Strengthening Regional Co-operation for Wildlife Protection Project

Action Plan for the Management of Birds in Bangladesh

2015 - 2025

Bangladesh Forest Department
Ministry of Environment and Forests

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Government of the People's Republic of Bangladesh
Bangladesh Forest Department
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Acronyms

BFD	Bangladesh Forest Department
BFRI	Bangladesh Forest Research Institute
BGB	Border Guard of Bangladesh
CCF	Chief Conservator of Forests
CMC	Co-management Council
CMS	Convention and Management Strategy
CF	Conservator of Forests
CNRS	Center for Natural Resource Studies
CREL	Climate-Resilient Ecosystems and Livelihoods
CRO	Chief Research Officer
DCCF	Deputy Chief Conservator of Forests
DFO	Divisional Forest Officer
DO	Divisional Officer
ECA	Environmental Conservation Act
ECA	Ecologically Critical Areas
ECR	Environment Conservation Rules
FSMP	Forestry Sector Master Plan
GoB	Government of Bangladesh
IBA	Important Bird Areas
ICT	Information and Communication Technology
IPAC	Integrated Protected Area Co-management Project
MoEF	Ministry of Environment and Forests
NACOM	Nature Conservation Management
NGO	Non Government Organizations
NSP	Nishorgo Support Project
NPO	Non-profit Organizations
NWC	National Wildlife Centre
NWFP	Non-wood Forest Products
TFF	Tree Farming Fund
WCS	Wildlife Conservation Society
WBE	Water Bird Estimate
WPE	Waterbird Population Estimation
WCCU	Wildlife Crime Control Unit
WNCC	Wildlife and Nature Conservation Circle
WRRCs	Wildlife Rescue and Recovery Centres
WWF	World Wildlife Fund
UP	Union Parisad

Executive summary

The preparation of bird management plan is an important initiative to protect the bird species in Bangladesh and its transboundary habitats that includes objectives, strategies and actions. The vision and strategy are based on an analysis of the key values and threats of birds, particularly the threatened species. This Management Plan is the prime guiding document for other plans in relation to bird species. The action plan for the management of illegal exploitation and trade of threatened bird species of Bangladesh provides a framework for conservation and mainly focuses on management of the threatened birds and conservation of Important Bird Areas (IBA) of the country. Although the plan is extensively dealing with issues such as public relations, awareness, education, policy and research, the document itself is not meant as a tool in those fields to keep its scope clear. Other plans and documents may be required to elaborate such aspects.

The bird management action plan consist of (a) introductory chapter that includes wildlife diversity of Bangladesh and threats on them, purpose of the plan, physical characteristics and location of Bangladesh and conception of action plan; (b) threatened birds and their habitats including IBAs; (c) Policy and institutional framework including recent developments toward conservation priority and co-management under the new Wildlife (Conservation and Security) Act 2012, (d) evaluation of values of avifauna; (e) analysis of issues and threats on bird diversity and their populations, (f) vision and objectives and (g) management action plan and (h) monitoring plan.

Threatened Species of Birds

There are about 628 bird species in Bangladesh, of which 244 are migratory. A total of 41 species of birds categorized as threatened species in Bangladesh, of them 36 species are non-passerines and 5 species passerines (IUCN 2000). Of the threatened species, 19 are critically endangered, 19 endangered and 3 are vulnerable.

Regarding the habitats, the wetlands are the important habitat of migratory waterbirds. The wetlands are the abode of about 70 species of resident waterbirds including ducks, grebes, cormorants, bitterns, herons, egrets, storks, rails, jacanas, finfoot, waders, gulls, turns, skimmers, etc. and some other species are also dependent on water bodies. As mentioned in the IUCN Red Book, about 100 species of migratory birds regularly or occasionally visit the country. Birds of the country have great values economically, biologically and environmentally. Bird act as an important ecological indicators and biologically pest controlling agent. But the population of bird species has been decreasing gradually by different manmade and natural causes, particularly the number of migratory birds coming in the winter season. Habitat destruction and pollution are the main reason for the decline of bird population. Therefore, all conservation measures should be taken in order to increase the number of each bird species in the country. Problem is that there are

many visitors come to the protected areas and important bird areas every year, particularly in winter. Management of visitors should be leased out. All protected areas are administered by the Wildlife management and Nature Conservation Circle (WMNCC). The protected areas are managed mainly as a recreational area, while the other areas are managed for resource collection that provides benefit to local stakeholders. A Wildlife Centre is being constructed in the country under Forest Department (FD) for the purpose of developing the BFD's wildlife management capacity, performing various bird research, raising awareness and monitoring implementation of management action plan.

1 Introduction

1.1 Wildlife diversity and threats

Vertebrate animals other than humans, living in natural habitat without the help of humans are known as wildlife. Members of the class Amphibia, Reptilia, Aves and Mammalia and their eggs or young are considered as wildlife. Wild animals can live independently without the help or care of human. Not necessarily a wild animal has to live in forests or jungles; a toad, a wall lizard, a sparrow, a pigeon, a myna, a crow, the snake, etc are the members of wildlife, who live very close to human settlement. Wildlife can be found in all ecosystems e.g. Deserts, forests, rain forests, plains, grasslands, other areas including the most developed urban sites, all have distinct forms of wildlife.

Most wild animals, particularly bird, largely depend upon the extent, growth and distribution of forests, decline of these natural habitats severely and adversely affect most inland and resident vertebrate fauna. In the last three decades, the stock of forest trees has declined in Bangladesh at an alarming rate. In Bangladesh, there are about 53 species of amphibians, 158 reptiles, 650 birds and 121 mammals (Sarker and Sarker, 1988, Khan, 2008). Among the birds, about 420 species were resident and about 230 species migratory (Appendix 1-2).

Among the avifauna of Bangladesh, the Sarus crane, *Grus antigone* is considered as the largest bird of the country. This species is rarely seen in recent times. A few species of flowerpeckers and sunbirds are perhaps the smallest. Degradation of forests and consequent ecological alterations obviously affect the composition of the avifauna. The Pinkheaded duck (*Rhodonessa carryophyllacea*), the Nukta or Comb duck (*Sarkidiornis melanotos*), the Common peafowl (*Pavo cristatus*), the Burmese peafowl (*P. muticus*), Sarus crane (*Grus antigone*), and the Bengal Florican (*Eupodotis bengalensis*), Greater adjutant (*Leptoptilos dubius*), Red-headed Vulture, (*Sarcogyps calvus*) which once were more or less widely distributed, have now disappeared from Bangladesh. Of these, about 41 are listed as threatened (Appendix 1). Most birds that migrate to Bangladesh come from the mountainous of the northern parts of the subcontinent. Some species come from different parts of Europe and from Siberia. There are certain species that stay in Bangladesh for a short period; they move further South or Southeast. There are many species which stay here during autumn or spring.

