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Floral Diversity Investigation at Bangabandhu Jamuna Eco Park, Sirajgonj, Bangladesh

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Abstract: ***The study was undertaken in the area of Bongabondhu Jamuna Eco-park (BJEP), Sirajgonj, Bangladesh with a view to investigating the biodiversity especially for the plant and its conservation. The species of the area showed a heterogeneous assemblage of 267 species among them there have 119 plant species and without its 84 species of waterfowls and birds. The total number of plant recorded 77 genera fewer than 42 families among them 19 aquatic plants were found in the area belonging to 1 shrub, 5 grasses and 13 herbs species. The present study aimed to assess the floral diversity of the park and its distribution. The types of plants are identified by reconnaissance survey. The study plots were selected at random and the plants were marked and identified species wise. Raunkaier abundance classes were also compared to explain the plot wise variation in the floral diversity, very abundant, abundant, frequent, occasional and rare distribution. As the area is important for human settlements, agriculture, fisheries, navigation, communication, ecotourism and so on; the outcome of the study could be used as a valuable indicator for providing useful information of the status and knowledge of biodiversity of the studied area.***

Keywords: Bangabandhu Jamuna Eco-park, Vegetation studies, Bio-diversity, Conservation.

1. Introduction

It is important to know about the biodiversity of the area of BJEP. It crosses the Jamuna river from Saidabad on the east bank to Sirajgonj on the West. It is fulfill both the plant and animal biodiversity. Before establishing the greatest Jamuna Bridge the place of Eco-park was very desert condition. The environment was hard and unsuitable for living animals. The Government of Bangladesh had been decided to establish a Ecopark in this areas to overcome this condition that are necessary to conserve biological diversity, development of ecotourism and economic development of a country.

Biological diversity or Biodiversity refers to the variability among the living organisms; plants, animals and microbes from all sources including terrestrial and aquatic ecosystems and ecological complexes of which they are part. (Shukla and Chandel, 2000). Biodiversity encompasses multiple values and is vital for the production of food and to conserve the teal foundations needed to sustain people's livelihood. Goals of sustainable development have been identified which includes: 1) Economic well being,2) Social and human development and 3) Environmental sustainability and regeneration. (Clayton and Bass, 2002). Over the past few decades biodiversity became the issues of global anxiety for its rapid reduction worldwide and interestingly most of the economically poorest countries hold the majority of the world's biodiversity. (Koziell, 2001). It is also widely supposed that the poorest people of those poor countries who depend most immediately upon local ecosystems for their livelihoods are somehow responsible for the degradation of biodiversity and will mostly affected by the consequence of this biodiversity loss. (CBD, 2006). This popular topic stressed especially in the Rio Declaration and renewed by the Lisbon Conference in 1998 (Neumann and Starlinger, 2001). Bangladesh is a part of the Indo Burma region which is one of the ten global hot spot areas for biodiversity and supposed to have 7000 endemic plant species (Mittermeier et al., 1998). About 5,700 species of angiosperms alone, including 68 woody legumes, 130 fiber yielding plants, 500 medicinal plants, 29 orchids, three species of gymnosperms and 1700 pteridophytes have been recorded from Bangladesh (Firoz et al., 2004: Khan, 1977: Troup, 1975). The services provided by biodiversity and ecosystems play a crucial to sustain our livelihoods and protect our health. There is no confusion that the beauty and diversity of our living species greatly improve the quality of our lives (Tucker et al., 2005).

From ecological and conservation view point, assessment of biodiversity of any habitat or locality has been regarded as one of the vital issue for careful preservation, promotion and management of the variety of life forms (Alam and Masum, 2005).There is little quantitative information available on the composition and structure of vegetation of the Bangabandhu Jamuna Eco Park. Thus present study is conducted to assess the quantitative structure and diversity of trees in this park which will provide information to the policy maker and world conservationist about this protected area comparing to the other protected area of the country as well as the world. So, adequate measures would be taken to conserve and enrich its diversity.

