:

- Documentation and Data Management;
- Seed Production of Open Pollinated Species (including trees);
- *in vitro* Preservation;
- Taxonomy;
- Monitoring Stability and Dynamics of *in situ* Populations;
- Genebank Management;
- Seed Health and Processing;
- Genetic Diversity Assessment;
- Genetic Marker Study and Genetic Fingerprinting;
- Cryopreservation.

Current PGR personnel and future training needs are shown in Table 13.

Table 13 Current PGR strength and future training needs of different institutes

Institute	No. PGR personnel currently available		Approved number of posts		Training needs			
	Scientist	Technician	Scientist	Technician		Scientists		Technicians
					Short	Medium	Long	
BARI	8	6	-	-	16	6	10	2
BRRI	6	2	12	-	6	4	3	2
BJRI	3	3	6	7	6	4	3	3
BINA	-	-	-	-	2	3	2	2
BFRI	12	3	7	6	7	10	12	-
BTRI	-	-	3	2	2	3	2	2
SRTI	-	-	3	2	2	3	2	2
Total	**29**	**14**	**31**	**17**	**41**	**33**	**34**	**13**

At the moment no organized training courses are available in the country. However, potentials for developing training courses are there but international/regional assistance will be required. It may be noted here that BJRI has already offered training courses to PGR workers from India, China, Nepal, Thailand and Indonesia with assistance from IJO.

Courses on PGR are not subjects in educational institutions in the country, except that the Institute for Postgraduate Studies (IPSA) has recently introduced a course on PGR management. It is important that awareness about PGR be created as extensively as possible and for this, courses on genetic resources should be included as a subject of education from the university down to the primary school where both men and women would be equally involved. This aspect could well be considered at regional and global levels.

The staff recruitment for PGR in Bangladesh is too low to sustain PGR activities and often staff trained in PGR are posted elsewhere. Transfers of PGR staff should necessarily be avoided by creating career opportunities for PGR workers. It is felt that commitment for biodiversity conservation should be conditional for international assistance in agriculture, forestry, urbanization, and other major construction projects.

5.3 NATIONAL LEGISLATION

Quarantine Laws, as currently being practised in the country, cannot be considered as conducive to exchanges of PGR materials, especially for live materials such as plant parts, recalcitrant seeds, etc. There are instances where live PGR materials, imported after years of efforts, were destroyed due to delays in delivery to concerned research institutes. There should be separate quarantine regulations for research materials. New quarantine laws are, however, about to be implemented.

Special legislation is required for *in vitro* materials because the future exchange of genetic materials is likely to be undertaken more through *in vitro* systems for better safeguard from pathogen contamination and also for economy of spaces, especially in cases of vegetatively propagated materials.

In Bangladesh four classes of seeds (Breeder Seeds, Foundation Seeds, Certified Seeds, Truthfully Labelled Seeds) are currently recognized. The National Seed Policy of Bangladesh has recently been framed but the subsequent Seed Rules, in coherence with the Seed Policy though have been formulated, are awaiting gazette notification by the government. The Seed Policy has recommended free import and distribution of seeds other than rice, wheat, jute, potato and sugarcane. These five crops have been identified as controlled or notified crops and their import and distribution are subject to stringent regulations. The Seed Policy allows free trade of farmers' varieties. Although the Seed Policy allows free trade in seeds, some essential precautions are needed in import, sale and distribution of seeds, no matter whether they fall under controlled/notified crops or not.

The IPR legislation is yet to be formulated in Bangladesh. This however requires an in-depth study. The implications of GATT/WTO accords need to be thoroughly studied before formulation of the IPR legislation, the legislation on exchange of genetic materials, and import/export of plant materials. In drawing up such regulations, due recognition to farmers' rights must be ensured. Further regional / international dialogues and collaborations may prove useful in this regard.

National awareness on biodiversity has so far been rather low to the extent that even among scientists an opportunity to study and understand the Biodiversity Convention has not yet arisen. A National Committee of PGR has recently been proposed at a meeting held at BARC (3 April 1995) where an eminent agricultural scientist has been nominated to act as the Chairman of the Committee. A National Workshop on PGR is now being planned.

Bangladesh has so far followed friendly and liberal exchange of PGR materials, mainly through bilateral arrangements. Also joint explorations/expeditions with overseas/ international missions have been allowed in the past without imposing restrictions. In view of IPR and GATT/WTO accords, the situation warrants a fresh study. Possibilities do exist for changes in current national policies.

5.4 OTHER POLICIES

No incentives are provided in Bangladesh for production and marketing of improved varieties/certified seeds. Development, production and marketing of improved seeds have until recently been confined to the public sector where these activities have been considered as routine work, without any incentive. However, the private sector has now started seed production in the country.

PGR workers are not involved in planning any major agricultural development projects. However, during initiation of a new project, the Ministry of Planning demands a statement as to the impact of a new project on the environment, and not essentially on PGR.

CHAPTER 6
International Collaboration

6.1 UNITED NATIONS INITIATIVES

UNCED

Bangladesh, a risk prone and yet a gene rich region, faces serious threats of erosion of plant genetic resources. The country has much to expect from Agenda 21, particularly in "Meeting Agricultural Needs without Destroying the Land", and "Sustaining Biological Diversity". The message in Agenda 21 (adopted by the United Nations Conference on Environment and Development, UNCED), " We can better manage and protect the ecosystem and bring about a more prosperous future for us all " and that "No nation can achieve this on its own" but "Together we can ..." , has been a call for international/global collaboration. Bangladesh responded to the call and adopted Agenda 21 at the Earth Summit in June, 1992 in Rio de Janeiro (Brazil). Although Bangladesh has not yet developed its National Agenda 21, it has set up a National Environment Committee under the Chairmanship of the Prime Minister and has recently completed a National Environment Management Action Plan (NEMAP) through a nation-wide consultative process.

However, the country has not been able to make much progress in implementing Chapter 14 G (Conservation And Sustainable Utilization of Plant Genetic Resources for Food and Sustainable Agriculture) and Chapter 15 (Conservation Of Biological Diversity) of Agenda 21 since the Convention in 1992. Even though Bangladesh signed the Biodiversity Convention at Rio in 1992 and ratified it in 1994, the level of participation in the negotiations through Intergovernmental Negotiating Committee (INC) has been minimal. It is hoped that concrete plans and actions on the implementation of "Biodiversity Convention" (covering Chapter 14 G and Chapter 15) will follow. (Similar is the case with Convention on Climate i. e. Bangladesh signed it, but the level of participation has been minimal).

The United Nations, for over a decade, has taken initiatives in mobilising a global consensus on PGR through its "International Undertaking on Plant

Genetic Resources", "Intergovernmental Commission on Plant Genetic Resources", etc. These helped ensure commitments of countries to "Agenda 21" and the "Biodiversity Convention". These set the stage for developing a "A Global Plan of Action" on Plant Genetic Resources at the first meeting of ICPPGR to be held in 1996. While the FAO Commission helped develop consensus and commitment of Governments to PGR, helped facilitate policy issues for international exchange of plant genetic resources and facilitate steps towards developing the Global Plan of Action, the Convention of Biological Diversity forum is apparently expected to translate these initiatives into a reality. In this context, we view the roles of FAO Commission and the Convention are certainly complementary and mutually strengthening.

However, if the Convention is expected to translate the vision of the Commission, it is axiomatic that there would be some distinct / separate roles of the two bodies, even though the two are mutually complementary.

FAO Global System

Bangladesh is a member of the FAO Commission and the reasons for joining the Commission has been stated above. The foremost benefit(s) the country gained from joining the Commission has been:

a. a greater awareness, beyond the PGR workers to the policy makers of the country, about the need for PGR conservation,

b. a concern for and an opportunity to participate in developing regional/global action plans for PGR,

c. an opportunity to learn from others who have gone ahead with PGR activities.

Our major expectation from the Commission during the next decade include:

a. assistance in developing a National PGR system for Bangladesh (not only for orthodox conservation of PGR but also for conservation through advanced techniques/methods including Cryopreservation, Genetic Marker Studies and Genetic Fingerprinting),

b. facilitating easy, fair and equitable exchange of plant genetic resources, taking into consideration the Farmers' Rights and the Breeders' Rights.

Even though Bangladesh signed the Undertaking on Plant Genetic Resources, unfortunately information on the matter hardly trickled downward. Except some government regulations (i.e. declaration of (a) a ban on the use of fuelwood for brick industries and (b) a ban on tree felling in

high forests), hardly anything tangible for conservation of PGR has taken place in the country.

However, we envisage

1. a judicious land use policy in the country,
2. an inventory of PGR of the country (at an early date) under the guidance of professionals in relevant fields,
3. a moratorium on tree felling in all reserved forests (for a specified period),
4. identification of *in situ* conservation sites and their preservation measures,
5. establishment of *ex situ* conservation sites that will include a larger number of national parks and arboreta in different ecological zones of the country,
6. a moratorium on export of PGR without the consent of a National Committee of on Plant Genetic Resources (already proposed in a meeting held recently at BARC),
7. establishment of a Bureau of Plant Genetic Resources and strengthening and streamlining existing the PGR activities currently scattered under various ministries, institutions /organizations,
8. the ratification of the Biodiversity Convention by the National Parliament soonest, and
9. large scale involvement of the private sector and NGOs in PGR activities.

To accomplish most of the above Bangladesh will need assistance, both technical and financial, to help conserve the country's rich genetic resources. An "international fund" for such activities is very much the needed.

FAO/UNDP, either alone or in association with other organizations, have in the past helped Bangladesh in the following PGR collaboration projects:

- the establishment of the Genebank at BARI;
- the establishment of the Genebank at BJRI, in association with the Asian Development Bank and UNDP;
- the Mango Project of BARI;
- the Integrated Maize Promotion Project (IMPP) of BARI; and
- the Forest Tree Improvement Programme (FORTIP) of BFRI.

6.2 INTERNATIONAL AGRICULTURAL RESEARCH CENTRES

The CGIAR

The CGIAR commodity centres have contributed significantly to the country's plant genetic resources through the following national plant genetic resources programmes:

1. IRRI contributed to rice improvement programme of BRRI;
2. IBPGR (IPGRI) contributed to the establishment of the Genebank at BARI (in association with FAO/UNDP);
3. ICRISAT contributed to the Pulses (legumes) Improvement Programme of BARI;
4. CIMMYT contributed to the Wheat and Maize Improvement Programmes of BARI;
5. CIP contributed to the Potato improvement Programme of BARI;
6. AVRDC contributed to the Vegetable Improvement Programme of BARI;
7. ICARDA contributed to Barley and Wheat Development Programmes of BARI;
8. IITA contributed to Maize and Grain Legume Programmes of BARI.

The CGIAR centres have provided plant genetic materials:

a. as finished products,

b. in the form of advanced breeding lines,

c. as parental stock for breeding programmes already undertaken/to be undertaken within the country.

The CGIAR supports generally came through CGIAR staff located in the country/region. For this the Bangladesh Agricultural Research Council and ARIs have, in most cases, Memorandums of Understanding (MOUs) with GCIAR centres.

National staff have received training from the following CGIAR centres:

- **IRRI;**
- **CIMMYT;**
- **CIP;**
- **ICARDA;**
- **ICRISAT;**
- **IITA;**
- **IPGRI (IBPGR).**

In some cases the training received were through in-service training at CGIAR centres, and in some cases through attendance of courses at the centres.

In most of the cases, training received at CGIAR centres have been based on the slots offered to the country, rather than on country-driven needs. As such it is difficult to comment on if CGIAR centres failed to provide training sought from them.

In the absence of a strong national PGR programme, it is difficult to envisage transfers of CGIAR genetic resources functions to our national programmes.

The IRRI has received a huge number of rice germplasm from Bangladesh but their identity numbers are not known to Bangladesh. We would like the IRRI to take initiatives to convey these identity numbers to concerned research institute in Bangladesh (BRRI). Similarly all CGIAR centres and other genetic resources centres (whether national, regional or international), that obtained germplasm through joint explorations undertaken on bilateral arrangements or otherwise, may convey the identity of and information on germplasm to the country(ies) of origin to be fair with Farmers' Rights.

The mechanisms of communication between national programmes and CGIAR centres, as mentioned above, are mainly based on MOUs. Collaborations with CGIAR centres without an MOU, that passes through a long government channel and often is time consuming, does not seem easy. Often the process takes not only months but years. However, information of, say, results of characterization, evaluation and use of the country's indigenous germplasm from overseas users of PGR germplasm, have not been forthcoming. Such information dissemination may be established as a matter of routine for the recipient PGR centres (whether national, regional or international).

CGIAR scientists located in the country/region extended support and helped in programme execution and exchange of information. They often helped expedite execution of programme activities.

IPGRI

IPGRI, with its regional centres, is certainly better poised to help identify national needs and opportunities, and help solve regional vis a vis national problems. Similarly, it can initiate and organize regional programmes (in coherence with national programmes) including training of PGR personnel, workshops, seminars and mass awareness drives on PGR, in addition to conservation activities. All these would obviously be based on global perspectives. These activities we regard as the most important functions of IPGRI.