1.2 Purpose of the threatened bird species management action plan

The purpose of the action plan is to prioritize the goals. The management action plan for bird species can help to start-up making an annual plan in order to conserve target species. Another purpose of this management action plan is to estimate current status of

birds and their habitats that may help for monitoring threatened birds. To do that following task are important to be considered;

- Full and active executive support from the Bangladesh Forest Department (BFD),
- Effective communication,
- Wildlife staffs involvement,
- Comprehensive organizational planning and competitive analysis, and
- Widespread perceiving for the strategic planning.

Successful strategic planning implementation requires a large commitment from executives and senior managers, whether the strategic planning can be prepared. Executives must lead, support, follow-up, and update the results of the strategic planning implementation process. The purpose outlines what the plan wants to achieve over a 3–5 year period and contributes to completion of only a portion of the vision. The goal should be specific, measurable, achievable, realistic and time-bound (SMART). Every goal should have a set of indicators. Indicators can be compiled by asking, 'How am I going to indicate to someone that the objective has been achieved?' The purpose of action plan might differ between the national and international levels. The national plan should refer and contribute to achieving the aim of the international plan.

Bird management action plan aims at conserving bird species, populations of each species, the sites and habitats important for birds, so as to:

- Prevent the decline of population and extinction of bird species in the wild,
- Help, through birds, to maintain diverse natural environments and enrich the quality of people's lives,
- Sustain the vital ecological systems that underpin human livelihoods.

1.3 Location and physical characteristics of Bangladesh

Geographic Location

Bangladesh located from 20°34″ North Latitude to 26°38″ North Latitude and from 88°01″ East Longitude to 92°41″ East Longitude. Previously it was known that Bangladesh is a South-Asian small country. It's total area is about 1,47,570 sq km. Zoogeographically, Bangladesh is an interesting country lying at the junction of the Indian and Malayan sub-regions of the Indomalayan Realm. Three sides of Bangladesh are covered with India and South-East side is covered with Myanmar (Appendix 7). Bay of Bengal is situated in the South side of Bangladesh. The West bengal of India is situated in the West side of Bangladesh. Meghalaya is to the North, Assam, Tripura, and Mijoram is to the East of Bangladesh. It means that Bangladesh is enclosing with India largely. Total boundary line of Bangladesh is about 4712 km. The length of boundary line with India is about 3715 km with Mayanmar 280 km and rest about 716 km is the coast line. The political sea line of Bangladesh is about 12 nm. Bangladesh may be divided into four physical regions: the Ganges- Brahmaputra Delta, the Barind Tract, the Central Region and the Chittagong

Region. The Ganges, Brahmaputra, Meghna and several smaller rivers unite in Bangladesh to form the largest deltaic system in the world (Akonda, 1987). Bangladesh is a low-lying, riverine country situated in South Asia with a largely marshy jungle coastline of 710 km (441 mi) on the northern littoral of the Bay of Bengal. Formed by a big delta plain at the confluence of the Ganges (Padma), Brahmaputra (Jamuna), and Meghna Rivers and their tributaries.

Physical geography

The physical geography of Bangladesh is varied and has an area characterized by two distinctive features: a broad deltaic plain subject to frequent flooding, and a small hilly region crossed by swiftly flowing rivers. On the south is a highly irregular deltaic coastline of about 580 kilometers, fissured by many rivers and streams flowing into the Bay of Bengal. The territorial waters of Bangladesh extend 12 nautical miles (22 km), and the exclusive economic zone of the country is 200 nautical miles (370 km). The plain is part of the larger Plain of Bengal, which is sometimes called the Lower Gangetic Plain. Although altitudes up to 105 meters above sea level occur in the northern part of the plain, most elevations are less than 10 meters above sea level; elevations decrease in the coastal south, where the terrain is generally at sea level. With such low elevations and numerous rivers, water—and concomitant flooding—is a predominant physical feature. About 10,000 square kilometers of the total area of Bangladesh is covered with water, and larger areas are routinely flooded during the monsoon season. The only exceptions to Bangladesh's low elevations are the Chittagong Hills in the southeast, the Low Hills of Sylhet in the northeast, and highlands in the north and northwest. The Chittagong Hills constitute the only significant hill system in the country. Altitudes of the Chittagong Hills from 600 to 900 meters above sea level. At 1,052 meters altitude, the highest elevation in Bangladesh is found at Mowdok Mual, in the southeastern part of the hills. The country produces large quantities of quality timber, bamboo, and sugarcane. A variety of wild animals are found in the forest areas, such as in the Sundarbans on the southwest coast, which is the home of the Royal Bengal Tiger. The alluvial soils in the Bangladesh Plain are generally fertile and are enriched with heavy silt deposits carried downstream during the rainy season.

Urbanization is proceeding rapidly, and it is estimated that only 30% of the population entering the labor force in the future will be absorbed into agriculture, although many will likely find other kinds of work in rural areas. The areas around Dhaka and Comilla are the most densely settled. The Sundarbans, an area of coastal tropical jungle in the southwest and last wild home of the Bengal Tiger, and the Chittagong Hill Tracts on the southeastern border with Burma and India, are the least densely populated.

Soil Type

Soil of the country is highly fertile, but vulnerable to flood and drought. Roughly 80% of the landmass is made up of fertile alluvial lowland called the Bangladesh Plain. Hills rise

above the plain only in the Chittagong Hill Tracts in the far southeast and the Sylhet division in the northeast.

Climate

Heavy rainfall is characteristic of Bangladesh causing it to flood every year. Three seasons are generally recognized: a hot, muggy summer from March to June; a hot, humid and rainy monsoon season from June to November; and a warm-hot, dry winter from December to February. In general, maximum summer temperatures range between 38 and 41 °C (100.4 and 105.8 °F). April is the hottest month in most parts of the country. January is the coolest month, when the average temperature for most of the country is 16–20 °C (61–68 °F) during the day and around 10 °C (50 °F) at night. Straddling the Tropic of Cancer, Bangladesh has a tropical monsoon climate characterized by heavy seasonal rainfall, high temperatures, and high humidity. Natural disasters, such as floods, tornadoes, and tidal bores affect the country yearly. Bangladesh also is affected by major cyclones, on average 16 times a decade. A cyclone struck the southeastern coast in May 1991. Cyclone Sidr struck the southwestern coast on 15 November 2007, affecting not only the coastal districts of the administrative division Khulna but also about half of the tropical forest Sundarbans.

Winds are mostly from the north and northwest in the winter, blowing gently at 1 to 3 kilometers per hour (0.6 to 1.9 mph) in northern and central areas and 3 to 6 kilometers per hour (1.9 to 3.7 mph) near the coast. From March to May, violent thunderstorms, called northwesters by local English speakers, produce winds of up to 60 kilometers per hour (37.3 mph). During the intense storms of the early summer and late monsoon season, southerly winds of more than 160 kilometers per hour (99.4 mph) cause waves to crest as high as 6 meters (19.7 ft) in the Bay of Bengal, which brings disastrous flooding to coastal areas.