The objective of the study was to investigation and estimation the present condition of floral biodiversity status on the basis of trees at Bangabandhu Jamuna Eco-Park.

2. Review of Literature

Bangladesh's wetland habitats are particularly significant in supporting avifaunal, aquatic and plant biodiversity. Avifaunal biodiversity is high, with approximately 650 bird species recorded nationally thus far (compared with 800 in Europe and the Middle East together), at least 40 of which are globally threatened. Floodplains and other inland wetlands, along with coastal wetlands, support millions of migratory waterfowl annually, from over 150 species.

Inshore areas of the Bay of Bengal, as well as inland wetlands, support considerable aquatic biodiversity, including some 120 species of marine fish, 260 species of freshwater and brackish water fish and several globally threatened turtle species. Plant biodiversity in Bangladesh is estimated at over 5,000 species of higher plants, some 158 of which are found in freshwater wetlands and 334 in coastal wetlands. Key components of Bangladesh's plant biodiversity include its globally significant mangrove resources as well as the within-species genetic diversity found in several thousand varieties of rice grown within seasonally flooded areas. (CWBMP, UNDP, 2000)

Although Bangladesh is rich in biodiversity (species) but has identified 12 species of wildlife as extinct in Bangladesh Contradictorily Hussain (1992) and Asmat (2001) found 18 species of wildlife as extinct from the country. A lot of country' s mammals, birds, reptiles are now under tremendous pressure forseveral reasons. IUCN (2000) has listed a total of 40 species of inland mammals, 41species of birds, 58 species of reptiles and 8 species of amphibians under variousdegrees of risks in the country. Unfortunately reliable information regardingthreatened floral diversity is not available in the country. It has been assumed thatalready 10% flora of the country haveextinct. According to a recent exercisecompleted by the Bangladesh National Herbarium, 106 vascular plant species facerisks of various degrees of extinction in Bangladesh (Reza, 2004). Again, Dey (2006) listed 167 plant species as vulnerable or endangered in Bangladesh.

Ecologically Bangladesh supports a diverse set of ecosystems. These includessandy beaches tomangroves, flood plains, ecosystems, expansion in HYV rice production, indiscriminate use of pesticides and pollution and siltation of the river as well as wetland system. lowland forests, terraces and hills reaching far north into the eastern Himalayas – oneof 25 biodiversity hot-spots globally identified. The country has the world's largestcontinuous mangrove forests in its south-western part; in its eastern part it has a largetract of evergreen to semi-evergreen hill forests; once very rich in biodiversity besides in north- eastern part of the country there are many wetland areas; locallycalled haors which harbors a huge number of plants, migratory birds (water fowls) and freshwater fish species. In Bangladesh, over 80% of the land is low-lying andhence waterlogged or flooded at least part of the year. Much of the land area does notgenerally exceed 40m ASL, making the country's landscape the single largest flood-basin in South Asia. The entire country is biogeographically a transition between theIndo-Gangetic plains and the eastern Himalayas and in turn part of the Indo-Chinesesub region of the Oriental realm (IUCN, 2004).

Bangladesh Forest Department (FD) manages 1.53 million hectaresof forest land of the country (Roy, 2005). Besides, 0.73 million ha of unclassed state forests (USF) are under the control of district administration. Thenatural forests of Bangladesh covers three major vegetation types occurring in threedistinctly different land types, i.e., hill forest (evergreen to semi-evergreen); plain landsal forest and mangrove forest. Although, once this public forests were very wealthybut during the last few decades they have been degraded heavily due to variousmanagerial and other problems.

Bangladesh has the highest rural population densities in the world with lowest percapita forest land (Anon, 2003; Rahman et. al. 2003). The contribution of the forestrysector to GDP is 3.3% at current prices and about 2% of the country's labor forces areemployed in this sector (Siddiqi, 2001). Officially, although Bangladesh has nearlyabout 17.5% forest coverage butonly 6% of them are wellstocked. Besides, the annualdeforestation rate in the countryis 3.3% which is highest amongthe south-east Asian countries (Poffenberger, 2001). In recentdays, although government has become anxious about biodiversity conservation but country's forest and biodiversity are still facing various challenges like other regions of the world.