IPGRI, in the same vein, can play a catalytic role in international collaboration, developing/strengthening national capabilities in PGR activities, in disseminating information on PGR and their uses (whether in-country and abroad) not only to scientists, but also to administrators, policy makers and most importantly to the general mass at the grassroot level. It is the later three groups whose awareness and interests on PGR matter most in the implementation of conservation programmes.

IPGRI regional offices may take initiatives to document exchanges of germplasm that have taken place within and from respective regions in the past, publish information on their characterization, evaluation and uses so far, and convey such information to all interested in the region and outside the region. A similar documentation of current exchanges of germplasm may be taken up as a routine work. This may also include PGR materials held in CGIAR centres, regional genebanks as well as national genebanks. IPGRI may also help promote NGOs and the private sector for activities on PGR. These may include private sector parks, arboreta, *in situ* conservation sites, etc.

Other International Centres

IDRC

The International Development Research Centre (IDRC), Canada provided assistance in pulse crops survey in Bangladesh.

IUCN

The International Union for Conservation of Nature and Natural Resources (IUCN) - the World Conservation Union, has helped Bangladesh in the preparation of the National Conservation Strategy (NCS) entitled "Towards Sustainable Development", with financial assistance from NORAD. The conservation strategy focused on inter alia Rural Development, Land Resources, Environmental Awareness and Genetic Resources. The recommendations of the NCS are considered important and the pertinent recommendations (of the NCS) are given in Appendix 6.

ODA

The Overseas Development Agencies (of United Kingdom) provided assistance in Tea Improvement as well as Pulse Improvement Programmes.

Regional Research Centres

IJO

The International Jute Organization (IJO) with its base at Dhaka (Bangladesh) has undertaken, since its inception in 1984, 23 projects. Of these the Germplasm Project at BJRI, started in 1987, has to its credit the following:

1. Increased the supply of germplasm substantially for breeding programmes on jute (Corchorus spp.), kenaf and mesta (Hibiscus spp.). These germplasm are being shared by jute producing countries (Bangladesh, India, Thailand, China, Indonesia, Nepal, etc.).
2. In spite of limitations, a good progress has been made in characterization, evaluation and conservation of germplasm at the genebank located at the Bangladesh Jute Research Institute.
3. Workshops and training programmes, with participation of member countries, contributed to exchange of information and helped in human resource development in the region.

4. The pressure on lands for growing food crops increased with the increase in population in the region. This pushed jute to marginal lands. This has created the need for developing varieties suitable for marginal lands. While varieties with high yield and quality fibres are lacking, pushing jute to marginal lands warrants a greater effort to develop varieties that suit poorer soils and yet produce higher yields. Thus conservation of germplasm for new breeding programmes has become ever more a critical matter, and the genebank at BJRI, Dhaka is capable to supply most of the needed germplasm for future breeding programmes.

5. The Genebank at BJRI has been designated as the Centralized Germplasm Repository (CGR) for maintaining base collections of jute and allied fibres crops, collected by IJO since August 1990. This, no doubt, reflects the capabilities and potentials that exist in the country in terms of PGR activities.

AVRDC

Bangladesh has a MOU with AVRDC. The resident scientist of AVRDC has initiated a good number of programmes on vegetable development in Bangladesh and has already completed some training programmes on vegetables, including Germplasm Collection, Evaluation, Documentation and Conservation. Bangladesh has exchanged a substantial number of vegetable germplasm with AVRDC.

In fact Bangladesh lagged behind abysmally in undertaking vegetable breeding programmes in the past and it is AVRDC which 'initiated', in some meaningful way, vegetable breeding in the country. The activities need to be sustained and strengthened, and expanded to fruit crops, if possible.

It is a fact in Bangladesh that research institutes have no authority to deal with regional centres, for that matter with any centre, without the consent of the concerned government ministries. As such a formal agreement between the government and the centre is essential to the success of the collaboration/relationship.

Regional Intergovernmental Initiatives

Bangladesh has not yet established collaboration with ECPGR, IICA and RECSEA. It is important that collaboration with such regional initiatives, especially with RECSEA and IICA be established at an early date in the interest of Bangladesh.

It is strongly felt that a SAARC Plant Genetic Resources Centre should be established with a view to initiating regionally integrated plant genetic

resources programmes. Such a regional PGR centre would not only strengthen regional PGR activities, but also would help create awareness beyond the scientific arena, to policy makers, administrators and farmers in the region in general. It may also help initiate regional approach to include PGR courses in educational institutions with a view to creating awareness of and equipping younger generations on PGR conservation.

The International Jute Organization (IJO), with its headquarters in Bangladesh, has contributed to the development of the Germplasm Division of BJRI, training of PGR personnel and a greater cooperation and collaboration among member countries of IJO.

Bilateral Intergovernmental Initiatives

Bangladesh has bilateral arrangements with the following countries:
Australia,
China,
India,
Egypt,
Japan,
Malaysia,
Nepal,
North Korea,
Pakistan,
Sri Lanka,
Thailand,
Turkey.

The exchanges of germplasm with these countries, on a reciprocal basis, is included in the bilateral arrangements.

Recently BRRI received some financial assistance for collection and conservation of rice germplasm from Swiss Development Cooperation (SDC). The assistance has been channelled through IRRI for a four-year project (1995-98) entitled “Safeguarding and Preservation of Biodiversity of the Rice Genepools”.

CHAPTER 7
National Needs and Opportunities

7.1 OPPORTUNITIES

Bangladesh is remarkably rich in genetic variability of field crops, fruits, nuts and forest species. It is also the secondary centre of origin of many important vegetables and fruits. People here have lived for millennia on naturally endowed genetic diversity of these plant species, and very little of the diversity has yet been exploited scientifically to the benefit of the people. This provides the scope for utilization of these yet untapped genetic resources, not only for the benefit of the people in the country but also around the globe. Much of the future agricultural cum economic development lies hidden in these untapped resources. But this calls for collection, and conservation and utilization of these resources before they are lost or threatened with extinction.

Bangladesh constitutes the larger part of one of the Vavilovian Mega Centre of Genetic Diversity, the South Asian Gene Centre sharing with India. The country has a large number of plant scientists and technicians working in agricultural research institutes, universities and the Bangladesh National Herbarium.

For an efficient utilization and exploitation of these resources and opportunities, a sound national programme on plant genetic resources is not only desirable but essential. This warrants a national commitment at the highest level and promotion of greater collaborations both at the regional and the global level.

7.2 NATIONAL NEEDS

- An assessment of genetic diversity, the rate and extent of PGR erosion, and prioritization of PGR activities based on the information gathered from such studies - (urgent need).
- Establishment of a Bureau of Plant Genetic Resources with appropriate infrastructure for conservation of orthodox and recalcitrant seeds, vegetatively propagated materials, including facilities for a Cryo bank and a DNA bank - (urgent need).
- Strengthening and integration of national PGR network including field genebanks.
- Development of PGR documentation and data management systems to facilitate local and Regional use of PGR information.
- Development of human resources necessary for national PGR programmes.
- Formulation of national legislation to implement the Biodiversity Convention -(urgent need).
- Development of biotechnological capabilities to upgrade the national PGR programme, especially for bilateral and collaborative research.
- Strengthening of national varietal improvement programmes and an integration of such programmes with PGR activities.

CHAPTER 8
Proposals for a Global Plan of Action

In order to facilitate the process of assigning high priority for PGR activities in national policies, and to create a conducive environment for free and fair exchange of germplasm with a view to resolving problems of food production programmes:

- Facilitate collaborative efforts between and among countries and regions on collection, evaluation, utilization and other PGR activities.
- Facilitate exchange of PGR information.
- Establish regional PGR fund to promote regional PGR activities.
- Ensure global involvement for sharing crop genetic and other natural resources (including water) for the benefit of each country.
- Facilitate global action and assistance in creating awareness, both at the national and the international level, on the importance of PGR, environment and habitat conservation. This may include introduction of course curricula on PGR at all levels of education and mass awareness drives/campaigns.
- Undertake global action to minimize any adverse effect/implications the Biodiversity Convention and GATT/WTO accords on the economies of developing countries.
- Take global approaches, where necessary, to prevent / reduce habitat destruction and environmental pollution accruing from development programmes, especially by a national government with the involvement of international organization(s). In other words, international assistance in national projects for protection of habitats, conservation of genetic resources, reduction in environmental pollution may be made conditional.
- Facilitate global assistance to strengthen national varietal development programmes.

The list has been prepared in order of priorities.

APPENDIX 1

Cultivated crop plants of Bangladesh

Crop	Scientific Name	Growing Season	Status
Cereals			
Rice	*Oryza sativa*	Rabi and Kharif	Major
Wheat	*Triticum aestivum*	Rabi	Major
Maize	*Zea mays*	Rabi and Kharif	Minor
Barley	*Hordeum vulgare*	Rabi	Minor
Pearl Millet	*Panicum miliaceum*	Rabi	Minor
Fox Tail Millet	*Setaria italica*	Rabi	Minor
Triticale	*Triticale*	Rabi	Minor
Pulses (Grain legumes)			
Grasspea	*Lathyrus sativus*	Rabi	Major
Lentil	*Lens culinaris*	Rabi	Major
Chickpea	*Cicer arietinum*	Rabi	Major
Mungbean	*Vigna radiata*	Rabi	Major
Blackgram	*Vigna mungo*	Rabi	Minor
Pigeonpea	*Cajanus cajan*	Rabi and Kharif	Minor
Cowpea	*Vigna unguiculata*	Rabi and Kharif	Minor
Oilseeds			
Mustard	*Brassica spp.*	Rabi	Major
Groundnut	*Arachis hypogea*	Rabi and Kharif	Major
Sesame	*Sesamum indicum*	Rabi and Kharif	Major
Linseed	*Linum usitatissimum*	Rabi	Minor
Niger	*Guizotia abyssinica*	Rabi	Minor
Safflower	*Carthamus tinctorius*	Rabi and Kharif	Minor
Coconut	*Cocos nucifera*	Round the year	Major
Vegetables			
Brinjal (Eggplant)	*Solanum melongena*	Rabi and Kharif	Major
Radish	*Raphanus sativus*	Rabi	Major
Bottle gourd	*Lagenaria siceraria*	Rabi	Major
Tomato	*Lycopersicon esculentum*	Rabi	Minor
Squash	*Cucurbita moschata/pepo*	Rabi and Kharif	Major
Pumpkin	*Cucurbita maxima*	Rabi	Minor
Cucumber	*Cucumis sativus*	Kharif	Major
Marfa, Phuti	*Cucumis melo*	Rabi	Minor
Bitter gourd	*Momordica charantia*	Kharif	Minor
Teasle gourd	*Momordica dioica*	Kharif	Major
Snake gourd	*Trichosanthes anguina*	Kharif	Minor
Amaranth	*Amaranthus spp./gangeticus*	Rabi and Kharif	Minor
Spinach	*Spinacea oleracea*	Rabi	Minor
Lima bean	*Phaseolus lunatus*	Rabi	Minor
French bean	*Phaseolus vulgaris*	Rabi	Minor

Crop	Scientific Name	Growing Season	Status
Country bean	*Dolichos purpureus*	Rabi	Major
Ribbed gourd	*Luffa acutungula*	Rabi	Minor
Songe gourd	*Luffa cylindrica*	Kharif	Minor
Indian spinach	*Basella alba*	Kharif	Minor
Okra	*Abelmoschus escunletus*	Kharif	Major
Ash gourd	*Benincasa hispida (B. cerifera)*	Kharif	Major
Cheena sak	*Brassica spp.*	Rabi	Major
Bathua	*Chenopodium album*	Rabi	Minor
Water melon	*Citrulus vulgaris*	Kharif	Major
Kalmi sak	*Ipomea aquarica (I. reptans)*	Kharif	Minor
Winged bean	*Psophocarpus tetragonolobus*	Rabi	Minor
Potato	*Solanum tuberosum*	Rabi	Major
Sweet potato	*Ipomoea batatus*	Rabi	Major
Arum	*Colocasia esculenta*	Round the year	Major
Yam bean,Shak aku	*Pachyrrhizus tuberosus*	Round the year	Minor
Yam	*Dioscorea spp.*		Minor
Spices			
Chilli	*Capsicum annum/frutescens*	Rabi and Kharif	Major
Turmeric	*Curcuma domestica/longa*	Rabi	Major
Coriander	*Coriandrum sativum*	Rabi	Minor
Black cumin	*Nigella sativa*	Rabi	Minor
Fenugreek (Methi)	*Trigonella foenum-graceum*	Rabi	Minor
Black pepper	*Piper nigrum*	Rabi	Minor
Cuminseeds (Jeera)	*Cuminum cyminum*	Rabi	Minor
Ginger	*Zingiber officinale*	Rabi	Major
Onion	*Allium cepa*	Rabi	Major
Garlic	*Allium sativum*	Rabi	Major
Join	*Carum capticum*	Rabi	Minor
Fruits			
Jackfruit	*Artocarpus heterophyllus*	A tree, fruits in Kharif	Major
Mango	*Mangifera indica*	A tree, fruits in Kharif	Major
Litchi	*Litchi chinensis*	A tree, fruits in Kharif	Minor
Guava	*Psidium guajava*	A tree, fruits in Kharif	Minor
Watermelon	*Citrullus lanatus (C. vulgaris)*	Rabi	Major
Lime	*Citrus aurantifolia*	A tree, fruits in Kharif	Minor
Lemon	*Citrus limon*	A tree, fruits in Kharif	Minor
Pomelo	*Citrus grandis*	A tree, fruits in Kharif	Minor
Mandarin	*Citrus reticulata*	Rabi	Minor
Sweet orange (Malta)	*Citrus sinensis*	A tree, fruits in Rabi	Minor
Carambola (Kamranga)	*Averrhoa carambola*	A tree, fruits in Kharif	Minor

Crop	Scientific Name	Growing Season	Status
Fibre crops			
Cotton	*Gossypium spp.*	Rabi and Kharif	Minor
Jute	*Corchorus spp.*	Kharif	Major
Mesta and Kenaf	*Hibiscus spp.*	Kharif	Minor
Sunnhemp	*Crotalaria juncea*	Rabi	Minor
Sugar crops			
Sugarcane	*Saccharum officinale*	Rabi and Kharif	Major
Date palm	*Phoenix sylvestris*	A tree, fruits in Kharif	Minor
Beverage			
Tea	*Camellia sinensis*	A tree, harvested in Kharif	Major
Narcotics			
Tobacco	*Nicotiana tabacum, N. rustica*	Rabi	Minor
Green manuring crops			
Sunnhemp	*Crotalaria juncea*	Rabi	Minor
Sesbania (Shon pat)	*Sesbania spp.*	Kharif	Minor

Source: Mondal, M. H. 1990. Plant genetic resources activities in Bangladesh. Proc. South Asia National Coordinators Meeting, 21-24 March, 1990, held at IBPGR Regional Office for South Asia, NBPGR Campus, Pusa, New Delhi - 110 012, India.