River System

The rivers of Bangladesh mark both the physiography of the nation and the life of the people. About 700 in number, these rivers generally flow south. The larger rivers serve as the main source of water for cultivation and as the principal arteries of commercial transportation. The rivers also drain excess monsoon rainfall into the Bay of Bengal. The profusion of rivers can be divided into five major networks. The Jamuna-Brahmaputra is 292 kilometers long and extends from northern Bangladesh to its confluence with the Padma. Originating as the Yarlung Tsangpo River in China's Xizang Autonomous Region (Tibet) and flowing through India's state of Arunachal Pradesh, where it becomes known as the Brahmaputra ("Son of Brahma"), it receives waters from five major tributaries that total some 740 kilometers in length. At the point where the Brahmaputra meets the Tista River in Bangladesh, it becomes known as the Jamuna. The Jamuna is notorious for its

shifting subchannels and for the formation of fertile silt islands (chars). No permanent settlements can exist along its banks.

The second system is the Padma-Ganges, which is divided into two sections: a 258-kilometre segment, the Ganges, which extends from the western border with India to its confluence with the Jamuna some 72 kilometres west of Dhaka, and a 126-kilometre segment, the Padma, which runs from the Ganges-Jamuna confluence to where it joins the Meghna River at Chandpur. The third network is the Surma-Meghna River System, which courses from the northeastern border with India to Chandpur, where it joins the Padma. The Surma-Meghna, at 669 kilometres by itself the longest river in Bangladesh, is formed by the union of six lesser rivers. Below the city of Kalipur it is known as the Meghna. When the Padma and Meghna join together, they form the fourth river system—the Padma-Meghna—which flows 145 kilometres to the Bay of Bengal. Like the Jamuna, the Padma-Meghna and other estuaries on the Bay of Bengal are also known for their many chars.

A fifth river system, unconnected to the other four, is the Karnaphuli. Flowing through the region of Chittagong and the Chittagong Hills, it cuts across the hills and runs rapidly downhill to the west and southwest and then to the sea. The Feni, Karnaphuli, Sangu, and Matamuhari—an aggregate of some 420 kilometres—are the main rivers in the region. The port of Chittagong is situated on the banks of the Karnaphuli. The Karnaphuli Reservoir and Karnaphuli Dam are located in this area. The dam impounds the Karnaphuli River's waters in the reservoir for the generation of hydroelectric power. The Ganga–Brahmaputra rivers contribute nearly 1000 million tons/yr of sediment. The sediment contributed from these two rivers forms the Bengal Delta.

1.4 Conception of the action plan

There is a process of making bird management action plan. It needs to arrange interview of stakeholders and local people to collect information about bird diversity and status. Consultation from experts is necessary to make action plan. Making decision which field you select for preparing action plan is also important. Resource person, references and using of websites are also the important components of preparing management action plan.

Conservation Priority Setting

A generic framework for setting conservation priorities based on the principles of classic decision theory is provided. This framework encapsulates the key elements of any problem, including the objective, the constraints, and knowledge of the system. While some approaches prioritize assets or locations for conservation investment. It is concluded here that prioritization is incomplete without consideration of the conservation actions required for conservation of assets at particular locations. Using the

general framework for setting up conservation priorities, multiple criteria can be rationally integrated and where, how, and when to invest conservation resources can be scheduled. Trade-offs is unavoidable in priority setting when there are multiple considerations, and budgets are almost always finite. Very large-scale strategic mapping leads to familiar conservation priorities exemplified by biodiversity hotspots. In contrast, tactical conservation actions unfold on much smaller geographical extents and they need to reflect the habitat loss and fragmentation that have sharply restricted where species now live. It should exist range maps of endangered bird species (see Appendix 1) to identify priority conservation areas that would conserve the greatest number of species at risk in Bangladesh. By at risk species, it means those that are endemic, significant population reduction within 1 – 2 decades and have small ranges. The estimated ranges of these species shrank by 18-100% after accounting for habitat and suitable elevation (Ocampo-Peñuela and Pimm, 2014). By incorporating detailed maps of natural habitats, practical recommendations for conservation actions should be made. A series of national and regional workshops need to be organized, resulting in the identification of all Important Bird Areas (IBA). A second level of prioritization among IBAs, that included information about opportunities for action as well as bird population data, identify IBAs as high priority areas for conservation action (Arizmendi et al., 2005). It is recommended that restoration of natural forest and habitat including wetlands and implementing Co-management policy are important.

Followings are the priorities for the conservation of bird

1. Documentation of existing habitats and species, including its status and distribution.
2. Develop action plans for protection and conservation of threatened bird species of Bangladesh.
3. Develop protected area-based inventory of bird species, including their importance and role in nature.
4. Ensure that all sectors of the Bangladesh society, including Government at different levels, are fully aware of the need to conserve bird diversity and of their personal and institutional responsibility in this task.
5. Develop suitable measures to promote co-management of PAs and designate community conservation areas.
6. Values of the different goods and services provided by the bird diversity to the economy of the country and its people.
7. Promote understanding and awareness of stakeholders on the importance and methods for conservation through appropriate communication tools, including development of local language material.
8. Identify indicators for the monitoring bird diversity and their environment.

9. Support breeding programmes for critically endangered bird species (see Appendix 1) by ensuring native genetic stocks are maintained.
10. Identify the impacts of climate change, desertification, floods and other processes on the integrity of habitats and species and develop suitable management plans.
11. Identify key habitats that ensure ecosystem integrity and connectivity (corridors, migratory flyways of birds) and support actions to maintain and promote connectivity between such areas.
12. Enhance capabilities as well as understanding on issues of conservation, management and use to relevant stakeholders.
13. Enhance support to do research by academic institutions working on elements of bird management action plan.
14. Strengthen institutional capacities of different sector and individual level to deal with issues of negotiation as well as implementation.

2 Threatened birds of Bangladesh

2.1 Conservation status

The International Union for Conservation of Nature and Natural Resources (IUCN) Red List uses a hierarchical structure of nine categories for assigning threat levels for each bird species or subspecies. These categories range from 'Extinct' to 'Least Concern' (Figure 1). At the highest levels of threat, taxa are listed as 'Critically Endangered,' 'Endangered,' or 'Vulnerable,' all of which are given 'Threatened' status. A series of quantitative criteria is measured for inclusion in these categories, including: reduction in population size, geographic range size and occupancy of area, total population size of birds, and probability of extinction. The evaluation of these criteria includes analyses regarding the number of mature individuals, generation time, and population fragmentation. Each taxon is appraised using all criteria. However, since not all criteria are appropriate for assessing all taxa, satisfying any one criterion qualifies listing at that designated threat level of bird species.