3. Materials and Method

3.1 Geographical location of the study area

The study area Bangabandhu Jamuna Eco park lies at the Sirajgonj Sadar Upozilla under the Sidabad Union. The main convenience of this eco-park is, its lies surrounding point of the two parts of the country because of existing great Jamuna Bangabandhu Bridge. The total area of Ecopark is 600 acres among them only 124 acres areas are restricted by fencing at 2007-2008. It is 125 km far from the capital Dhaka and situated at the west of Jamuna Bridge.

3.2 Site selection for the study

The information about the environmentally important area for collecting floral data of area. It is impossible to determine the overall floral biodiversity of this park because there have thousand of species. So we have selected four plots randomly for our study convenience. Our selective areas are:

1) Deep Point (West), 24˚24′01.12″ N to 89˚44′56.93″E
2) Site of Embankment Point (East), 24˚24′02.69″ N to 89˚45′06.90″E
3) Site of the River Point (North), 24˚24′30.89″ N to 89˚44′55.36″E
4) Officers Rest House, 24˚23′57.19″ N to 89˚44′53.94″E

3.3 Identification of Biodiversity status

We have identified floral species at selected four plots (20m x 20m) by observation with the "Quadrat Method" where we hahe taken $1m^2$ for each quadrat and also help from expert and interview of the local people. According to the expert and local people's opinion many floral species are available in those plots but very few among them were found during when we observed by the Quadrat Method. To estimate the floral biodiversity at BJEP we have taken three steps. Within each plot the number and name of all the trees, were counted and recorded. To estimate the floral biodiversity at BJEP we have taken three steps.

Firstly, we had determined the density of species by crude density process.

Secondly, we had determined the frequency by belt transect method by using formula.

Thirdly, we had compared the frequency of the species by with the Raunkaier classes of abundance.

3.4 Floral Estimation of BJEP

The eco-park is full of hundreds of floral species and it is quite impossible to determine the full floral species estimation. So we have taken trees of the park. Actually it is not overall estimation of the park but also for the main trees because in our country both eco-park and national park the main victims for extinction is tree. The study may help the authority for knowing about how much floral species remain and how of them are in abundance.

3.4.1 Assessing of total distribution of the tree

First we have selected the size of plot area and then we assessed what kinds of trees remain at the BJEP in each of plots. It is very important to know that what kinds of trees and how much of trees remain at the area. Without assessing the trees quantity we cannot estimate the floral diversity. Here we take a table with contains 1sq m for distributing the total area 20 sq m and input the amount of species present at every sq m.

3.4.2 Density Distribution

The numerical strength of a species in relation to a definite unit space is called density. Here we have identified the crude density that refers the number of individuals of a particular species per unit area. Each organism occupies only the area that can adequacy meet its requirement.

The formula use for measuring the density of the species here the plants is:

$$\text{Density}=\frac{\text{Total no.of individuals of a species in all the sample plots}}{\text{Total no.of sample plots}}$$

3.4.3 Frequency distribution of the floral species basically for the tree at BJEP

The term "frequency" has different meetings to different disciplines. But in the biodiversity it contains further perspective. As with any vegetation sampling activity, the first step is to design a protocol that can accomplish the assessment or monitoring goal within available time and resources. Once this is set, then frequency measures can be accomplished by random, systematic, or subjective locations of plots. A stratified approach might also be advantageous.

Step 1: Count and record the number of individuals of each species in each plot.
Step 2: Calculate frequency of each plant by the following equation:

$$(F) = \frac{\text{No.of plots of in which species occures}}{\text{Total no.of plots in examine}} \times 100$$

In the data sheet we have use 20 plots where each contain 1sqm specifically examined so total number of plots in which a plant occurred is 20.