APPENDIX 2

Edible fruit species in Bangladesh forests

SL No.	Species	Family	Description	Distribution
1.	*Alangium salvifolium* (L.f.) Wangerin (Aikha, Ankura, Akarkanta)	*Alangiaceae*	Small deciduous tree or straggling shrub	Chittagong, Chittagong Hill Tracts, village groves
2.	*Anthocephalus chinensis* (lamk.) Rich ex Walp. (Kadam)	*Rubiaceae*	Tall deciduous tree	Chittagong Hill Tracts, Dhaka, Mymensingh, Dinajpur
3.	*Antidesma ghaesembilla* Gaertn. (Khudijam)	*Euphorbiaceae*	Deciduous shrub or small tree	Chittagong, Chittagong Hill Tracts, Cox's Bazar, Dhaka, Dinajpur
4.	*Artocarpus chaplasha* Roxb. (Chaplash, Chambal)	*Moraceae*	Large deciduous tree	Chittagong, Cox's Bazar, Chittagong Hill Tracts, Dhaka, Dinajpur, Sylhet, Madhupur
5.	*Artocarpus lakoocha* Roxb. (Dewa)	*Moraceae*	Medium sized deciduous tree	Chittagong, Cox's Bazar, Chittagong Hill Tracts, Dhaka, Dinajpur, Sylhet, Madhupur
6.	Baccaurea ramiflora (Roxb.) Muell-Arg. Lour. (B. sapida) (Latka)	*Euphorbiaceae*	Small to medium sized evergreen tree	Chittagong, Cox's Bazar, Chittagong Hill Tracts, Sylhet (usually in shady places)
7.	*Bauhinia vahlii* W. et A. (Chehur)	*Caesalpiniaceae*	Gigantic tredrillar woody climber (attaining 35 m and 60 m diameter	Dhaka, Mymensingh, (small forests)
8.	*Buchanania lanzan* Spreng. (*B. latifolia* Roxb.)	*Anacardiaceae*	Medium sized evergreen tree (Trunk looks like crocodile skin)	Chittagong, Cox's Bazar, Chittagong Hill Tracts, Sundarbans
9.	*Bauea burmanica* Griff.	*Anacardiaceae*	Medium sized evergreen tree	Chittagong, Cox's Bazar, Chittagong Hill Tracts, Dhaka,Mymensingh,Sylhet .
10.	*Bridelia retusa* Spreng. (Kamkui, Kantakhasi, Kosoi)	*Euphorbiaceae*	Small to medium sized deciduous tree	Chittagong, Chittagong Hill Tracts, Dhaka,Mymensingh
11.	*Calamus erectus* Roxb. (Kadam Bet)	*Palmae*	Erect, tuft, very thorny cane	Chittagong, Chittagong Hill Tracts, Sylhet
12.	*Calamus rotung* L. (Chanci Bet) *C. tenuis* Roxb. (Bhandari Bet)	*Palmae*	Slender climbing cane with long stem	Chittagong, HillTracts, Sunamganj,Sundar-bans
13.	*Carallia brachiata* (Lour.) Merr. (*C. lucida* Roxb.) (Rajcow, Khenargachh)	*Rhizophoraceae*	Medium sized to tall evergreen tree with horizontal branches green thick leaves	Chittagong, Cox's Bazar, Chittagong Hill Tracts, Mymensingh,Sylhet
14.	*Cleistocalyx operaculatus* (Roxb.) Herr. & Perry (*Eugenia operculata* Roxb.) (Tepajam, Thengajam, Batijam)	*Myrtaceae*	Small to medium sized tree, thick leaves with small of jam (?) when bruised and turn red or purplish when shedding	Chittagong (Andhermanik & Dhoom) growing in Savanas, Madhupur sal forest, Dinajpur (Singra).

SL No.	Species	Family	Description	Distribution
15.	*Cordia dichotoma* Forest f. (*C. myxa* Roxb.) (Bahanari, Laskkara)	*Ehretiaceae*	Medium sized deciduous tree	Chittagong, Cox's Bazar, Chittagong Hill Tracts, Mymensingh,Sylhet
16.	*Dillenia indica L.* (Chalta)	*Dilleniaceae*	Medium sized semi deciduous tree with redish smooth bark	Chittagong, Cox's Bazar, Chittagong Hill Tracts, in villages throughout
17.	*Dillenia pentagyna* Roxb. (Hargoja, Akshi, karkota. Ajugi)	*Dilleniaceae*	Medium sized to large deciduous tree	Chittagong, Cox's Bazar, Chittagong Hill Tracts, Dhaka, Mymensingh,Sylhet (usually growing inSavanas)
18.	*Diospyros peregrina* Gaertn,. (D. *embryopteris* Pers.) (Deshi Gab)	*Ebenaceae*	Small to medium sized evergreen tree fluted lofty black trunk	Grows wild in different forests
19.	*Diospyros toposia* (Buch.) Ham (*D. racemosa* Roxb.) (Gabgulal)	*Ebenaceae*	Medium sized to large evergreen tree with black rough bark	Chittagong, Chittagong Hill Tracts, usually growing in moist places
20.	*Ehretia acuminata* R. Br. *(E. serrata* Roxb.) (Kaloaza, Kulaza)	*Ehretiaceae*	Small to medium sized semi evergreen tree	Chittagong, Chittagong Hill Tracts, Sylhet
21.	*Elaeocarpus floribundus* Blume. (Belphol) *E. robusta* Roxb. (Jalpai) (*E. tectorius* (Lour.) Poir.)	*Elaeocarpaceae*	Medium sized evergreen tree with alwayas some crimson redish old leaves	Chittagong, Chittagong Hill Tracts, Sylhet, Mymensingh
22.	*Emblica officinalis* Gaertn. *Phyllanthus emblica* L.	*Euphorbiaceae*	Small to medium sized deciduous tree with beautiful pinnately compound leaf-like foliage although the leaves are simple	Chittagong, Chittagong Hill Tracts, Sylhet, Dhaka, Mymensingh. Dinajpur
23.	*Erioglossum rubiginosum* Blume. *E. edule* Blume (Amlaki)	*Sapi ndaceae*	Evergreen large shrub or small to medium sized tree with young parts densely covered by rusty golden tomentum	Chittagong, Chittagong Hill Tracts, and villages
24.	*Ficus auriculatus* Lour. *F.* Roxb*urghii* Wall. *F. macrophylla* Roxb. (Dumur)	*Moraceae*	Small to medium sized very silky evergreen tree	Chittagong Hill Tracts, Sitapahar, on Kaptai Road.
25.	*Ficus racemosa* L. (*F. glomerata* Roxb.) (Jagdumur)	*Moraceae*	Medioum sized tree, deciduous for short time with redish broen smooth bark	Chittagong, Chittagong Hill Tracts, Cox's Bazar and throughout the country

SL No.	Species	Family	Description	Distribution
26.	*Ficus hispida* L. (Tkoska, Kakdumur)	*Moraceae*	Large shrub or small tree with l;arge opposite, very coarse (hairy) leaves.	Grows in all forest areas and in waste places throughout the country
27.	*Firmiana colorata* Roxb. R. Br.(*Sterculia colorata* Roxb.) (Faisa Udal, Pata Gota)	*Sterculiaceae*	Medium sized deciduous tree	Chittagong, Chittagong Hill Tracts, Sylhet, Dhaka, Mymensingh
28.	*Flacourtia jangomas* (Lour.) Raeusch, (Paniala, Kukluki) *F. cataphracta* Roxb. ex Willd. (Ujal)	*Flacourtiaceae*	Small to medium sized deciduous tree with compound branched spines on the main trunk	Chittagong, Chittagong Hill Tracts, Cox's Bazar, Sylhet.
29.	*Flacourtia indica* (Burm. f.) Merr. (*F. ramontchii* (L.) Heritt.; *F. sepiaria* Roxb.) (Beuchi, Paniala)	*Flacourtiaceae*	Much thorny bushy deciduous shrub to small tree	Chittagong, Cox's Bazar, Sylhet. Mymensingh, Dhaka
30.	*Garcinia cowa* Roxb. *G. kydia* Roxb. (Kaglichu)	*Guttifereae*	Tall evergree glabrous tree with drooping branches and exuding yellow latex	Chittagong, Chittagong Hill Tracts, Sylhet
31.	*Garcinia xanthochymus* Hook.f. (Tamal, Dambel)	*Guttifereae*	Medium sized semi-deciduous tree with copious yellow latex	Chittagong Hill Tracts
32.	*Grewia tiliaefolia* Vahl.(Dhaman)	*Tiliaceae*	Medium sized deciduous tree	Chittagong, Hill Tracts
33.	*Madhuca indica* J.F. Gmell. *M. latifolia* Roxb. *Bassia latifolia* Roxb. (Mahua)	*Sapotaceae*	Medium sized deciduous tree with white latex and large leathery leaves crowded at the end of branches	Forests of Dinajpur (Dharmapur, Santal Village)
34.	*Mangifera sylvatica* Roxb. (Jangli Am)	*Anacardiaceae*	Large evergreen tree	Chittagong, Chittagong Hill Tracts, Cox's Bazar, Sylhet
35.	*Melastroma malabathricum* L. (Datranga, Lutki)	*Melastomaceae*	Bushy shrub with purple coloured flowers	Chittagong, Cox's Bazar, Sylhet,
36.	*Microcos paniculata* L. *Grewia microcos* Wall. ex Mast. (Asar, Patka)	*Melastomaceae*	Small to medium sized tree or shrub	Chittagong, Chittagong Hill Tracts, Cox's Bazar, Sylhet
37.	*Nypa fruticans* Wurmb.(Golpata)	*Palmae*	Stemless	Chittagong, Hill Tracts, Sylhet
38.	*Paramigyna citrifolia* Hook. f. (Ban Nebu, Karipa)	*Rutaceae*	Spiny scandant shrub with recurved spines	Chittagong, Chittagong Hill Tracts, Sylhet

SL No.	Species	Family	Description	Distribution
39.	*Parkia* Roxb *urghii* G. Don. P. javanica Merr. (Sapota)	*Mimosaceae*	Tall unarmed tree, bipinnate leaves and small leaflets.	Chittagong, Chittagong Hill Tracts (Bandarban)
40.	*Phoenix paludosa* Roxb. (Hintal)	*Palmae*	Soboliferous gregarious palm (bushy when young) can grow stem up to 6m	Mangrove forests of Sundarbans.
41.	*Randia spinosa* Poir. R. dumetorum Lam.(Mainphal)	*Rubiaceae*	Small deciduous tree or large shrub	Chittagong, Hill Tracts, Cox's Bazar, Sylhet,Dhaka,Dinajpur
42.	*Randia uliginosa* DC. (Piralu)	*Rubiaceae*	Small to medium sized tree or large shrub with redish brown bark	Sylhet, Chittagong Hill Tracts
43.	*Rhizophora mucronata* Poir. (Haoa, Khamo, Jhanna)	*Rhizophoraceae*	Small to mid- sized tree with leathery leaves ,stilt roots	Sundarbana o\and other tidal forests
44.	*Sarcolobus globosus* Wall. (Baolilata)	*Asclepiadaceae*	Glabrous trwining shrub	Sundarbans and tidal creeks of Chgittagong
45.	*Schleichera oleosa* (Lour.) Oken. *S. trijuga* Willd. (Kusum, Lakkha)	*Sapindaceae*	Lartge deciduous tree with much fluted knotty trunk	Dhaka, Chittagong, Mymensingh
46.	*Semicarpus anacardium* L. (Beula, Bhelatuki)	*Anacardiaceae*	Small deciduous tree with large leaves corowded at the end of the branchlets	Mymensingh, Dhaka, Chittagong, Chittagong Hill Tracts
47.	*Shorea robusta* Gaertn. (Gajari)	*Dipterocarpaceae*	Mid-sized semideciduous tree	Dhaka, Mymensingh, Comilla, Sal;illa of Sylhet
48.	*Sonneratia caseolaris* L. (*S. acida* L.) (Orali, Choila)	*Sonneratiaceae*	Small to medium sized evergreen tree with yellow drooping branches	Sundarbans and other coastal areas
49.	*Spondias pinnata* (L.) Kurz. (Amra) *S. mangifera* Willd. (Amletung)	*Anacardiaceae*	Medium sized to large deciduous tree	Chittagong, Dhaka, Cox's Bazar and villages throughout the country
50.	*Sterculia foetida* L. (Jangli Badam)	*Sterculiaceae*	Tall deciduous tree with nearly horizontal whorled branches and digitate	Cox's Bazar and Chittagong
51.	*Stixis suaveolens* (Roxb.) Pierre. (*Roydsia sauveolens* Roxb.)	*Caparidiaceae*	Large unarmed woody climber	Chittagong Hill Tracts and Chittagong
52.	*Syzygium claviforum* Roxb. Wall ex Cowan & Cowan. (Nalijam)	*Myrtaceae*	Medium sized evergreen tree	Chittagong, Cox's Bazar and Chittagong Hill Tracts