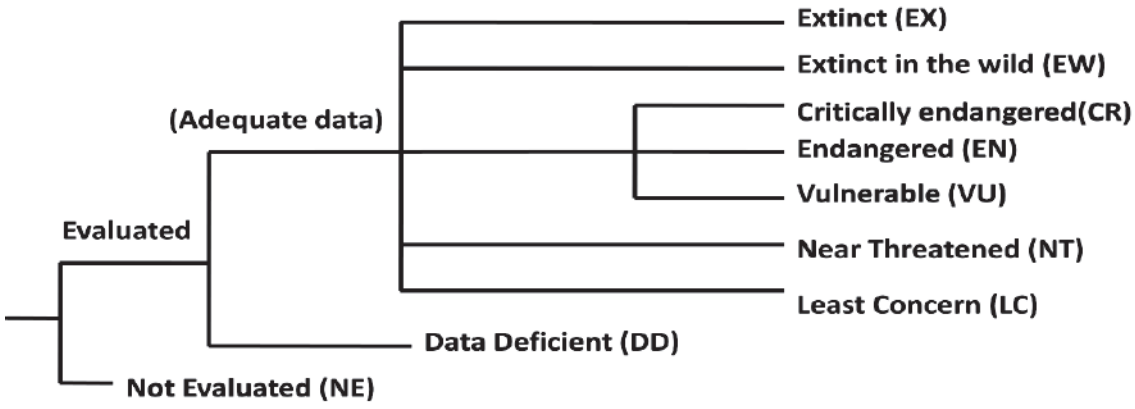

Figure 1. IUCN categories used in deciding where to place species for protection and their position relative to one another.

2.2 Bird Species

There are about 628 bird species in Bangladesh, out of which 244 are migratory. A total of 41 species of birds categorized as threatened species, of them 36 species are non-passerines and rest 5 species passerines (Table 1 and Appendix 1) (IUCN, 2000). Of the threatened species of birds, 19 species are critically endangered, 19 endangered and 3 vulnerable (Appendix 1).

The wetlands are the important habitat of migratory waterbird population. The wetlands are the important habitat of about 70 species of resident waterbirds including ducks, grebe, cormorants, bitterns, herons, egrets, storks, rails, jacanas, finfoot, waders, gulls, turns, skimmers etc. and many other fish eating (piscivores) birds. As mentioned in the

IUCN Red Book, about 100 species of migratory birds regularly or occasionally visit the country.

"The Asia-Pacific Migratory Waterbird Conservation Strategy" 2001-2005, identified 50 species of migratory waterbirds as threatened, out of which 14 species occur in Bangladesh. In addition to that eleven species of resident waterbirds are also identified as threatened species. According to the Red Book of Threatened Birds of Bangladesh 2000 the important threatened species are Masked Finfoot (*Heliopais personata*), Indian Skimmer (*Rhynchops albicollis*), Black-headed Ibis (*Treskeornis melanocephala*), Greater Adjutant (*Leptoptilos dubius*), Lesser Adjutant (*L. javanicus*), Baikal Teal (*Anas formosa*), Baer's Pochard (*Aythya baeri*), Ferruginous Pochard (*Aythya ferina*), Wood snipe (*Gallinago nemoricola*), Norman's Green shank (*Tringa guttifer*), Spoon-billed Sandpiper (*Eurynorynchus pygmeus*).

Table 1. Number of the threatened bird species according to the IUCN 2000

Group	Total No. Of Living Resident Species	Extinct	Threatened				Data deficient (DD)	Not Threatened (NO)
			Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)	Total		
Birds	388	6	19	18	4	41	158	189

2.3 Habitat

When defining bird habitats, biologists generally consider both the type of vegetation and landscape a species uses, as well as particular attributes of the vegetation. Habitats are important for predicting where birds can be found and for developing strategies for their conservation and management.

Forest habitat

Terrestrial habitats of birds include forests, grasslands, deserts and rainforests. They are typically defined by factors such as plant structure (trees and grasses), leaf types (e.g., broadleaf and needle leaf), plant spacing (forest, woodland) and climate. Grasslands include a variety of upland grass-dominated habitats. In general, grasslands occur on dry slopes and have well-drained sandy or loamy soils.

Viability of bird species is dependent upon maintaining a mixture of vegetation quantity, quality and distribution. Terrestrial means living and moving 'on land'. Avifauna use different vegetative and structural stages for feeding, breeding and cover. Vegetation change, both natural and human-caused is the major influences on terrestrial birds. Spatial characteristics of landscapes—such as fragmentation, patch size distribution and

connectivity—are largely determined by management actions and their interactions with natural disturbances such as fire, insects, and disease.

Hill Forests: Wet evergreen and semi-evergreen forests occur in hilly areas of Bangladesh. Hilly forest extends from Teknaf peninsula, north along the Myanmar border to Chittagong hills and Chittagong Hill Tracts (CHT), and low hills in the district of Hobigonj, Moulvibazzar and Sylhet.

Wet evergreen forests are magnificent dense forests and support a diversified and rich in biodiversity. The trees in the top canopy attain a height of about 45-60m. A few semi-evergreen species may occur but they do not affect the evergreen nature of the forests. The floral diversity is rich with epiphytes, orchids, and woody and non-woody climbers, ferns, mosses and palms particularly in shady moist places. Herbs and grasses are abundant and the undergrowth is a tangle mass of shrubs, bamboo and canes/rattans. These forests occur in shady areas of CHT, Chittagong, Cox's Bazar, Hobigonj, Moulvibazzar and Sylhet (Das 1990, Hossain and Hoque 2013). Major dominant tree species are boilam (*Anisoptera scaphula*), chapalish (*Artocarpus chama*), garjan (*Dipterocarpus turbinatus, D. alatus, D. costatus*), telsur (*Hopea odorata*), champa (*Michelia champaca*), narikeli (*Pterygota alata*), civit (*Swintonia floribunda*), etc. About 700 species of flowering plants grow in this forest type (Pasha, Banglapedia). Bamboo is abundant throughout the hilly areas and Alam et al. (1996) recorded 18 bamboo species from Bangladesh.

Semi-evergreen forests occur in CHT, Cox's Bazar, Chittagong and Sylhet in more exposed dry areas. Trees in the top canopy reach a height of about 25-55m. In this forest type, the evergreen species predominate but there are many deciduous species. As many of evergreen forest species occur here, only during winter these forests are distinguishable from evergreen forests. Over 800 species of flowering plants have been recorded in this forest type (Pasha, Banglapedia). In the forest, there are several layers of plants they provides food and shelter for many species of birds. Some bird e.g., palm swift, drongos, bee eaters forage on open space in and around the forest. They seat on the tree branches and prey insect from the air.