3.5 "Raunkaier" abundance classes

Raunkaier classes a model for determining the abundance of species. It is an universal classes for measuring abundance of species in biodiversity estimation. Though some specialist are not agreed with this process because it is failed to measure the coral reef. Here we use these abundance classes of Raunkaier for measuring the abundance for estimating the floral biodiversity.

Rank	*Classes*	*Stalks per square meter (%)*
1.	Very abundant	81 to 100
2.	Abundant	61 to 80
3.	Frequent	41 to 60
4.	Occasional	21 to 40
5.	Rare	0 to 20

(Shukla and Chandel, 2000)

4. Results and Discussion

For vegetation studies, a reconnaissance survey was conducted for identifying different types of plants. Study plots of 400 m^2 were randomly selected. All plants >10 cm gbh (1.3m above ground level) were marked and identified species wise. Here some lists are given below. Here all plants are listed commonly from the four selected area.

4.1 Aquatic plants of the BJEP

A total number of 19 aquatic plants were found in the area of BJEP belonging to 19 families having 1 shrub, 5 grasses and 13 herbs species. The total genus of completely aquatic species was 10 bearing the dominant species Nymphpea pubescens (Sada Shapla) and Hygrorhiza arigtdta (Dol). Gramineae is the largest and Lemnaceae is the minor family based on their species abundance in the wetlands area. Family Convolvulaceae having 2 species, Pontederiaceae 1 species, Araceae 2 species, Polygonaceae 1 species, Cyperaceae 2 species, Onagraceae 1 species and Amaranthaceae 1 species each.

Table 1: Biodiversity of aquatic plants observed in the area of BJEP

Local Name	*Family*	*Genus*	*Species*
Kachuripana	Pontederiaceae	Eichhornia	crassipes
Khudipana	Lemnaceae	Lentna	minor
Fopapana	Araceae	Pistia	stratiotes
Panikachu	Pontederiaceae	Monochoria	Hastata
Sada Shapla	Nymphaceae	Nymphaea	pubescens
Panilong	Onagraceae	Ludwigia	hyssopifolia
Kalmilata	Convolvulaceae	Ipomoea	acluatica
Dholkalmi	Convolvulaceae	Ipomoea	Jistulosa
Malancha	Amaranthaceae	Alternanthera	philoxeroides
Helencha	Cnagraceae	Jussleua	repens
Jonia	Cyperaceae	Fimbristylis	miliceae
Keshur	Cyperaceae	Cyperus	michelianus

4.2 Timber plants of the BJEP

The recorded timbered plants of the area of BJEP were 17 where all the species are tree. Leguminaceae and Moraceae were the largest families having 4 species and 3 species where Gramineae, Bombaceae, Euphorbiaceae, Myrtaceae, Lythraceae, Meliaceae, Verbenaceae, Rubiaceae and Urticaceae have only one species of each. The species abundance of Ficus spp. was rich (3 species) but the plantation richness of the genus Gameuna, Dalbergia, Trewia and Eucalyptus was adequate.

Table 2: Biodiversity of the timber plant species identified in the area of BJEP

Local Name	*Family*	*Genus*	*Species*
Akashmoni	Mimosaceae	Acacia	auriculiformis
Eucalyptus	Myrtaceae	Eucalyptus	camaldulensis
Rain tree	Mimosaceae	Albizzia	Saman
Sissoo	Papilionaceae	Dalbergia	Sisso
Pitali	Euphorbiaceae	Trewia	Polycarpa
Jarul	Lythraceae	Lagerslroentia	Speciosa
Mahogoni	N4eliaceae	Swielenia	macrophylla
Gamar	Verbenaceae	Gmelina	Arborea
Kadam	Rubiaceae	Anthocephalus	Chinensis
Sheora	Urticaceae	Sterblus	asper
Sonalu	Caesalpinaceae	Cassia	Fistul
Simul	Bombaceae	Bombax	Ceiba
Bot	Moraceae	Ficus	bengalensis
Pakur	Moraceae	Ficus	Comosa
Dumur	Moraceae	Ficus	Carica
Bamboo	Gramineae	Baflthusa	auruttdinaceae