SL.No.	Species	Family	Description	Distribution
39.	*Parkia* Roxb *urghii* G. Don. P. javanica Merr. (Sapota)	*Mimosaceae*	Tall unarmed tree, bipinnate leaves and small leaflets.	Chittagong, Chittagong Hill Tracts (Bandarban)
40.	*Phoenix paludosa* Roxb. (Hintal)	*Palmae*	Soboliferous gregarious palm (bushy when young) can grow stem up to 6m	Mangrove forests of Sundarbans.
41.	*Randia spinosa* Poir. R. dumetorum Lam.(Mainphal)	*Rubiaceae*	Small deciduous tree or large shrub	Chittagong, Hill Tracts, Cox's Bazar, Sylhet,Dhaka,Dinajpur
42.	*Randia uliginosa* DC. (Piralu)	*Rubiaceae*	Small to medium sized tree or large shrub with redish brown bark	Sylhet, Chittagong Hill Tracts
43.	*Rhizophora mucronata* Poir. (Haoa, Khamo, Jhanna)	*Rhizophoraceae*	Small to mid- sized tree with leathery leaves ,stilt roots	Sundarbana o\and other tidal forests
44.	*Sarcolobus globosus* Wall. (Baolilata)	*Asclepiadaceae*	Glabrous trwining shrub	Sundarbans and tidal creeks of Chgittagong
45.	*Schleichera oleosa* (Lour.) Oken. *S. trijuga* Willd. (Kusum, Lakkha)	*Sapindaceae*	Lartge deciduous tree with much fluted knotty trunk	Dhaka, Chittagong, Mymensingh
46.	*Semicarpus anacardium* L. (Beula, Bhelatuki)	*Anacardiaceae*	Small deciduous tree with large leaves corowded at the end of the branchlets	Mymensingh, Dhaka, Chittagong, Chittagong Hill Tracts
47.	*Shorea robusta* Gaertn. (Gajari)	*Dipterocarpaceae*	Mid-sized semideciduous tree	Dhaka, Mymensingh, Comilla, Sal;illa of Sylhet

Source: Das, D.K. 1987. Edible fruits of Bangladesh forests. Bull. No. 3 Plant Taxonomy Series, BFRI, 16 pp. Local name(s)in parenthesis (bold letters)

APPENDIX 3

Medicinal plants available in Bangladesh

Sl. No.	Species name	Local name	Family	Location
1.	*Abroma augusta* L.	Ulatkambal	*Sterculiaceae*	All over the country
2.	*Abelmoschus esculentus* W & A.(*Hibiscus esculentus* L.)	Bhindi, Dheras, Okra	*Malvaceae*	All over the country
3.	*Abrus precatorius* L..	Kunch, Rati, Chanyi, Kaich, Gungchi, Gujna	*Leguminosae*	Dhaka, Chittagong, Chittagong Hill Tracts, Mymensingh,Sylhet
4.	*Abutilon indicum* (L.) (Sweet.) G. Don	Petari, Jhampi, Jhumka	*Malvaceae*	All over the country\
5.	*Acalypha indica* L.	Muktajhuri, Biral hatchi, Swetbasanta	*Euphorbiaceae*	All over the country
6.	*Achyranthes aspera* L.	Apang, Upatlangra	*Amaranthaceae*	All over the country
7.	*Acorus calamus* L.	Bach, Gharbach, Swetbach	*Araceae*	All over the country, especially in low lying areas of Dinajpur
8.	*Adhatoda vasica* Nees.	Basak, Bakas, Adulsa	*Acanthaceae*	All over the country, especially in low lying areas of Dinajpur
9.	*Aegle marmelos* (L.) Correa	Bel	*Rutaceae*	All over the country, especially in low lying areas of Dinajpur
10.	*Agati grandiflora* Desv. (*Sesbania grandiflora* (L.) Pers.)	Bakphul, Agasta, Buko, Bak, Agati	*Leguminasae*	All over the country, especially in low lying areas of Dinajpur
11.	*Alangium salvifolium* Thw.	Baghankura, Dhalakura	*Alangiaceae*	All over the country, especially in low lying areas of Dinajpur
12.	*Aloe vera* Tawin. (*A. barbadensis* Mill.)	Ghritakanchan, Gheekachu, Ghritakumari, Musabbar	*Agavaceae*	All over the country, especially in low lying areas of Dinajpur
13.	*Amaranthus spinosus* Willd.	Kanta Notey, Kanta Denga, Katamiris	*Amaranthaceae*	All over the country, especially in low lying areas of Dinajpur
14.	*Andrographis paniculata* (Burm f.) Wall ex Nees	Kalomegh, Mahatita	*Acanthaceae*	Dinajpur, Chittagong, Chittagong Hill Tracts
15.	*Cymbopogon citratus* (DC) Stapf	Lemonghas, Gandhatrina	*Gramineae*	All over Bangladesh
16.	*Annona squamosa* L.	Ata, Sharifa, Sitaphal, Luna	*Annonaceae*	All over Bangladesh
17.	*Argemone mexicana* L.	Shial Kanta, Bara Shial Kanta, Kengrabiji	*Papavaraceae*	All over Bangladesh
18.	*Aristolochia indica* L.	Iswarar Mul	*Aristolochiaceae*	All over Bangladesh, especially in Chittagong, Hill Tracts
19.	*Asparagus racemosus* Willd	Shata Muli, Hilum	*Liliaceae*	Madhupur, Sylhet, Chittagong
20.	*Boerhaavia repens* L. (*B. diffusa* L.)	Punarnava, Gandhapurna, Swetpurna	*Nyctaginaceae*	Dhaka, Mymensingh, Chittagong, Dinajpur

Sl. No.	Species name	Local name	Family	Location
21.	*Bryophyllum calycinum* Salisb.	Patharkuchi, Patiapuri, Kafpata	*Crassulaceae*	All over Bangladesh
22.	*Caesalpinia crista* L. (*C. nuga* L.)	Let Kanta	*Leguminosae*	All over Bangladesh, Chittagong, Hill tracts, and estuarine areas
23.	*Calophyllum inophyllum* L.	Sultan Champa, Punnag, Kannyal, Nag Champa, Gulab, Kath Champa, Panial	*Guttifereae*	Along the sea shore and inland in Barisal district
24.	*Calotropis gigantea* R. Br.	Bara Akand, Gur Akand	*Asclepiadaceae*	All over Bangladesh
25.	*Canna orientalis* Rosc.(*C. indica* L.)	Sarbajaya, Phena	*Cannaceae*	All over Bangladesh
26.	*Canscora decussata* (Roxb.) Roem & Schultz	Daukuni	*Gentianaceae*	All over Bangladesh
27.	*Cassia alata* L.	Dad Mardan, Dadmari	*Leguminseae*	All over Bangladesh
28.	*Clerodendrum viscosum* Gaertn.	Bhant, Ghetu, Ghetuphul	*Verbenaceae*	All over Bangladesh
29.	*Clitoria ternatea* L.	Aparajita, Nila Aparajita	*Leguminosae*	All over Bangladesh
30.	*Coccinea cordifolia* (L.) Cogn. (*C. indica* W & A.)	Telakucha, Vinbu, Kak Jhinga, Kawoaluli, Kanduri, Kuchila, Mamakola, Makal	*Cucurbitaceae*	All over Bangladesh
31.	*Curcuma amada* Roxb.	Amada, Faliya	*Zingiberaceae*	All over Bangladesh
32.	*Curcuma aromatica* Salisb. (*C. zeodaria* Roxb.)	Ban Haldi, Jangli Haldi	*Zingiberaceae*	All over Bangladesh
33.	*Curcuma zedoaria* Rosc.	Shathi, Ekangi, Phaulga, Kachuri	*Zingiberaceae*	All over Bangladesh
34,	*Datura innoxia* Mill. (*D. metel* (L.) Sims.	Dhutra	*Solanceae*	All over Bangladesh
35.	*Datura stramonium* L.	Dhutra	*Solanaceae*	All over Bangladesh
36.	*Eclipta alba* (L.) Hassk.	Kesuti, Kesaraj, Keoti, Kalo Keshi, Bhangra,	*Asteraceae*	All over Bangladesh
37.	*Eclipta erecta* L. (*E. prostata* L.)	Bhimraj	*Asteraceae*	All over Bangladesh
38.	*Eupatorium odoratum* L.	Assam Lata, Bara Shialmuti, German Lata, Pishab	*Asteraceae*	All over Bangladesh
39.	*Euphorbia antiquorum* L.	Tesra Mansha, Nerasij, Sibgach, Tiktasij, Bajbaran	*Euphorbiaceae*	All over Bangladesh
40.	*Eupatorium ayapana* Vent.	Ayapan	*Asteraceae*	All over Bangladesh
41.	*Ficus hispida* L.	Kak Dumur, Dumur, Dhungri, Thoska	*Moraceae*	All over Bangladesh
42.	*Heliotropium indicum* L.	Hati Sur, Hatisud	*Boraginaceae*	All over Bangladesh
43.	*Hemidesmus indicus* R. Br.	Anantamul	*Asclepiadaceae*	Mymensirgh, Sundarbans, Sylhet
44.	*Holarrhena antidysenterica* (Heyne ex Roth.) Wall.	Kurchi, Kuteswar, Kuruz, Kuruchi, Indrejab, Grimallika, Kutuz	*Apocynaceae*	Dhaka, Chittagong, Chittagong Hill Tracts, Mymensingh, Sylhet, Dinajpur
45.	*Hydnocarpus kurzii* (King) Warb. (*Teraktogenes kurzii* King)	Chaulmoogra, Bolgach, Hiddigach	*Flacourtiaceae*	Chittagong, Chittagong Hill Tracts
46.	*Hydrocotyle asiatica* L.	Thankuni, Thulkuri, Brahmanbuti	*Umbellifereae*	All over Bangladesh
47.	*Ipomea digitata* L.	?	*Convolvulaceae*	All over Bangladesh
48.	*Ipomea hederacea* Jacq. (*I. nil* Meissn)	Nil Kalmi	*Convolvulaceae*	All over Bangladesh
49.	*Ipomea turpethum* (L.) R. Br.	Noapata, Tori, Cheuri, Dudh Kalmi	*Convolvulaceae*	All over Bangladesh
50.	*Ixora coccinia* L.	Rangan (Lal), Rajana	*Rubiaceae*	All over Bangladesh
51.	*Jasminum sambac* (L.) Ait.	Beli, BanaMallika, Malshi, Mogra	*Oleaceae*	All over Bangladesh
52.	*Jatropha curcas* L.	Baghverenda, Banbherenda	*Euphorbiaceae*	All over Bangladesh
53.	*Jatropha gossypifolia* Roxb.	Lalbherenda, Nikunta	*Euphorbiaceae*	All over Bangladesh
54.	*Lawsonia inermis* L. (*L. alba* Lamk.)	Mendi, Mehedi, Hena, Sudi	*Lythraceae*	All over Bangladesh