Management alternatives for Forest Plan revision either contribute to or mitigate changing patterns of habitat alteration and fragmentation, and disturbance to birds. Particular attention is paid to those species whose viability may be affected by the alternatives and their associated activities. Species with a viability concern include those listed or proposed for listing under the Endangered Species Act, those on the Regional Forester's sensitive species list, species at risk, and Forest Management Indicator Species for which populations and habitat conditions may be a concern. Currently, there is no approved or standardized viability analysis approach used by the Forest Service, and the discussion is continuing at the national level.

Moist Deciduous Forests: They are known as sal (*Shorea robusta*) forests. Sal growing areas of Bangladesh fall within Indian region. They are deciduous in nature except a few patches

along the foot hills of Garo hill which are semi-evergreen type. In Bangladesh, sal forests are found in Dhaka, Gazipur, Tangail, Mymensingh, Sherpur, Jamalpur, Netrokona, Dinajpur, Rajshahi, Panchagar, Rangpur, Naogaon and a small patch in Comilla (Chowdhury, 1994).

Sal is the dominant species in this forest type and usually form 75% - 100% of the upper canopy but may be absent locally over large patches. The associates are other species but they vary in different localities. The trees are 10-25m in height. Associate species are Palas *(Butea monoserma),* haldu *(Adina cordifolia),* sildha jarul *(Lagerstroemia parviflora),* kumbi *(Careya arborea),* hargaza *(Dillenia pentagyna),* bhela *(Semecarpus anacardium),* koroi *(Albizia procera),* gandhi gazari *(Miliusa velutina),* menda *(Lisea monopetala),* chapalish *(Artocarpus chama),* bahera *(Terminalia bellirica),* hortiki *(Terminaria chebula),* amloki *(Phyllanthus emblica),* etc. Undergrowth includes sungrass and other grasses. Among the palms, only rattans are found along the outskirts.

Mangrove Forests: The mangroves are found in the form of natural and planted forests in Bangladesh. The natural ones are the Sundarbans is on the western part of coastline under Khulna Division and the Chakoria Sundarbans in Chittagong District on the eastern part. Mangrove plantations have been raised along the shoreline and near shore islands of Bangladesh during the last 50 years (Siddiqi, 2002). Sundari *(Heritiera fomes)* and gewa *(Excoecaria agallocha)* are the dominant species of the Sundarbans. Other commercially important trees include kankra (*Bruguiera sexangula*), goran *(Ceriops decandra),* shingra *(Cynometra ramiflora),* kripa *(Lumnitzera racemosa),* keora *(Sonneratia apetala),* passur *(Xylocarpus mekongensis),* etc. The palms include golpata *(Nypa fruticans)* and hantal *(Phoenix paludosa).* There are about 70 species in the Sundarbans including 28 true mangrove species while others are mangrove associates (Chaffey and Sandom, 1985).

Initial vegetation of the Chokoria Sundarbans included 53 species (Cowan, 1926). The forests consisted mainly of *Ceriops decandra* and *Avicennia officinalis*. A notable feature of the forest is complete absence of *Nypa fruticans*, although this species grows naturally further south.

Homestead Forests: Planting trees near homesteads is a traditional land use system in Bangladesh. They form small scattered groves in different stories around villages through ecological and anthropogenic selections. The village forests comprise 10% of the total forests areas of the country but they contribute to substantial wood production, almost 80 percent. Homestead flora includes annual herbs to woody perennial indigenous and exotic species of multiple uses. Trees are dominant and common features of homesteads (Alam and Masum, 2005). Village trees in Bangladesh are represented by 183 species (excluding bamboo) covering 136 genera under 48 families. Floristic elements of village tree flora consist of native, African and New World texa. About 50 species are exotic and many of them have been naturalized (Alam *et al.*, 1996).

Common trees of upper stratum are *Albizia procera*, *A. lebbeck*, *Aphanamixis polystachya*, *Artocarpus heterophyllus, Artocarpus lacucha, Polyalthia longifolia,*

Aalstonia scholaris, Azadirachta indica, Dillenia indica, Mangfera indica, Cordial dichotoma, Elaeocarpus floribundus, Bombax ceiba, Syzygium cumini, Albizia saman, Swietenia macrophylla, Tamarindus indica, Toona cialiata, Acacia nilotica, Lagerstroemia speciosa, Ficus bengalensis, F.religiosa, F. racemosa, Anthoceprhalus chinensis, eucaluptus camaldulensis, Areca catechu, Borassus flobellifer, Cocos nucifera, Gmelina arborea, etc (Khan and Alam 1996). The mid stratum is dominated by medium to small trees and bamboos. Plants of medicinal value, fruit trees and rattans are also found.

Coastal Aforestation: Creation of mangrove plantation along the coast is in progress since 1966 with primary objective to protect the human lives and properties against cyclones and tidal surges. In fact, Bangladesh is the pioneer country in coastal plantation in the world. Keora (*Sonneratia apetala*) and baen (*Avicennia officinalis*) are the main planting species. Up to 2013, an area of 196,000 ha has been planted with mangroves. A considerable proportion is lost through erosion and encroachment of forest land. Net plantation area is 132,000 ha (BFD, 2014). In recent years, mesophytes have been successfully established by planting the seedlings on excavated heaps in relatively matured coastal land not frequently inundated by tidal water (Siddiqi, 1996).

Riparian Habitats

A good number of species use riparian areas for nesting. These types of habitats are believed to support potential bird species at risk. Riparian habitats account for a very small portion of land area, but support additional species besides birds. These habitats are adjacent to rivers and streams or occurring on nearby floodplains and terraces. Riparian habitats are shaped and maintained through seasonal flooding, scour, and soil deposition. Floods replenish nutrients, recharge groundwater, and reset succession processes. Riparian habitats occur along rivers and streams at all elevations, from valley bottom floodplains. Riparian habitats also include springs, seeps, and intermittent streams, and many low elevation alluvial floodplains.

Grassland Habitats

These habitats support many species of birds, particularly the granivores like quails and seed eaters e.g., doves, munia, etc. Many of these species are totally dependent on sagebrush habitats. The sage grouse, a proposed management indicator species, will be analyzed to show potential effects on these habitats.

Aquatic Habitats

Aquatic habitats cover lakes and ponds, rivers and streams, costal habitats, marine and intertidal zones and paddy fields. Below is a description of these various aquatic habitats.

Freshwater Habitat: Freshwater habitats include bogs, ponds, lakes, rivers, streams, reservoirs and paddy fields. Freshwater aquatic habitats typically contain water year-round, while wetlands may dry out in the dry season. All freshwater habitats of Bangladesh are

important feeding and foraging grounds of water birds and fish eating birds including shorebirds. Haor areas in greater Sylhet are the important winter feeding ground of many species of migratory birds, particularly wild ducks and other resident water fowls.