4.3 Fruit plants of the area of BJEP

Three palms, 1 herb and 7 tree fruit plants were observed in the area locality with the abundance of Banana, Tal and Khejur species. Palmae is the biggest family with 3 species and Musaceae is the lowest family with single species. Anacardeaceac, Rutaceae, Moraceae, , Rhamnaceae and Dilleniaceae had only 1,- 1, 1,2, 1 and 1 species, respectively.

Table 3: Biodiversity of fruit plant species identified in the area of BJEP

Local Name	*Family*	*Genus*	*Species*
Am	Anacardiaceae	Mangifera	indica
Kanthal	Moraceae	Artocarpus	heterophyllus
Payara	Myrtaceae	Psidium	Guajava
Jam	Myrtaceae	Syzygium	cumini
Boroi	Rhamnaceae	Zizyphus	mauritiana
Chalta	Dilleniaceae	Dillenia	indica
Tal	palmae	Borassus	flabellifer
Khejur	palmae	phoenix	sylvestris
Shupari	palmae	Areca	catechu

4.4 Fodder plants of the area of BJEP

Only 5 species of fodder plants was found in the area with species abundance of Mander and Jiga. Three species of Leguminoceae, 1 species of Moraceae and 1 species of Burseraceae were identified during the study period. All the species of fodder plants belonging to the habitat of tree.

Table 4: Biodiversity of fodder plant species observed in the area of BJEP

Local Name	*Family*	*Genus*	*Species*
Ipil-Ipil	Mimosaceae	Leucaena	leucocephala
Mander	Papilionaceae	Erythrina	variegata
Babla	Mimosaceae	Acacia	nilotica
Jiga	Burseraceae	Guruga	pinnata
Khoksha	Moraceae	Ficus	hispida

4.5 Medicinal plants of the area of BJEP

Two grasses, 3 shrubs, 5 trees and 10 herbs species of medicinal plants were observed in the study area with a total of 23 species richness. Among the trees, Alstonia macriphylla, Ipomoea fistulosa and Hygrorhiza asistata were the dominant species. Bishkathali belonging to Polygonaceae, Tulsi belonging to Labiatae, Dhutora belonging to Solanaceae, Thankuni belonging to Umbelliferae and Hatisur belonging to Boraginaceae were the most common species of the wild medicinal plants. According to family, Solanaceae had 3 species, Cyperaceae 2 species, Gramineae 1 species, Amaranthaceae 2 species, Compositae 1, Leguminosae 2 species with endangered species arjun of Combretace and bishjarul of Acanthaceae family.

Table 5: Biodiversity of medicinal plant species observed in the area of BJEP

Local Name	*Family*	*Genus*	*Species*
Chatim	Apocynaceae	Alslonia	macrophylla
Arjun	Combretaceae	Terminalia	arjuna
Akande	Asclepiadaceae	Calotropic	procera
Bishjarul	Acanthaceae	Justicia	gendarussa
Sonalu	Caesalpinaceae	Cassia	fistula
Goraneem	Meliaceae	Melia	sempervirens
Dhutora	Solanaceae	Datura	metel
Lazzabati	Mimosaceae	Mimosa	pudica
Helencha	Onagraceae	Jussleua	repens
Dholkalmi	Convolvulaceae	lpomoea	Jistulosa
Hatisur	Boraginaceae	Heliotropium	indicum
Keshuti	Compositae	Eclipta	alba
Tulsi	Labiatae	0cimum	sanctum
Amrul	Oxalidaceae	Oxalis	corniculata

4.6 Analysis of the main trees in BJEP

Density determination of the study area

Study area 1: Deep Point (West), 24˚24′01.12″ N to 89˚44′56.93″E

At the study area 1, the highest density of plants in each quadrat could be found for Jhau (1.65) and then followed by Akashmoni (1.10), Shilkoroy (1.0), Jarul (0.85), Nagessor (0.75), Segun (0.75) remain respectively.