Sl. No.	Species name	Local name	Family	Location
55.	*Leucas aspera* (Willd.) Spreng	Dulfi, Dandakalash, Swetadrone	*Labiateae*	All over Bangladesh
56.	*Mollotus philipinensis* Muell. Arg	Kamela, Sindur	*Euphorbiaceae*	Sylhet, Chittagong, Chittagong Hill Tracts, Dinajpur, Dhaka, Myemsnsingh
57.	*Mentha spicata* L. (*M. viridis* L.)	Pudina	*Labiateae*	All over Bangladesh
58.	*Mimosa pudica* L.	Lajjabati, Lajak	*Leguminaseae (Mimosae)*	All over Bangladesh
59.	*Mirabilis jalapa* L.	Sandha Malati, Sandhamoni, Krishnakoli	*Nyctaginaceae*	All over Bangladesh
60.	*Moringa oleifera* Lam.	Sajina, Sanja	*Moringaceae*	All over Bangladesh
61.	*Nelumbo nucifera* Gaertn. (*Nelumbium speciosum* Willd.)	Padma, Raktapadma	*Nymphaeaceae*	All over Bangladesh
62.	*Nerium indicum* Mill. (N. odorum (Ait.) Soland)	Karabi, Rakta Karabi	*Apocynaceae*	All over Bangladesh
63.	*Nyctanthes arbor*-tristis L.	Seuli, Shephalika, Singhra, Harshinghra, Shefali	*Oleaceae*	All over Bangladesh
64.	*Ocimum sanctum* L.	Kalo Tulsi, Tulsi	*Labiateae*	All over Bangladesh
65.	*Ocimum basilicum* L.	Babui Tulsi, Dulal Tulsi, Sada Tulshi, Sabja	*Labiateae*	All over Bangladesh
66.	*Opuntia dillenii* Haw.	Phani Mansha, Nagkana, Nagphana, Bidar	*Cactaceae*	All over Bangladesh
67.	*Phyllanthus emblica* L. (*Emblica officinalis* Gaertn,)	Amlaki, Amla, Aula	*Euphorbiaceae*	Chittagong, Chittagong Hill Tracts, Mymensingh, Dinajpur
68.	*Piper longum* L.	Pipla, Pipul	*Piperaceae*	Chittagong, Chittagong Hill Tracts, Mymensingh, Dinajpur, mostly in Sylhet
69.	*Plumbago indica* L. (*P. rosea* L.)	Raktachita,RaktachitraAgnichita, Lalchita,	*Plumbaginaceae*	All over Bangladesh
70.	*Plumbago zeylanica* L.	Chita, Chitra, Chitrak	*Plumbaginaceae*	All over Bangladesh
71.	*Portulaca oleracea* L.	Bara Laniya, Bara Nunia	*Portulacaceae*	All over Bangladesh
72.	*Randia dumetorum* Lamk.	Mankanta, Manphal, Mainkanta, Belong, Mainphal, Pendel	*Rubiaceae*	Chittagong, Sylhet, Mymensingh
73.	*Rauwolfia serpentina* Benth	Sarpagandha, Chhota Chadar, Chhota Chand	*Apocynaceae*	Chittagong, Sylhet, Mymensingh
74.	*Rauwolfia canescens* L.	Bara Chadar	*Apocynaceae*	Chittagong, Sylhet, Mymensingh
75.	*Ricinus communis* L.	Venna, Bherenda, Reri, Gab Bherenda	*Euphorbiaceae*	All over Bangladesh
76.	*Sapindus trifoliatus* L.	Bara Ritha	*Sapindaceae*	Chittagong
77.	*Saraca indica* L.	Ashoke	*Leguminoseae*	Chittagong, Chittagong Hill Tracts
78.	*Sida acuta* Burm.	Kureta, Urisia	*Malvaceae*	All over Bangladesh
79.	*Sida cordifolia* L.	Berela, Bola Kureta	*Malvaceae*	All over Bangladesh
80.	*Smilax macrophylla* Roxb.	Bulkumia, Kumari Lata, Bara Kumari Lata, Kamarika Muktajhuri	*Liliaceae*	All over Bangladesh

Sl. No.	Species name	Local name	Family	Location
81.	*Solanum nigrum* L.	Kakmachi, Gurkamai, Phuti Begun	*Solanaceae*	All over Bangladesh
82.	*Solanum xanthocarpum* Schrad. & Wend.	Kantakini, Kantakiri	*Solanaceae*	All over Bangladesh
83.	*Streblus asper* Lour	Ash sheora, Harbi, Khirnasta, Harbon, Hekra	*Urticaceae (Moraceae)*	All over Bangladesh
84.	*Tephrosia purpurea* Pers.	Bannil, Lohamori, Sarpunkha	*Leguminaseae*	Dhaka, Chittagong, Sylhet, Mymensingh
85.	*Tinospora cordifolia* (Willd.) Hook f	Gulancha	*Menispermaceae*	Dhaka, Chittagong, Sylhet, Mymensingh
86.	*Tylophora indica* (Burm. f.) Merr. (*T. asthmatica* Wt. & Arn.)	Anantamul	*Asclepiadaceae*	Dhaka, Chittagong
87.	*Vitex negundo* L.	Nishinda, Bara Nishinda, Sabdbhalu, Nigunda, Samalu	*Verbenaceae*	All over Bangladesh
88.	*Vitex peduncularis*	Harina, Arsol, Baruna, Goda	*Verbenaceae*	Dhaka, Chittagong
89.	*Vitis quadrangularis* Wall	Harbhanga Lata, Harjora, Marmaria Lata	*Vitaceae*	All over Bangladesh
90.	*Woodfordia floribunda* Salis.	Dhaiphul, Dhain, Urisia	*Lythraceae*	Chittagong, Hill Tracts
91.	*Xanthium indicum* Koenig	Ghagra, Lehra	*Asteraceae*	All over Bangladesh
	(*Xanthium strumarium* L.)	Chhota Ghagra, Bichaphal, Banokra, Khagra	*Asteraceae*	All over Bangladesh

APPENDIX 4

Crop plants and their wild relatives allied species available in Bangladesh

Sl. No.	Species name	Local name	Family	Location
1.	*Abroma augusta* L.	Ulatkambal	*Sterculiaceae*	All over the country
2.	*Abelmoschus esculentus* W & A.(*Hibiscus esculentus* L.)	Bhindi, Dheras, Okra	*Malvaceae*	All over the country
3.	*Abrus precatorius* L..	Kunch, Rati, Chanyi, Kaich, Gungchi, Gujna	*Leguminosae*	Dhaka, Chittagong, Chittagong Hill Tracts, Mymensingh,Sylhet
4.	*Abutilon indicum* (L.) (Sweet.) G. Don	Petari, Jhampi, Jhumka	*Malvaceae*	All over the country\
5.	*Acalypha indica* L.	Muktajhuri, Biral hatchi, Swetbasanta	*Euphorbiaceae*	All over the country
6.	*Achyranthes aspera* L.	Apang, Upatlangra	*Amaranthaceae*	All over the country
7.	*Acorus calamus* L.	Bach, Gharbach, Swetbach	*Araceae*	All over the country, especially in low lying areas of Dinajpur
8.	*Adhatoda vasica* Nees.	Basak, Bakas, Adulsa	*Acanthaceae*	All over the country, especially in low lying areas of Dinajpur
9.	*Aegle marmelos* (L.) Correa	Bel	*Rutaceae*	All over the country, especially in low lying areas of Dinajpur
10.	*Agati grandiflora* Desv. (*Sesbania grandiflora* (L.) Pers.)	Bakphul, Agasta, Buko, Bak, Agati	*Leguminasae*	All over the country, especially in low lying areas of Dinajpur
11.	*Alangium salvifolium* Thw.	Baghankura, Dhalakura	*Alangiaceae*	All over the country, especially in low lying areas of Dinajpur
12.	*Aloe vera* Tawin. (*A. barbadensis* Mill.)	Ghritakanchan, Gheekachu, Ghritakumari, Musabbar	*Agavaceae*	All over the country, especially in low lying areas of Dinajpur
13.	*Amaranthus spinosus* Willd.	Kanta Notey, Kanta Denga, Katamiris	*Amaranthaceae*	All over the country, especially in low lying areas of Dinajpur
14.	*Andrographis paniculata* (Burm f.) Wall ex Nees	Kalomegh, Mahatita	*Acanthaceae*	Dinajpur, Chittagong, Chittagong Hill Tracts
15.	*Cymbopogon citratus* (DC) Stapf	Lemonghas, Gandhatrina	*Gramineae*	All over Bangladesh
16.	*Annona squamosa* L.	Ata, Sharifa, Sitaphal, Luna	*Annonaceae*	All over Bangladesh
17.	*Argemone mexicana* L.	Shial Kanta, Bara Shial Kanta, Kengrabiji	*Papavaraceae*	All over Bangladesh
18.	*Aristolochia indica* L.	Iswarar Mul	*Aristolochiaceae*	All over Bangladesh, especially in Chittagong, Hill Tracts
19.	*Asparagus racemosus* Willd	Shata Muli, Hilum	*Liliaceae*	Madhupur, Sylhet, Chittagong
20.	*Boerhaavia repens* L. (*B. diffusa* L.)	Punarnava, Gandhapurna, Swetpurna	*Nyctaginaceae*	Dhaka, Mymensingh, Chittagong, Dinajpur
21.	*Bryophyllum calycinum* Salisb.	Patharkuchi, Patiapuri, Kafpata	*Crassulaceae*	All over Bangladesh
22.	*Caesalpinia crista* L. (*C. nuga* L.)	Let Kanta	*Leguminosae*	All over Bangladesh, Chittagong, Hill tracts, and estuarine areas
23.	*Calophyllum inophyllum* L.	Sultan Champa, Punnag, Kannyal, Nag Champa, Gulab, Kath Champa, Panial	*Guttifereae*	Along the sea shore and inland in Barisal district
24.	*Calotropis gigantea* R. Br.	Bara Akand, Gur Akand	*Asclepiadaceae*	All over Bangladesh
25.	*Canna orientalis* Rosc.(*C. indica* L.)	Sarbajaya, Phena	*Cannaceae*	All over Bangladesh
26.	*Canscora decussata* (Roxb.) Roem & Schultz	Daukuni	*Gentianaceae*	All over Bangladesh
27.	*Cassia alata* L.	Dad Mardan, Dadmari	*Leguminseae*	All over Bangladesh
28.	*Clerodendrum viscosum* Gaertn.	Bhant, Ghetu, Ghetuphul	*Verbenaceae*	All over Bangladesh
29.	*Clitoria ternatea* L.	Aparajita, Nila Aparajita	*Leguminosae*	All over Bangladesh

Family	Crop	Allied species	Local name	Status
Camelliaceae (contd.)		Hybrids (involving *assamica, sinensis, combodiensis*)		Cultivated
		C. caudata		Cultivated
		C. japonica		Cultivated
		Camellia kissi		Cultivated
		C. irrawadiensis		Cultivated
		C. sesanquc		Cultivated
		Thea wallichi		Wild
Cannaceae	Indian Shot	*Canna indica L.*	Sarbajaya	Cultivated/ Wild
Caricaceae	Papaya	*Carica papaya L.*	Pepe	Cultivated
Chenopodiaceae	Beet	*Beta vulgaris L.*	Beet, Beet Palong	Cultivated
	Quinoa	*Chenopodium album L.*	Betosok, Batua Shak	Wild/ Cultivated
		C. ambrosioides L.	Chandan Beto	Wild?
	Spinach	*Spinacea oleracea* L.	Palong, Palong Shak	Cultivated
Convolvulaceae	Sweet potato	*Ipomoea batatus* Lamk.	Misti Alu	Cultivated
	and allies			
		I. alba L.(*I. bonanox* L.)	Halkalmi,Dudh Kalmi	Wild
		I. aquatuca Forsk. (*I. reptans* Poir)	Kalmishak, Kalmi	Wild
		I. pescaprae (L.) R. Br. (*I. biloba* Forsk.)	Chgalkuri, Dupati Lata	Wild
		I. cairica (L.) Sweet	Rail Lata	Wild
		I. fistulosa Mart. ex Choisy (*I. crassicaulis* (Benth) Roxb)	Dholkalmi, Ddaru Kalmi, Policelat	Wild
		I. hederacea Jacq. (*I. nil* Meissn.)	Nil Kalmi	Wild
		I. indica (Burm. f. Merr. (*I. learil* Lam.)	Pravatrani	Wild
		I. mauritiana Jacq. (*I. paniculata* (L.) Br.)	Bhuikumra, Muralia Lata	Wild
		I. maxima (L. f.) Don (*I. sepiaria* Koen. ex Roxb.)	Bankalmi	Wild
		I. pestigridis L.	Languli Lata,	Wild
		I. quamoclit L. (*Quamoclit pinnata* Boj.)	Taru Lata, Kunja Lata Kamla Lata, Gote Lata	Wild/ Cultivated
		I. turpethum (L.) R. Br.	Noa Pata, Tori, Cheuri	
		I. vitifolia Bl.	Karma Lata, Kam Lata	
Crucifereae	White Mustard	*Brassica alba* Hook.	Sadasarisha, Dhuprai	Cultivated
	Mustard	*B. campestris* L. var. sarsoon Prain	Sarisha	Cultivated
	Mustard	*B. campestris* L.var . toria Duthie & Fuller	Tori, Sarisha	Cultivated
		B. integrifolia (West.) Schultz.*(B. juncea var. agrostis* Prain)	Keel Rai	Cultivated
	Brown Mustard	*B. juncea* L.	Rai Sarisha, Bara Rai, Jhuni, Chanchi	Cultivated