The majority of the natural aquatic fresh water habitats of Bangladesh are wetlands. Intricate network of rivers that drain into and inundate Bangladesh have created many riverine ecosystems in the country (Anon, 2004). The haors in the north-eastern parts of Bangladesh (see Appendix 7) are probably the most complex of seasonally inundated wetlands. They switch between a vast basin of water during the monsoon and a well-networked system of smaller wetlands including beels and khals in the summer. Surface water is the most severely impacted natural resource in the country. All most all haor basins are known for its rich biodiversity. There is little doubt that the seasonally inundated wetlands are amongst the most productive ecosystems. Among the whole haors are considering the ecological value of the haor, the Tanguar haor has been declared a Ramsar site and an Ecologically Critical Area (MoEF 1991, MoEF 2001). The largest *haor* in the country is Hakaluki Haor, which extends over 18,000ha during the rainy season, and consists of more than 80 inter-connected beels. Diversity and population density of birds are very high in these wetland. Many species of migratory birds come in these islands for feeding and foraging in the winter season.

Lakes and Ponds and other natural water bodies: Most reservoirs also are included in these habitats and land cover type as they represent man-made versions of lakes and ponds, which are difficult to distinguish with imagery. Eventually, when the lakes and reservoir coverage for the state is completed, reservoirs might be separated from natural water bodies.

Marsh, man-made Lake and Pond - These habitats feature standing water and believed to support bird species. Water bodies such as reservoirs usually do not meet the needs of many of these species because the drawdown of water for irrigation or power production reduces the quality of shoreline habitats. Marsh, lakes and ponds that have not had their hydrologic regime modified provide the best habitat. Because these habitats are strongly protected by both Forest Plan Management direction and legislation, no significant effects are anticipated from any management alternative. Marshes are seasonally or continually flooded and have water-adapted plants such as sedges, bulrush, rushes and floating vegetation. Marshes can have mucky soils resulting in water with high mineral content and dominated by herbaceous species, often including wildflowers.

Rivers and Streams: These are the open water portions of the stream or river network. Most rivers and streams are mapped as linear features, so these generally apply only to the larger rivers in which both banks can be mapped, or smaller rivers and streams can be created with arbitrary buffer of the mapped stream.

Fresh Water Swamp Forest: This occurs in low lying areas (haor) of Sylhet Division. Large area of swamp forest is covered with grasses namely *Erianthus ravennae, Saccharum*

spontaneum and *Phragmites karka*. These three species grow mixed together but *P. karka* over the other two species near the streams. In the depression where water is stagnant almost throughout the year, *Barringtonia acutangula* forms a pure crop. The undergrowth of *B. acutangula* is *Calamus tenuis*. In the elevated grassland, *Albizia procera, Bombax ceiba, Cordial dichotoma* and *Lagerstroemia speciosa* are found growing scattered. Species observed along the river bank and near the villages are *Pongamia pinnata, Trewia nudiflora, Crataeva magna* and S*alix tetrasperma.* This is a highly productive ecosystem and supports plenty of fish and an ideal habitat for the migratory birds.

Wetland habitat: This is a place where the water controls the environment, the plant and animal life. In the wetland habitat, ground is wet or covered with water for most of the year. The wetlands are rich with biodiversity. Since these areas are covered with water and available of diverse aquatic organisms, many species of aquatic birds e.g., herons, egrets, snips, sandpipers, water fowls, etc. come for foraging and feeding of those small vertebrate and invertebrate animals including fishes. Wetlands are covered with water during all or part of the year. Permanently wet habitats include backwater sloughs, oxbow lakes, and marshes, while seasonally wet habitats include seasonal ponds and vernal pools. Wetland habitats are highly diverse and include the following different types:

Alkaline wetlands occur in depressions in more arid areas and are intermittently flooded. An impermeable soil layer prevents water from percolating through the soil and concentrates salts in some areas. Soil salinity varies greatly by soil moisture and type and determines plant species. Plant species are tolerant of saline conditions due to the concentration of salts by water evaporation. Vegetation includes salt-tolerant grasses, rushes, sedges and shrubs such as black greasewood.

Deciduous swamps and shrub lands are located in depressions, around lakes or ponds or on river terraces. They generally flood seasonally with nutrient-rich waters and are dominated by woody vegetation.

Seasonal ponds and vernal pools hold water during the winter and spring but typically dry up during the dry summer months. Vernal pools occur in complexes of networked depressions that are seasonally-filled with rainwater. They host a variety of species with unique adaptations.

Near shore Marine and Intertidal habitat: This type includes underwater reefs, kelp beds and other coastal nearshore marine habitats. This habitat is ideal for shore birds and many species of wader birds including wild ducks and geese.

Estuaries occur where freshwater rivers meet the salty waters of the ocean. They are influenced by tidal flooding, and as such experience frequent changes in salinity, water levels, sunlight, and oxygen.

Estuaries have four main subsystems: Marine, bay and riverine. The marine subsystem is at the river's mouth and is dominated by salt-water plants and animals including birds. Bays are characterized by broad mud flats that are alternately covered by water and exposed to the air due to tidal flows. The riverine portion of the estuary extends up the river as far as tides influence water flow and salinity. The river forms a single channel that is usually bordered by salt and brackish marshes. Variation in salinity, tidal inundation, and soils influences marsh plant composition and often results in zones of vegetation, primarily grasses, rushes, sedges, etc.

Special type of habitats: Rural and urban habitat, agricultural lands, fallow lands, etc. can be categorized as species type of habitats. Many species of bird prefer to live in these types of habitats where they forage, make nest and do roosting.

2.4 Stakeholders

Following Units are being established:

- National Wildlife Centre (NWC) may provide, coordinate or support training, research, education and awareness, ICT - based knowledge management and monitoring and evaluation services, as well as having charge of four Wildlife Rescue and Recovery Centres (WRRCs) located in Dhaka, Khulna, Sylhet and Chittagong.

Stakeholders include a wide variety of groups which can be categorize according to their relation to wildlife conservation and protected areas (Figure 2).

Categories according to relation to wildlife	Stakeholders (not exhaustive)
Directly managing habitat, wildlife and protected areas	BFD, WNCC
Law enforcement related to wildlife utilization and trade	Wildlife Crime Control Unit (WCCU), police, custom officers and staffs, BGB (Border Guard of Bangladesh), Ansar battalion, judiciary, Coast guards, Airport, Seaport and Landport authorities, etc.
Research, monitoring and awareness creation by National and International organizations	Universities, Bangladesh Bird Club, Zoos, IUCN, Birdlife International, Wetland International, etc
General awareness creation with regard to wildlife conservation and sustainable use	BFD, NGOs, Forest Department, media, etc.
Sharing land, resources and space with wildlife	Communities, school and college teachers, CMC, CPG, Response team resource users, public and private sectors
Influencing policies regarding wildlife and protected areas	Ministries, BFD, NGOs, politicians, community leaders, local media

Figure 2. Overview of different stakeholder categories.