Study Area 2: Site of Embankment Point (East), 24˚24′02.69″ N to 89˚45′06.90″E

At the study area 2, the highest density of plants in each quadrat could be found for Jhau (1.90) and then followed by Rain tree (1.25), Jarul (1.15), Bot (0.80), Pakur (0.75), Simul (0.65) remain respectively.

Selective Area 3: Site of the River Point (North), 24°24′30.89″ N to 89°44′55.36″E
At the study area 3, the highest density of plants in each quadrat could be found for Payara (1.75) and then followed by Am (1.70), Eucalyptus (1.25), Ipil-Ipil (1.00), Boroi (0.45), Babla (0.40) remain respectively.

Selective Area 4: Officers Rest House, 24°23′57.19″ N to 89°44′53.94″E
At the study area 3, the highest density of plants in each quadrat could be found for Mahagony (1.60) and then followed by Nym (1.50), Kathal (0.65), Kadam (0.55), Bakul (0.50), Krisnochura (0.45) remain respectively.

Frequency determination of the study area

Study area 1: Deep Point (West), 24°24′01.12″ N to 89°44′56.93″E
At the study area 1, the highest frequency (%) of plants in each quadrat could be found for Jhau (55) and then followed by Akashmoni (50), Shilkoroy (45), Jarul (40), Nagessor (35), Segun (40) remain respectively.

Study Area 2: Site of Embankment Point (East), 24°24′02.69″ N to 89°45′06.90″E
At the study area 2, the highest frequency (%) of plants in each quadrat could be found for Jhau (70) and then followed by Rain tree (45), Jarul (45), Bot (40), Pakur (35), Simul (35) remain respectively.

Selective Area 3: Site of the River Point (North), 24°24′30.89″ N to 89°44′55.36″E
At the study area 3, the highest frequency (%) of plants in each quadrat could be found for Am (60), and then followed by Payara (50), Eucalyptus (35), Ipil-Ipil (35), Boroi (25), Babla (20) remain respectively.

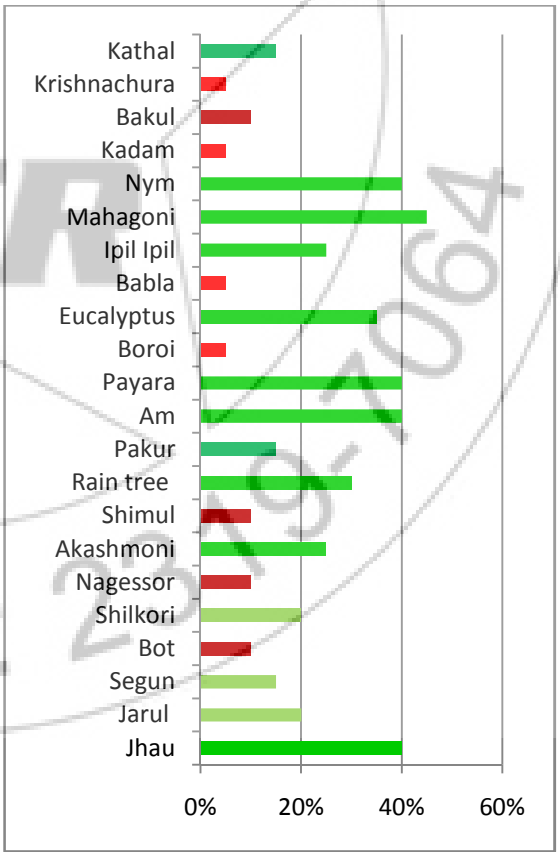
Selective Area 4: Officers Rest House, 24°23′57.19″ N to 89°44′53.94″E
At the study area 4, the highest frequency (%) of plants in each quadrat could be found for Mahagony (45) and then followed by Nym (45), Kathal (30), Kadam (30), Bakul (20), Krisnochura (20) remain respectively.