Family	Crop	Allied species	Local name	Status
	Rapeseed	*B. napus* L.	Maghi, Tori, Sarisha	Cultivated
	Black Mustard	*B. nigra* (L.) Koch.	Kalo Sarisha	Cultivated
	Cauliflower	*B. oleracea* L. var. botrydis	Phul Kopi	Cultivated
	Broccoli	*B. olerecea* L. var. italica	Brocoli	Cultivated
		B. rapa L.	Shalgam	Cultivated
		B. rugusa Prain *var. cunefolia*	Lahisag	Wild/ Cultivated
	Garden Cress	*Lepidium sativum* L.	Halim, Halim Shak	Wild/ Cultivated
	Radish	*Raphanus satiivus* L.	Mula	Cultivated
Cucurbitaceae	Wax Gourd	*Benincasa hispida* L. (Thunb.) Cogn.(*B. cerifera* Savi.)	Chal Kumra	Cultivated
	Coccinia	*Coccinia indica* L	Telakucha, Kakjhinga	Wild ..
	Melon	*Cucumis melo* L.	Bangi, Kakri, Kharbuj, Khermia	Cultivated
	Cucumber	*Cucumis sativus* L.	Khira, Shasha, Mome	Cultivated
	Sweet Gourd	*Cucurbita maxima* Duch.	Kumra, Misti Kumra	Cultivated
	Squash	*Cucurbita moschata* Duch.	Safra Kumra	Cultivated
	Squash	*Cucurbita pepo* DC	Dhada Kadu, Kumra, Khetpapra	Cultivated
	Colocynth	*Citrullus colocynthis* (L.) Schrad.	Makal. Indrayan	Wild
	Watermelon	*Citrullus lanatus* (Thunb.) Mans. (*C. vulgaris* Schrad.)	Tarmuj	Cultivated
	Hodgsonia	*Hodgsonia macrocarpa* (Bl.) Cogn. (*H. heteroclita* HK. f.)	Makal	Wild
	Bottle Gourd	*Lagenaria siceraria* (Mol.) Stan. (*L. vulgaris* Ser.)	Lau, Kadu, Pani Lau	Cultivated
	Ribbed gourd	*Luffa acutangula* Roxb.	Jhinga, Ghosa Lata	Cultivated
		L. amara Roxb.	Tita Dhundul	Wild
		L. echinata Roxb.	Bidal, Ghosa Lata	Wild
	Sponge Gourd	*L. cylindrica* (L.) Roem (*L. aegyptiaca* Mill.)	Dhundul, Purul, Totpola	Wild/ Cultivated
	Bitter Gourd	*Momordica charantia* L	Korola, Kerala Karola	Cultivated
		M. cochichinensis Spreng.	Kakrol	Cultivated
	Teasle Gourd	*Momordica dioica* Roxb.	Kakrol	
	Snake Gourd	*Trichosanthes anguina* L.	Chichinga	Cultivated
	Trichosanthes	*Trichosanthes bracteata* (Lam.) Voigt.	Makal	Wild
		T. cordata Roxb.	Bhui kakra	Wild
		T. cucumerina L.	Ban Patol, Ban Chichinga	Wild
		T. dioica Roxb.	Patol	Cultivated
		T. lobata Roxb.	Ban Chichinga	Wild
		T. palmata Roxb.	Makal	Wild
Dioscoreaceae	Yams and allies	*Dioscorea belophylla* (Prain) Haines	Shora Alu	Wild/ Cultivated
	Aerial yam	*D. bulbifera* L. (*D. sativa* Thunb.)	Roth Alu	Wild/ Cultivated
	Lesser yam	*D. esculenta* (Lour.) Burk. (*D. aculeata* (Lour) Burk)	Sushni Alu, Mou Alu	Cultivated
		D. pentaphylla L.	Jhum Alu, Jhunihana Alu	Wild/ Cultivated

Family	Crop	Allied species	Local name	Status
		D. pubera Bl.(D. aguina Roxb.)	Kukur Alu, Kaku Alu	Wld/ Cultivated
		D. wallichi Hook	Goantia Alu	Widl/ Cultivated
Euphorbiaceae	Tung	*Aleurites molluccana* Willd.	Japhal Akhrot	Cultivated
	Cassava	*Manihot esculenta* Crantz. (*M. ultissima* Pohl.)	Shimul Alu, Kasava, Tapoica	Cultivated
	Castor	*Ricinus comminis* L.	Reri, Bheranda, Venna	Wild/ Cultivated
Gramineae	Adlay,	*Coix gigantica* Roxb.	Denga Gurgur	Wild
	Job's Tears	*C. lachryma-jobi* L.	Tasbi, Gurgur, Gurguri, Kalo kunch, Kawoa kathi	Wild
	Japanese millet	*Echinocloa colonum* (L.) Link	Shyama Ghas	Wild
	BarnYard millet	*E. crussgalli* (L.) P. Beauv.	Bara Shyama Ghas	Wild
		E. stagnina (Retz.) P. Beauv.	Dul, Parua	Wild
	Finger millet	*Eleusine coracana* (L.) Gaertn.	Marna, Marua	Wild?
Gramineae (contd.)	Fowl-foot grass	*Eleusine indica* (L.) Gaertn.	Malanga Kuri, Malan Kuri	Wild
	Teff	*Eragrostis tenella* (L.) P. Beauv.	Koni	Cultivated
	Barley	*Hordeum vulgare* L	Jab	Cultivated
	Bulrush millet	*Pennisetum typhoides* (Burm) Stap f.(*P. typhoidum*)	Bajra	Cultivated
	Pearl Millet	*Panicum milliaceum* L.	Cheena	Cultivated
	Foxtail millet	*Setaria italica* (L.) *P. Beauv.*	Kaon, Kangu, Kangui, Kora, Kaknidana, Shyamdhat	Cultivated
	Foxtail millet allies	*S. glauca* (L.) *P.Beauv.* (*Panicum flavescens* Sw.)	Kauni, Banaspati Ghash	Wild
		S. pallide-fusca (Schum) Stapf.	Pinginatchi	Wild
		S. verticillata (L.) *P.Beauv.*	Dorabiari	
	Barley	*Hordeum vulgare* L.	Jab, Barley	Cultivated
	Rice	*Oryza sativa* L.	Dhan, Chaul	Cultivated
	Rice allies	*O. minuta*	Buno Dhan	Wild
		O. nivara	Buno Dhan	Wild
		O. officinalis	Buno Dhan	Wild
		O. rufipogon Griff. (*O. fatua* Koen. ex Trin.)	Buno Dhan. Jhara Dhan	Wild
		Porteresia coarctata (*Oryza coarctata* Roxb.)	Harkata	Widl/ Cultivated
		Oryza hybrid Swarm: (*rufipogon/nivara*)	-	Wild
	Sugarcane	*S. officinarum* L.	Aakh, Kushur, Kushail, Gendari	Cultivated
	Sugarcane allies	*Saccharum bengalense* Retz. (*S. munja* Roxb.)	Munja Ghas	Wild
		Sclerostachya fusca (Roxb.) Camus (*Sacharum fuscum* Roxb.)	Khuri	Wild
		S. spontaneum L.	Kash, Kaicha, Khag, Khagra, Kaisha	Wild

Family	Crop	Allied species	Local name	Status
	Sorghum	*Sorghum bicolor* (*S. vulgare* Pers.)	Joar	Cultivated
	Johnson's grass	*S. halepense* (L.) Pers.	Kanta Much	Cultivated
	Triticale	*Tritico secale*	Triticale	Cultivated
	Wheat	*Triticum aestivum* L. (*T. vulgare* L.)	Gom	Cultivated
	Maize	*Zea mays* L.	Bhutta	Cultivated
	Bermuda grass	*Cynodon dactylon* (Pers.)	Durba, Bubla,Durba Ghas	Wild
	Other Grasses	*Panicum flavescens* Sw.	Bashpati Ghas	Wild
		P. paludosum Roxb.	Barti, Barati, Kalam	Wild
		P. punctatum Burm.	Karing Ghas	Wild
		P. satigerum Retz.	Bara Jalgenti	Wild
		Paspalidium flavidum (Retz.) *A. camus*	Bolai Mandi, Karing Ghas	Wild
		Paspalidium punctatum Burm. *A. camus* (*Panicum punctatum* Burm)	Petinar	Wild
	Kodo millet	*Paspalum scrobiculatum* Boj	Goicha, Khoda Dhan	Wild
Guttifereae	Mangosteen	*G. mangostana* L.	Mangostin	Cultivated
	Garcinia	*Garcinia cowa* Roxb.	Kau, Kaglichu	
		G. morella Desr.	Swarna Khiri	
		G. xanthochymus Hook. f.	Tamal, Dambel	
Leguminaseae	Wattle	*Acacia nilotica* (L.) Del. (*A. arabica* (Lam.) Willd.)	Babla, Kikor	Wild/ Cultivated
		A. catechu Willd.	Khair, Katha, Khadira, Khair babul	Cultivated
		A. catechuoides Wall.	Khair	Cultivated
		A. concinna DC.	Banritha, Lat babul, Kuchui	Wild/ Cultivated
		A. farnesiana (L.) Willd.	Gokul, Belati Babul	Wild/ Cultivated
		A. intsia Willd.	Kuchai	Wild
		A. monoliformis Griseb.	Akashmoni, Sonajhuri	Wild/ Cultivated
		A. pennata (L.) Willd.	Aila, Bisoal, Sembi	Wild
		A. suma Ham	Sami, Sankata, Laingach, Chaikanta, Saukanta	Wild
		A. tomentosa Willd.	Salsai Babla	Wild/ Cultivated
	Groundnut	*Arachis hypogea* L.	Cheen Badam	Cultivated
	Pigeon pea	*Cajanus cajan* (L.) Huth. (*C. indicus* Spreng)	Arhar, Arhar Dal	Cultivated
	Chickpea	*Cicer arietinum* L.	Chola, Chana, Boot	Cultivated
	Sunnhemp	*Crotalaria juncea* L.	Shon Pat, Shon, Ghore Shon	Cultivated
	Sunnhemp allies	*C. incana* L.	Chhoto Jhunjhuna	Wild

Family	Crop	Allied species	Local name	Status
		C. prostrata Roxb.	Chhoto Jhunjhuna	Wild
		C. retusa L.	Atasi, Bil Jhanjhana	Wild
		C. saltiana Andr.	Chhoto Jhunjhuna, Jhanjhani	Wild
		C. spectabilis Roth (*C. sericea* Retz.)	Pipli Jhanjhani	Wild
		C. verrucosa L.	Jhanjhania	Wild
	Derris and allies	*Deris elliptica* Benth.	Tubamul	Wild
		D. indica (Lamk.) Benth.	Makrigilla	Wild
		D. robusta Benth.	Koroi, Jangaria, Jumurja, Miringa,Jamruja	Wild/ Ciultivated
		D. scandens Benth.	Noa lata, Kamiria lata, Maora gota, Noshoth	Wild
		D. trifolia Lour. (*D. uliginosa* Benth.)	Kali Lata Felia Lata, Pan Lata, Pan Gota, Gila lata, Goali Lata	Wild
	Soybean	*Glycine max* (L.) Merr. (*G. soja* (L.) Swieb. & Zuce)	Soybean, Gari Kalai	Cultivated
	Indigo	*Indigofera linifolia* Retz.	Bhangara	Wild
		I. tinctoria L.	Nil	Wild
Leguminaseae	Lentil	*Lens culinaris* Medik. (*L. esculenta* Moen.)	Musur, Musuri Dal	Cultivated
		Medicago denticulata Willd.	Moyna	Wild
	Yam Bean	*Pachyrrhizus erosus* (L.) Urban	Shak Alu	Wild/ Cultivated
	Beans	*Phaseolus acontifolius* Jacq.	Ban moog, Gaheri, Birimoog	Cultivated
		P. adenanthus Mey.	Ban Barbati	Wild
		P. sublobatus Roxb. *Vigna sublobatus*)	Ghora Moog	Wild
		P. trilobatus (*Vigna trilobatus*)	Rakhal Kalai, Magani, Mugani	Wild
		P. vulgaris (L.) Schr.	Bakla, Faras Bean, Kalo Basak	Wild
		Pisum arvense L.	Chhto Motor	Wild
	Pea	*P. sativum* L.	Motor, Kabuli Motor	Cultivated
	Winged Bean	*Psophocarpus tetragonolobus* DC.	Pakhal Sim, Kunari Sim, Karat Sim	Wild/ Cultivated
	Tamarind	*Tamarindus indica* L.	Tetul, Amli	Wild/ Cultivated
	Field Bean	*Vicia faba* L.	Bara Sim, Bakla Sim	Cultivated
		V. hirsuta Coch.	Masur Chana	Cultivated
		V. sativa L.	Ankari	Wild/ Cultivated
		Vigna catjang Walp. *var. sinensis*	Lalsha, Barbati	Cultivated
	Blackgram	*V. mungo* (L.) Hepper (*Phaseolus. mungo* L.)	Mashkalai. Tikhakalai	Cultivated
		V. pilosa Bak.	Jhikrai, Malkenia	Wild/ Cultivated
	Mungbean	*V. radiata* (L.) Wilezck (*P. radiatus* L.)	Sona Moog, Moog, Hani Moog	Cultivated
		V. sinensis Endl. ex Hassk (*V. catjang* Walp *var. sinensis Prain*)	Barbati, Lalsha	Cultivated
	Cowpea	*V. unguiculata* Endl. ex Hassk	Barbati	Cultivated