3 Policy and institutional framework

3.1 Legislation

National policy and legislation are crucial for migratory waterbirds and wetlands of Bangladesh.

3.1.1 Laws

- **Bird species are protected under Wildlife (Preservation & Security) Acts, 2012, Bangladesh.**

The wildlife law provides for the protection and preservation of wildlife as well as their habitat. The Wildlife Order defines various protected areas in the form of game reserves, national parks and wildlife sanctuaries and aims to preserve wildlife including birds in those protected areas. The wildlife sanctuary regime also requires undisturbed breeding ground for the protection of wildlife as well as all natural resources in the sanctuary. The Act classified the wild animals as game and protected animals and listed them in the annexed schedules. While the game animals can be killed or hunted with a permit, protected animals are fully protected except for saving life, crops or livestock. The schedules of the Act are revisited and modified regularly as the status of threats to different species changes. Penalties for first time offences under the Wildlife Order may be payment of a nominal amount of compensation to the Conservator of Forests. Offences under the Act can also be tried by a First Class Magistrate.

3.1.2 Environmental Conservation Act, 1995 (amendment 2000, 2002) and the relevant Notifications, Circulars

The Environmental Conservation Act 1995 (ECA) is powerful law for ensuring conservation and sustainable use of the biological resources of the country and protection of its environment. Many of its loopholes were remedied in the subsequent amendments, Notifications and Circulars. The ECA is designed to conserve the environment, improve environmental standards and control and mitigate environmental pollution. It has overridden other inconsistent laws, established a Department of Environment empowered to intervene in almost all areas of environmental concerns, provided operational definition of important phrases like conservation, environment, eco-system, pollution etc. and prescribed punishment for various environmental offences. Section 5 of the Environment Conservation Act, 1995 provides for in-situ conservation by empowering the Government to declare areas as Ecologically Critical Areas and to take measures to protect the ecology of those areas provided that it is satisfied that the ecosystem of that area has reached or is likely to reach a `critical state'. In these ECAs, a ban is imposed on some activities, including the felling or extracting of trees and forest products; hunting and poaching of wild animals; catching or collection of snails, corals, turtles and other creatures, any activity that may threaten the habitat of

flora and fauna; activities likely to destroy or alter the natural characteristics of soil and water; controls over the establishment of industries that may pollute soil, water, air and/or create noise pollution and other activities that may be harmful for the fish and other aquatic life. The ECA itself, as fell as subsequent notifications, fails to specify a monitoring mechanism for the enforcement of its provisions. ECA, 1995 – Declaration of ecologically critical areas.

3.1.3 Environment Conservation Rules 1997,

Under the ECR 1997, industries have to carry out an EIA, install environmental treatment plants, conform to environmental quality standards, report accidents or unforeseen discharges of pollutants, and take remedial measures. The DoE issues Environmental Clearance Certificates which indicate that an industrial unit is conforming to the ECR.

The Environment Conservation Rules, 1997 were issued by the Government of Bangladesh in exercise of the power conferred under the Environment Conservation Act (Section 20), 1995. Under these Rules, the following aspects, among others, are covered:

(i) Declaration of ecologically critical areas

(ii) Classification of industries and projects into 4 categories

(iii) Procedures for issuing the Environmental Clearance Certificate

(iv) Determination of environmental standards

3.1.4 Forest Act 1927 (Amended in 2000)

The Act empowers the Government to declare any are of forest as Reserved or Protected and by doing that it may take measures for in-situ conservation of biological diversity. The government may also establish its control over portions of private forest by declaring them as controlled or vested forests and conversely assign the village community to the management of portions of reserved forest.

Any acts or omission detrimental to the natural resources of reserve and protected forests are prohibited and are punishable offences. Among them, the more serious ones include making fresh clearing of forest lands, removing timbers, setting fires, felling or otherwise damaging trees, clearing or breaking up any land for cultivation or any other purpose, hunting and poisoning water. The Act, however, allows any such work with permission of the Forest Officer, without clearly specifying what criteria have to be observed by the concerned officer in giving such permission. The Act also fails to establish a stringent regulatory regime for the protected forest areas and to provide for establishment of surrounding buffer zones for more effective regulation of reserved and protected areas. It also fails to provide sufficient recognition to indigenous practices and techniques for forest conservation including sustainable methods of zoom cultivation.

The Forest Act 1927 was amended further in April 2000 to provide for establishment of social forestry involving local community participation in the management regime. These rules are still under preparation by the Forest Department. It is feared that unless conservation guidelines including those concerning alternative livelihood are framed properly, the community might be moved more by the needs for overexploitation of forest resources. By virtue of section 26 (1A) and Section 32, the fisheries resources of the water bodies of any reserve or protected forest are protected from illegal fishing, poisoning of water and setting traps and snares.

3.2 National Policies

Environment Policy 1992: The environmental policies of Bangladesh have mostly been formulated in the post-Rio era. Among them, the Environment Policy of 1992 focuses solely on environmental issues. Under the Environmental Policy, the Department of Environment is assigned with the responsibility to implement the policies concerning protection of ECAs. Forest Department is responsible for managing Protected Areas and wildlife, whereas many forest areas are actually beyond the legal jurisdiction of MoEF. Furthermore, most of the concerned Ministries and Departments including the MoEF lack institutional capacities in terms of human, technological and financial resources needed for proper implementation of the policies. It is, therefore, imperative to make coordinated and integrated efforts to prioritise the areas of relevant legal and policy reform for facilitating wise and sustainable use of our bird diversity resources.

Forest Policy, Ordinance and Acts: Forest Act (FA) of 1927 provides the regulatory guidelines for forest protection and implementing the National Forest Policy.

National Fisheries Policy, 1992 provides the guidelines about the sustainable uses of fish and fisheries product.

Wetland Policy (Draft), 1998: The forestry Policy of 1994 and Land Use Policy of 2001 address sectoral aspects of sustainable development.

National Water Policy, 1999 provides the guidelines about the sustainable use of water resources.

Coastal Zone Policy, 2004 provides the guidelines about the sustainable utilization of coastal zones.

In the environment and forest policies, the conservation of biodiversity has suffered piecemeal treatment. Other important policies relating to the bird management action plan in Bangladesh include Fisheries Policy of 1998, National Agriculture Policy of 1999, National Water Policy of 1999 and Export Policy of 1997-2002. The Report of 1997 on National Conservation Strategy Plan has been developed that covers a wide range of issues except that of natural resource management. Unless those issues are included in the final policy, it would have no direct impact in influencing people's attitude towards

birds and environmental protection. The formulated policies, although fairly rich in content, are frequently not bolstered or supported by necessary actions of implementation. A national conservation strategy is still awaiting approval of the Government, which might facilitate to effectuate the environment-related provisions contained in the policies. Furthermore, although many of the policies underline the importance of amending existing laws and formulation of new laws, only two such examples exist, namely the ECA of 1995 and ECR of 1997.