Here the park have not contains any kind of very abundant species but contains some of abundant species that are marked at deep green and the species that are frequent marked as light green. At the same way the species which are found occasionally detected as dark red and the species that's found hardly at the park or may face at extinct level marked as red color finally that's are expressed by the following table.

Table 6: List of the major plants species abundances

Local name	*Name of the species*	*Abundances*
Jhau	Casuarina equiseiifolia	Abundant
Jarul	Lagerstroemia speciosa	Frequent
Segun	Tectona grandis	Frequent
Akashmoni	Acacia auriculiformis	Frequent
Shilkory	Atbiza procera	Frequent
Nagessor	Mesua ferrea	Occasional
Bot	Ficus bengalensis	Occasional
Simul	Bombax ceiba	Occasional
Rain tree	Albizzia saman	Abundant
Pakur	Ficus comosa	Frequent
Am	Mangifera indica	Abundant
Payara	Psidium guajava	Abundant
Boroi	Zizyphus mauritiana	Rare
Eucalyptus	Eucalyptus camaldulensis	Abundant
Babla	Acacia nilotica	Rare
Ipil-Ipil	Leucaena leucocephala	Frequent
Mahagoni	Swietenia mahagoni	Abundant
Nym	Azadirachta indica	Abundant
Kadam	Anthocephalus chinensis	Rare
Bakul	Minusops elengi	Occasional
Krisnochura	Delonix regia	Rare
Kalhal	Artocarpus heterophylluss	Occasional

By comprising this table we founded the following graph:



5. Conclusions and Recommendation

5.1 Conclusions

Bangabandhu Jamuna Ecopark is a historic and rich in floral biodiversity habitat in Bangladesh. It has dynamic influence on our environmental, social, ecological as well as economic sector. But it is very unfortunate that the biodiversity of this deciduous forest are decreasing day by day. Current management practices are inadequate and inefficient to manage the Bangabandhu Jamuna Ecopark sustainability. As identified in the forestry sector policy document, many of the aforestation forest estimation policies cannot be successfully implemented due to the following main causes: population pressure, poverty, high demand of fuel wood, negative influence of local and involvement of local political leaders in deforestation and encroachment of forest land by locals. To protect and enrich the biodiversity of this BJEP by enforcement of laws, extension of forest, motivation and awareness building and campaign among people are helpful to reduce the depletion of forest biodiversity. Corruption at different levels of management systems, illegal filling of trees and collection of fuel wood are some of major constraints in successful implementation of development projects. The concept of sustainable biodiversity conservation should be understood by forest personnel and local people. The honesty and sincerity of the forest department are also important for conservation process.

5.2 Recommendation

Protected areas in Bangladesh plays significant roles in ecological, social, economic aesthetic, recreational and also have an important role for conserving the biodiversity. The forest protected area specially the BJEP. The following recommendations can be implemented to overcome the problems and to upgrade the conditions.

1. Develop policy conducive to improve forest protected area management and build strengthen the institutional systems and capacity of forest Department and Key stakeholders so that improvement under the project can be constituencies to further these goals.
2. To stop the destruction of biodiversity by the social forestry project.
3. Improvement and extension of existing wildlife breeding centers and increase opportunities for sustainable ecotourism, education and research.
4. Improvement the income and livelihoods of people living in and around forest areas, job creation and enterprise development associated with forest areas and nature and also active and vibrant partnership for nature conservation between citizens and the Forest Department,
5. Updating and enforcing forest acts and rules. Awareness raising activities should be on a priority basis in the area to make the people understand how they would benefit from this project,
6. Planned ecotourism may be promoted in and around the forest with provision for generating funds for forest management and welfare of local people.