Family	Crop	Allied species	Local name	Status
Liliaceae	Onion	*A. cepa* L.	Piaz	Cultivated
	Garlic	*A. sativum* L.	Rasun	Cultivated
	Asparagus	*Asparagu racemosus* L.	Satamuli, Hilum	Cultivated
Linaceae	Flax/Linseed	*Linum usitatissimum* L.	Tishi, Chikna, Masina	Cultivated
Malvaceae	Okra	*Abelmoschus esculentus* (L.) Moen. (*Hibiscus esculentus* L)	Dheras, Bhindi,	Cultivated
	Tree cotton	*Gossypium arboreum var. conansis* L.	Kapas, Karpas	Cultivated
	Comilla Cotton	*G. arboreum/herbaceum* L.	Tula	Cultivated
	Khaki cotton	*G. arboreum/herbaceum* L	Khaki Tula	Cultivated
		Hibiscus abelmoschus L.	Mushak Dana, Kalo Kasturi	Cultivated
	Kenaf	*H. cannabinus* L.	Kenaf, Mesta pat, Bimli	Cultivated
		H. ficulenus L.	Jangli Bhindi, Jangli Dheras, Ban Dheras	Wild
		H. hirtus L.	Lal Surjamukhi	Wild/ Cultivated
		H. macrophyllus Roxb.	Kashipala, Kashiaudal, Chania	Wild/ Cultivated
		H. manihot L.	Gajasuddhi, Dumbula, Paresh, Palas Pipul, Paresh Pipul	Wild/ Cultivated
	China rose	*H. rosa-sinensis* L.	Joba, Jaba Phul, Rakta Jaba, Daru	Cultivated
	China rose	*H. schizopetalus* L.	Jhumko Joba, Latkan Joba	Cultivated
	Roselle	*H. subdariffa* L. *var. altissima*	Mesta Pat, Kenaf, Mesta	Cultivated
	Roselle	*H. sabdariffa* L. *var. subdariffa*	Chukair, Chukur	Cultivated
		H. syriacus L.	Sada joba, Nil Joba	Cultivated
		H. tiliaceus L.	Bolai, Bhola, Belapata, Chewla	Wild
		H. vitifolius L.	Ban Karpas	Wild
Marantaceae	Arrrowroot	*Maranta arundinacea* L.	Araroot, Takhur	
Moraceae	Jackfruit	*Artocarpus heterophylluys* Lamk. *(A. integrifolia L. f.)*	Kanthal	Cultivated
	Chaplash	A. chaplasha Roxb.	Chaplash, Chambal, Cham	Cultivated
		A. lakucha Buch- Ham (*A. lakoocha* Roxb.)	Deua, Deo Phal, Dephal, Deo Cham, Barta, Dalo Dalo Madar	Wild/ Cultivated
	Hemp	*Cannabis sativa* L. (*C. indica* Lamk.)	Siddhi, Bhang, Kef, Ganja	Wild/ Cultivated
	Ficus & allies	*Ficus altissima* Bl.	Bot, Prab	Wid
		F. benghalensis L. *var. krishnae* (C. DC.) Corner (*F. krishnae* C. DC.)	Krishna Bot	Wild
		F. comosa (*F. bejamina* L.) (Roxb.) Kurtz	Pakur, Jir, Kamruo	Wild
	Ficus and allies	*F. carica* L	Dumur Anjir	Wild
		F. cunea Buch.-Ham.	Jaga Dumur, Sadimadi, Joya Dumur	Wild
		F. elastica Roxb.	Bor, Ata Bor, Bharatio Rubber	Wild
		F. glaberrima Bl.	Kakri	Wild
		F. glomerata Roxb.	Jaga Dumur, Gulang Dumir	Wild

Family	Crop	Allied species	Local name	Status
		F. hederaceae Roxb. (*F. scandes* Roxb.)	Dumur, arkath	Wild
		F. heterophylla L. *f. var. heterophylla* L.	Ghati Shaora, Bala Dumur,Balam Dumur, Bolalat	Wild
		F. heterophylla L. *f. var. repens*	Bhui Dumur	Wild
		F. hispida L. f.	Kak Dumur, Dhungri	Wild
		F. hirta Vahl	Dangra, Khanda Dumur, Pakur, Khuska Dumur	Wild
		F. infectoria Roxb.	Pakur	Wild
		F. krisnnae C. DC	Krishna Bot	Cultivated
		F. lacor Buch.-Ham. (*F. infectoria* Roxb.)	Pakur	Wild
		F. lanecolata Ham	Buti Dumur, Eri Gachh	Wild
		F. lepidosa Wall.	Katgularia, Jir, Kamrup	
		F. nervosa Roth	Batrella	Wild
		F. racemosa L. (*F. glomerata* Roxb.)	Jaga Dumur, Gulang Dumur	Wild
		F. religiosa L.	Asswath, Pipal, Pan Bot	Wild
		F. rostrata Lamk.	Paraboha	
		F. rumphil Bl.	Hijulia, Gaya Asswath	Wild
		F. semicordata Buch.-Ham. ex Smith (*F. cunea* Buch.-Ham. ex Roxb.)	Jaga Dumur, Sadimasi	Wild
	Mulberry	*Morus indica* L. (*M. alba* L.)	Tut, Tunt	Cultivated
Musaceae	Bananas	*Musa ornata* Roxb.	Ram Kola, Bamanigi Kola	Cultivated
		M. paradisiaca L. *var. paradisiaca*	Kach Kola	Cultivated
		M. paradisiaca L. *var. sapientum*	Kola, Kathali Kola	Cultivated
		M. sapeentum L. *var sylvestris*	Aitta Kola, Aite Kola	Cultivated
Myristicaceae	Nutmeg and allies	*Myristica fragrans* Houtt	Jaiphal, Jayatri	Wild/ Cultivated
		M. longifolia Wall.	Amboala	Wild/ Cultivated
		M. malabarica Lamk.	Jayatri	Wild/ Cultivated
Myrtaceae	Clove and allies	*Eugenia aquea* Burm. f.	Jambo	Wild
		E. balsamea Wt.	Ekdarya	Wild/ Cultivated
		E. bracteata Roxb.	Hijli Menadi	Wild/ Cultivated
		E. claviflora Roxb.	Nali Jam, Lamba Nali Jam	Cultivated
		E. cymosa Ram.	Khoir Jam	Wild/ Cultivated
		E. formosa Wall.	Phul Jam	Wild/ Cultivated
		E. lancaefolia Roxb.	Para Jam	Wild/ Cultivated
		E. macrocarpa Roxb.	Chalta Jam	Cultivated
		E. operculata Roxb.	Boti Jam, Thenga Jam, Patia Jam, Dhepu Jam	Wild/ Cultivated

Family	Crop	Allied species	Local name	Status
		E. wallichi Wt.	Kharkhara Jam	Wild/ Cultivated
	Guava	*Psidium guajava* (L.) Bat. (*P. guayava* L.)	Peyara, Gaya, Sabri	Cultivated
		Syzygium cumuni (L.) Skeel (*E. jambolana* Lam.)	Jam, Jaman, Kalo jam	Cultivated
		S. jambos L.	Golap Jam	Cultivated
Oxalidaceae	Oxalis	*Oxalis corniculata* L.	Amrul, Amboli, Chukatripati	Cultivated
Palmae	Betel Nut	*Arecha catechu* L.	Supari, Gua	Cultivated
		A. triandra Roxb.	Ban Gua, Ban Supari	Wild
	Palmyra Palm	*Borassus flabellifer* L.	Tal	Wild/ Cultivated
	Coconut	*Cocos nucifera* L.	Narikel, Dab	
	Oilplalm	*Elaeis guineensis* Jacq.	Palm Tal	Cultivated
	Date Palm and allies	*Phoenix sylvestris* (L.) Roxb.	Khajur, Khejur, Khagi Khejur	Cultivated
		Ph. caerulea	Jhumko	
	Date Palm	*Ph. dactylifera* L.	Arabi Khejur Pindi Khejur	Cultivated
		Ph. paludodsa Roxb.	Hintal, Hital, Hantal	
Pedaliacveae	Sesame	*Sesamum indicum* L. (*S. orientele* L.)	Til, Jangli Til, Sanki Til, Kalo Til	Cultivated
Piperaceae	Piper	*Piper betel* L.	Pan, Tambuli	Cultivated
		P. chaba Hunter	Choi, Chab	Wild
		P. cubeba Vahl	Kababchini	Wild
		P. longum L.	Pepul, Pipla	Wild
		P. nigrum L.	Gol Marich	Cultivated
		P. peepuloides Roxb.	Pepul	Wild
Polygonaceae	Buckwheat	*Fagopyrum esculentum* Moen.	Dhanchi	Cultivated
Puniaceae	Pomegranate	*Punica granatum* L.	Dalim, Anar	
Rhamnaceae	Jujuba and allies	*Zizyphus mauritania* Lamk,	Kul, Boroi,	Cultivated
		Z. oenoplea (L.)	Ban Boroi, Gram Boroi, Shea Kul, Got Boroi	Wild
		Z. rugosa Lamk	Anai, Jangli Boroi	Wild
Rosaceae	Berries	*Rubus tinctorium* L	Manjistha	Wild/ Cultivated
		Rubus hexagynus Roxb.	Hira Chhara, Hira Chura	Wild/ Cultivated
	Quinine	*Cinchona officinalis* L.	Cinchona, Quinine	Cultivated
	Coffees	*Coffea arabica*. L	Kafi	Cultivated
		C. benglanensis Roxb.	Bannya Kafi	Wild
	Citrus	*Citrus aurantifolia* (Christ. & Panz.) Sw.	kagji Labu Nebu, Nimbu, Lebu	Cultivated
		C. chrysocarpa Lush.	Kamala, Kamala Lebu	Cultivated
		C. grandis (L.) Osdbeck	Jambura, Batabi Lebu, Moha Nembu	Cultivated
		C. limettoides Tanaka	Mitha Nebu	Cultivated
		C. limon (L.) Burm. f. (*C. medica var. limon* L.)	Gora Lebu, Karna Lebu	Cultivated

Family	Crop	Allied species	Local name	Status
		C. reticulata Blanco (*C. chrysocarpa* Lush)	Kamla, Kmla Lebu	Cultivated
		C. sinensis (L.) Osbeck	Malta, Moushandhi	Cultivated
Sapindaceae	Litchi	*Nephelium litchi* Lamb.	Lichu	Cultivated
		N. longana Camb.	Ash Phal	Cultivated
	Sapodilla	*Manilkara zapota* (*Achras zapota* L..; *Manilkara achras* Mill.)	Chabeda, Chiku, Safeda	Cultivated
		Manilkara hexandra (Mill.) Fosb (*Mimusips hexandra* Roxb.)	Khir Khejur	
Solanaceae	Peppers	*Capsicum annuum* L.	Kancha Morich, Kacha Lanka,	Cultivatd
		C. frutescens L.	Marich, Lanka Morich, Dhani Lanka, Dhani Morich	Cultivatd
	Tomato	*Lycopersicon esculentum* Mill. (*L. lycopersicum* (L) Karst	Tomato, Bilati Begun Gur Begun	Cultivatd
	Tobaccos	*N. rustica*	Deshi Tamak	Cultivatd
		N. tabacum L.	Tamak	Cultivatd
		N. plumbaginifolia Viv.	Ban Tamak,	Wild
	Egg plant and allies	*S. melongena* Wall	Begun ,Bagun	Cultivatd
		S. melongena Wall. var. esculerta	Kuli Begun	Cultivated
	Eggplant and allies	*Solanum filicifolium* Ort. (*S. torvum* Sw.)	Tit Begun, Goth Begun, Hat Begun	Wild
		S. ferox L.	Gota Begun, Ram Begun, Bagh Gota	Wild
		S. indicum L.	Phutki Begun, Baikur, Tit Begun, Brihati Begun	Wild
		S. nigrum L.	Gurkamai, Kakmachi, Phuti begun	Wild
		S. spirale L.	Bagua	Wild
		S. surrattense Burm. f. (*S. xanthocarpum* Schrad.Wendl.)	Kanti Kiri, Kantakini	Wild
		S. sysimbrifolium	???????	
	Potato	*S. tuberosum* L.	Alu, Gol Alu	Cultivated
		S. verbascifolium L.	Urusa	Wild
Sterculaceae	Cocao	*Theobroma cacao* L.	Koko, Chokolet	Cultivated
Tiliaceae	Jute	*Corchorus capsularis* L.	Pat, Tita Pat, Bogi Pat, Sada Pat, Nalte, Nalita Pat, Maricha, Naricha	Cultivated
		C. olitorius L.	Tosha Pat, Mitha Pat, Bogi Pat	Cultivated
		C. aestuans L. (*C. acutangulus* Lamk.)	Tita Pat, Jangli Pat	Wild
		C. fascicularis Lam.	Jangli Pat, Bil Nalita	Wild
Umbeliferae	Celery	*Apium graveolens* L	Chiruti, Chiluri	Cultivated
Urticaceae	Ramie	*Boehmeria nivea* (L) Gaud.	Kankhura, Kankura.	Cultivated
		B. platiphylla D. Don.	Ulichara	Wild
Vitaceae	Grape & allies	*Vitis adnata* Roxb (Wall.)	Alinga Lata	Wild
		V. assamica Laws.	Amasha Lata	Wild
		V. glabrata Heyne	Goda, Guaria	Wild
		V. lanceolaria Laws.	Horinia lata	Wild