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References

[1] Alam. M.S, Masum. K.M, (2005). Status of Homestead Biodiversity in the Offshore Island of Bangladesh, Research Journal of Agriculture and Biological Sciences, 1(3), pp 246-253.
[2] Anonymous. 2003. Bangladesh Economic Review, Economic Advisers Wing, Finance Division, Ministry of Finance, Bangladesh Secretariat, Dhaka.
[3] Asian Wetland Bureau Publication: NHBS, Wetlands International - Asia, Pacific. ...Wildlife, science and conservation since 1985
[4] CBD. 2006. Global Biodiversity Outlook 2. Secretariat of the Convention on BiologicalDiversity (SCBD), Montreal, 81 pp
[5] Clayton and Bass, 2002, Sustainable Development of the world through Biodiversity work, Kent State University, Ohio, USA
[6] Coastal and Wetland Biodiversity Management at Cox's Bazar and Hakaluki Haor (CWBMP), BGD/99/G31, United Nations Development Programme, 2000, p-1
[7] Dey. T.K. 2006. Useful Plants of Bangladesh (in Bengalis) 2nd revised edition. Aligarh Library. Dhaka. Bangladesh. 945-949 pp.
[8] Firoz. R., Mobasher. S.M., Waliuzzaman. M., and Alam. M.K, (eds). (2004). Proceedings of the Regional Workshops on National Biodiversity Strategy and Action Plan, IUCN Bangladesh Country Office, Dhaka.
[9] Hussain, K.Z. 1992. Wildlife preservation in Bangladesh. Wildlife Newsletter, 4: 5-10 pp
[10] IUCN. 2000. Red list of threatened animals of Bangladesh. The World Conservaiion Union (IUCN), Bangladesh. 54 pp.
[11] IUCN. 2004. National Biodiversity Strategy and Action Plan. Government of the People's Republic of Bangladesh (2nd Draft). Ministry of Environment and Forests (MoEF) and IUCN Bangladesh Country Office. Dhaka. 74 pp.

[12] Khan. M.S, (1977). Flora of Bangladesh, Report 4, Camelinanceae, Bangladesh National Herbarium, Bangladesh Agriculture Research Council (BARC), Dhaka.
[13] Koziell. I, (2001). Diversity not adversity: sustaining livelihoods with biodiversity, International Institute for Environment and Development, London.
[14] Mittermeier. R.A., Myers. N., Thomsen. J.B., Da Fonseca. G.A., Olivieri. S, (1998). Biodiversity hotspots and major tropical wilderness areas: approaches to setting conservation priorities, Conservation Biology, 12, pp 516-520
[15] Neumann. M., and Starlinger. F, (2001). The significance of different indices for stand structure and diversity in forests, Forest Ecology and Managemant, 145 (12), pp 91-106.
[16] Poffenherger, M (ed). 2000. Communities and forest management in South Asia. IUCN, DFID and Asia Forest Network. Indonesia. 35-46pp.
[17] Reza. A.H.M.A. 2004. Natural resources management in Bangladesh: Linking national priority to global perspective. Tigerpaper, 31(2): 10-16.
[18] Roy. M.K. 2005. Nishorgo Support Project: Designing a Co-management Model for the Protected Areas in Bangladesh. In: Nishorgo, Protected Area Management Program of Bangladesh. Dhaka, Bangladesh. 1-5 pp.
[19] Shukla, R.S. and Chandel P.S. 2000. Plant Ecology and Soil Science p-127,134-40
[20] Troup. R.S, (1975). Silviculture of Indian Trees, Forest Research Institute Press, Dehradun.
[21] Tucker. G., Bubb. P., de Heer. M., Miles. L., Lawrence. A., Bajracharya. S.B., Nepal. R. C., Sherchan. R. and Chapagain. N.R, (2005). Guidelines for Biodiversity Assessment and Monitoring for Protected Areas, KMTNC, Kathmandu.

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