Family	Crop	Allied species	Local name	Status
		V. latifolia Roxb.	Govila, Panibel	Wild
		V. pedata Vahl	Goali Lata	Wild
		V. quadrangularis Wall	Har Bhanga Lata, Harjora,	Wild
		V. setosa Wall.	Goali Lata	Wild
		V. trifolia (l.) Don	Anal Lata, Amal Lata, Sonekeshar	Wild
	Grape	*V. vinifera* L.	Angur, Kismis	Cultivated
Zingiberaceae	Turmeric	*Curcuma longa* L. (*C. domestica* Vahl)	Halud, Haldi	Cultivated
		C. zodoria Rosc.	Shathi, Ekangi, Phaulga, Kachuri	Cultivated/ Wild
	Cardamom	*Elettaria cardamomum* Maton.	Elachi, Chhoto Elachi	Cultivated
	Ginger allies	*Zingiber purpureum* Rosc. (*Z. casumnar* Roxb.)	Ban Ada, Baumurga Gach	Wild
	Ginger	*Zingiber officinale* Rosc.	Ada	Cultivated
	Ginger allies	*Zingiber rubens* Roxb.	Murga Gach	Wild
		Zingiber zerumbet Sm.	Mahabaribach, Narkasur	Wild

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APPENDIX 5

Research progress in evaluation of forest species

Category	Species name	Local name	Seed origin
A. *Species* introduced	*Acacia catechu* Willd.	Khair, Katha, Khadira, Khair Babul	probably India
	A. nilotica (L.) Del. (*A. arabica* (Lam.) Willd.)	Babla, Kikar	Sri Lanka
	Anacardium occidentale L.	Kaju, Kaju Badam, Hijli Badam	India & Pakistan
	Dalbergia sisso Roxb.	Shishu kath	Malaysia
	Mevca brasiliensis		not known
	Paraserianthes falcatara		perhaps Honduras
	Swietennia macrophylla King.	Bara Mehogini	Burma & India
	Tectona grandis L. f.	Segun, Teak	
B. Reccommended *species*	*Eucalyptus camaldulensis*		Pettord, Australia
	Leucaena leucocacephala (Lamk.) de Wit.	Ipil-Ipil	The Philippines
	Norus indica		India & Pakistan
	Pinus carribeae UAI hondurensis	Pine	Hondurus
	Xylia dolabriformis Benth.	Loha Kath, Pinkado	Burma
C. *Species* under arboreta trial	*Acacia feximifolius*		Garo Hills, India
	Alianthus grandis		Sadhya (?) & Assam
	Aleurites fordii		Malaysia
	A. montana		Malaysia
	Anogeissus acuminata Wall.	Chakua, Esri, Hiuri	Central India
	Artocarpus acuminata		Western Ghat, India
	A. hirsuta		Uganda
	Chlorophora excelea		Darang/ Assam, India
	Chukrassia labudaris		India
	Dalbergia latifolia Roxb.	Shitshal	Australia
	Eucalyptus alba		Australia
	E. botryaides		Australia
	E. citriodora Hook.	Eucalyptus	Australia
	E. robusta		Australia
	E. grandis (?)		Australia
	E. saligna(?)		Australia
	Eugenia alba		Andamans, India
	Lagerstroemia hypoleuca		Malaysia
	Melia azadarach L.	Poma, Moha Nim,Bokain	Thailand
	Pinus kesiya		Thailand
	P. merkusii		Honduras
	P. occarpa		Tanzania
	P. radiata		Kachar, India
	Podocarpus nerifolia Don.	Jinaru, Banspata	South India
	Plerocarpus marsupium		S. India
	P. sanialinus		Andamans, India
	Sterculia campanudata		Hondurus
	Swietennia mahagoni (L.) Jacq.	Mehogini	?

Category	Species name	Local name	Seed origin
D. *Species* performed poorly in arboretatrial	*Acacia senegal*		West Africa
	Arancaria angustifolia		not known
	A. cummuhumii ?		not known
	Canarium emphyllum		Andamans, India
	Dipterocarpus griffithii		Bhutan
	Eucalyptus globulus		Australia
	E. marculata		Australia
	E. sideropholia		Australia
	E. umbellata ?		Australia
	Greviollot robusta		Australia
	Manglietia insignis ?		Lakhshmipur ?
	Mansomia altissima		Nigeria
	Michelia clifolia		India
	M. oblonga Wall.	Sundi	Tejpur, Assam, India
	M. insignis		Tejpir, Assam, India
	Pancevia rulignosa		Assam, India
	Phoehe gosparensis		Assam, India
	Pinus ellilii		USA
	P. insularis		not known
	P. longifolia		India
	P. sinensis		Mauritius
	P. thunbergii		not known
	Palygala arillata		Sri Lanka
	Sanilalum album		South India
	Shorea assamica		Assam, India
E. *Species* that failed to grow	*Acacia cyanophylla*		not known
	A. karoo		not known
	Agathes pahnerstonii ?		not known
	Calamus seipionan		Mullaca, Indonesia
	Pinus ayacahuite		not known
	P. canariensis		not known
	P. douglasiana		not known
	P. michoacana		not known
	P. monlezumae		not known
	P. pinaster		not known
	Pinus pseudostrobus		not known
	Podorecarpus falcatus ?		not known
	Populus clone 214		not known
	Populus clone 262		not known
	Populus nigra ?		not known
	Populus trihocarpa ?		not known
	Populus wisdengii		not known
	Salix grees		not known
	Texalian grees		not known

Source: BFRI

APPENDIX 6

Some of the recommendations made in the National Conservation Strategy (NCS) of Bangladesh (NCS was prepared under the auspices of IUCN with financial assistance from NORAD)

- Inclusion of conservation of the environment and the resource bases and their sustainable use in the national Constitution:
- redefinition of the goals of rural development, conservation and sustainable development in the medium and long term perspectives;
- bottom up approach for planning for rural development for appropriate reflection of local needs, resource endowments, socio-psychological aspects, environmental considerations and sustainable use of resources;
- environmental impact assessment as a component in planning from the grassroot level;
- joint mass awareness programmes on conservation and sustainable development by the Government and NGOs;
- Incentives for conservation of scarce resources, both renewable and non-renewable by easily making available alternative resources or finances;
- focus of conservation and sustainable development in the research and training programmes of government agencies and NGOs;
- amendment of existing laws relevant to environmental aspects, conservation and sustainable resource base to cover specific related problems in the rural sectors; enactment of new laws in appropriate sectors of rural resource management and development; and priority in implementation of existing laws.

(Source: Huq, M. F. 1991. International Union for Conservation of Nature Natural Resources - The World Conservation Union, National Conservation Strategy of Bangladesh, Bangladesh Agricultural Research Council. Towards Sustainable Development: Rural Development and NGO Activities in Bangladesh. Dhaka, 1991)

- formulation of a comprehensive National Land Use Policy;
- detailed land resource assessment;
- prevention of activities leading to land degradation;
- proper allocation of land for urban and rural areas;
- formulation of a comprehensive National Land Use Policy;
- detailed land resources assessment;
- prevention of activities leading to land degradation;
- proper allocation of land for urban and rural areas;
- inclusion of resource conservation studies at every level of education curricula to make the future generations more conscious to the adverse result of extravagances;
- awareness creation on and public participation in resource conservation for their own welfare and for their children.

(Source: Rahman, M. R. 1991. International Union fore Conservation of Nature Natural Resources - The World Conservation Union, National Conservation Strategy of Bangladesh, Bangladesh Agricultural Research Council. Towards Sustainable Development: Land Resources in Bangladesh, Dhaka 1991).

- updating the syllabi of environmental education at various stages;
- greater emphasis on research on environmental issues in universities and research institutes of the country;
- creation of inter-disciplinary Centres or Institutes of Environmental studies in universities;
- training on Environmental Impact Assessment for personnel involved;
- organization of mobile song and drama troupes to popularize environmental issues.

(Source: Sharafuddin, A. M. 1991. International Union for Conservation of Nature Natural Resources - The World Conservation Union, National Conservation Strategy of Bangladesh, Bangladesh Agricultural Research Council. Towards Sustainable Development: Environmental Awareness and Education in Bangladesh, Dhaka, 1991.)

- lands regarded as unproductive, whether under government ownership (khas land), protected forests or unclassified state forests be allotted to dedicated environmentalists who have prepared the ground for future afforestation;
- the legislation concerning living resources in Bangladesh is marred by failures to implement laws, lack of coordination among agencies responsible to look after genetic resources. The problem is further accentuated by inadequate training facilities and low salaries of field staff. Before promulgation of legislation, it is important to ensure that the law is ecologically, economically and socially feasible. Public education programmes should precede and also follow the enforcement of laws to help the public to understand and support it;
- the institutional capacity of Ministry of Environment and Forest, established only in 1989, and the Forest Department to promote and administer conservation activities is yet to be developed to the required mark;
- Constraints limiting private forestry has restricted private sector involvement. The Government should encourage private enterprizes interested in afforestation and adequate khas land allotted to those who have already done satisfactory spade of work in the venture;
- severe restrictions should be imposed to harvest important medicinal plants from the wild; cultivation of such species on commercial scale should be encouraged. (The number of medicinal plants in a revised list by the National Herbarium exceeds 500);
- forestry projects managed by local people may be the solution to the problems caused by deforestation;
- conversion of natural forests to plantation of exotic species needs to be carefully assessed;
- inland and coastal flood control measures should take cognizance of the protection of local flora and fauna;
- conservation of wild genetic resources, both *ex situ* and *in situ* is now a matter of urgency;
- coordinated conservation action will depend on development on at least a primary cross sector inventory of wild genetic resources, thus allowing identification of species in need of attention;
- categories of wild plants of high priority for *in situ* conservation include the wild relatives of fruit and oil crops, commodity and industrial crops, timber species and plants used as forage and fibres;

- there is strong basis for *in situ* genebanks in the region; field programmes on *in situ* conservation should be guided by priorities identified at the country level, taking into consideration the biological and economic needs;
- systematic, ecological and geographic data are stressed as a background to germplasm collection and conservation;
- attempts at *in situ* conservation are likely to fail where there is intense pressure for land, weak legislation and implementation of laws, and public opinion unaware of the need for conservation;
- preferred efforts ate collection of as much reproductive materials as possible as *ex situ* conservation before the resources are destroyed (other countries in the region e.g. Nepal, Sri Lanka, etc. have already established *ex situ* collections of medicinal plants: FAO, 1984);
- adequate storage facilities for seeds or vegetative stocks are necessary with a duplication of collections to prevent risks of loss;
- recalcitrant seeds, to which belong fruit and nut species and many timber species have to be maintained as living plants (*in situ* genebanks) to protect wild gene pools of value for plant breeding;
- national botanic gardens can serve as centres for maintenance of genetic diversity, and the preservation of genetic materials located within the gardens provide the best chance for long time survival;
- information on the biology and variation on species will help decide the suitable type of conservation (*in situ*, *ex situ* as living trees, *ex situ* as reproductive materials or a combination of all three);
- there is need to maintain Natural Regeneration Plots (NRPs) in the hill forests for sustainable development of natural stands and to provide pasture for the wildlife;
- the orchid flora constitute one of the richest genetic resources in Bangladesh. Their preservation;

  a. through protection of natural habitats as National Parks,

  b. specialization in orchid species in institutions like Botanic Gardens,

  c. public awareness through displays and information shows, mass media and orchid societies should be promoted;

- the major constraint in the implementation is a lack of trained personnel. There is a clear need for a major push in training personnel in various aspects of conservation of genetic resources;

- immediate studies on biological diversity should concentrate on perennial plants with poorly known and are of potential value for production of food, fibre, oils and pharmaceuticals;
- the awareness for the need of conservation has to be created even at the pre-schooling stage to be continued at primary and secondary levels emphasising on the production of low cost educational; materials (posters with graphic designs, photography, audio-visual); this should go hand in hand with the creation of Nature Clubs are children will be taught and encouraged to identify common useful plants and flowers, birds and other animals and to learn their ecosystem;
- marshes and wetlands of particular significance as special biotic reserves should be managed including inventorying, research, monitoring and evaluation, and planning for their sustainable development . An ecologically and socio-economically acceptable basis for managing wetlands including their fisheries have to be developed and applied to promote the conservation of their genetic resources through quantifying their benefits;
- data bases on wild key species of ecological and socio-economic value are urgently needed. Regional information service on survey and authentication of indigenous germplasm of potential economic value such as legumes should be developed. Collaboration with National Botanical Research Institute of India at Lucknow and International Database System at Kew should be sought. This is prerequisite for taking up field studies on important wild resources like legumes. Training courses on computer database for documentation and information system linkage have to developed and implemented at the National Herbarium and other relevant institutions.

(Source: Khan, M. S. 1991. International Union fore Conservation of Nature Natural Resources - The World Conservation Union, National Conservation Strategy of Bangladesh, Bangladesh Agricultural Research Council. Towards Sustainable Development: Genetic Resources in Bangladesh, Dhaka 1991).

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