Policies are not always convenient for implementation either. This is due to a number of factors including the lack of consistency between them and the institutional weaknesses of the line agencies of the Government. As mentioned above, some provisions of the Fisheries Policy contradict that of the Land or Industrial Policy; the Environmental Policy does not conform to the narrow objectives of the Export Policies etc. The Agriculture Policy puts emphasis on increased irrigation from surface water sources viz. khals (canals), beels (wetlands) and rivers, without considering its impact on navigational as well as non-navigational use of the surface water. As a result many species of water birds (white breasted water hen, egrets, herons, etc.) loss their foraging habitat.

3.3 International Convention Agreements

3.3.1 Bonn convention

There was a Bonn convention regarding the conservation of migratory birds. The purpose of the Bonn Convention is to develop international cooperation with a view to the conservation of migratory species of wild animals. Wild animals require special attention because of their importance from the environmental, ecological, genetic, scientific, recreational, cultural, educational, social and economic points of view.

The Convention defines the following terms:

"migratory species" means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries;

"conservation status of a migratory species" means the sum of the influences acting on the migratory species that may affect its long-term distribution and abundance;

"endangered" means that the migratory species is in danger of extinction throughout all or part of the territory of a State.

National and internation conventions are;

1. Bonn (CMS)
2. Ramsar
3. Rio (BD)

Council Decision 98/145/EC of 12 February 1998 on the approval, on behalf of the European Community, of the amendments to Appendices I and II to the Bonn Convention on the conservation of migratory species of wild animals as decided by the fifth meeting

of the Conference of the parties to the Convention (Official Journal L 46, 17.2.1998). This Council Decision contains the list of 21 species of birds to be added to Appendix I to the Convention (endangered species) and 22 species to be added to Appendix II (species conserved through Agreements).

Council Decision 2006/871/EC of 18 July 2005 on the conclusion on behalf of the European Community of the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (Official Journal L 345, 8.12.2006). In accordance with the Bonn Convention, which provides for the conclusion of regional agreements for species listed in Appendix II, on 1 September 1997 the Community signed an agreement establishing an appropriate international legal framework for the conservation of migratory waterbird species and populations, individuals of which migrate in the Palaearctic and Africa. This Decision approves the Agreement on behalf of the Community. The Agreement, which entered into force on 1 November 1999, covers 235 species of waterbirds dependent on wetlands for at least part of their annual cycle and an area of 60 million square kilometres encompassing 116 States (all of Europe and Africa and part of Asia, including Bangladesh). It provides for a number of coordinated measures to achieve and maintain a favourable conservation status for the African-Eurasian migratory waterbirds concerned. These measures include the protection and restoration of sites frequented by migratory birds, a ban on non-indigenous waterbird species and cooperation between States in emergency situations. The Agreement also provides for measures, in the form of an action plan, to assist certain priority species, which it identifies. The action plan includes measures relating to the conservation of these species and their habitats (e.g. prohibition, with certain exceptions, of the taking of birds and eggs, prohibition of disturbance and of trade, conservation and rehabilitation of areas), the management of human activity (e.g. hunting, eco-tourism), research and monitoring (e.g. monitoring of populations, studies of migration routes, evolution of habitats), education and information, and the implementation of the action plan (giving priority to the most endangered species).

In order to conserve biodiversity in Bangladesh a National Conservation Strategy plan 1997 has been prepared. Under this strategy plan all animal species including birds of Bangladesh has been recommended for protection.

3.3.2 Important Birds Areas (IBAs)

The IBA programme aims to guide the implementation of national conservation strategies, through the promotion and development of Protected Areas. IBAs can show where current Protected Area systems miss key species, and how these gaps can be plugged. Birds have been shown to be effective indicators of biodiversity, so the conservation of IBAs ensures the survival of a correspondingly large number of other animals and plants[1].

Important Bird Areas are:

- Places of international significance for the conservation of birds and other biodiversity
- Recognised world-wide as practical tools for conservation
- Distinct areas amenable to practical conservation action
- Identified using robust, standardised criteria
- Sites that together form part of a wider integrated approach to the conservation and sustainable use of the natural environment

Locations of Important Bird Areas (IBAs)

The 12,000 IBAs and in some 200 countries and territories have been identified as Important Bird and Biodiversity Areas that represent the largest global network of important sites for biodiversity. They are identified using internationally agreed criteria applied by local experts.

[1]

The global network is likely to comprise around 15,000 IBAs covering some 10 million km^2 (7% of the world's land surface). Currently, only about 40% of all IBAs receive some form of protection. IBAs are the sites needed to ensure the survival of viable populations of most of the world's bird species. They hold a large and representative proportion of other biodiversity too.

Important IBAs in Bangladesh

All haor areas in greater Sylhet district, coastal area of Bay of Bengal including coastal islands and Sundarbans and all sanctuaries including Pablakhali, Dudhpukuria and Dupachari are the important Bird areas of the country (Appendix 7).

Under Hatiya, Damar Char lies on the central-south coast, at the extreme southern tip of the Lower Meghna delta. This site, along with adjacent localities such as Nijumdip, has previously hosted populations of a number of threatened species, and the area is already designated as an Important Bird Area (IBA) (BirdLife International, 2009). However, from Sonadia island (21.47°N91.87°E) to the south and Belekadia, Kaladia and Hasher Char (21.60°N 91.85°E) to the north currently have no effective protection and, although this is designated as an Ecologically Critical Area by the Government of Bangladesh, it is the site of a proposal to develop a major deep-water port (Mahmud, 2009). This area qualifies as an IBA, meeting criteria A1 and A4i and A4ii (see Global IBA criteria at www.birdlife.org/datazone/sites/global_criteria.html). The other IBAs of Bangladesh are all haor areas of Sunamgonj, Habiganj district, and other costal islands of Bangladesh including Sundarbans.

The wetlands are home to about 70 species of resident waterbirds including ducks, grebe, cormorants, bitterns, herons, egrets, storks, rails, jacanas, finfoot, waders, gulls, turns and

[1] (Source: http://www.birdlife.org/worldwide/programme-additional-info/important-bird-and-biodiversity-areas)
[2] http://archive.thedailystar.net/newDesign/print_news.php?nid=229289

skimmers. Eleven species of resident waterbirds are identified as threatened. The important threatened species are masked finfoot, Indian skimmer, black-headed ibis, greater adjutant, lesser adjutant, Baikal teal, Baer's pochard, ferruginous pochard, wood snipe, Nordmann's greenshank and spoon-billed sandpiper.

The wetlands of Bangladesh are being degraded rapidly due to population pressure, withdrawal of water for irrigation, destruction of swamp forest and many other anthropogenic and natural causes. Large scale habitat conversion, unsustainable harvesting policies and lack of ecological considerations have led to the destruction of valuable wetland habitat for water birds and other associated biodiversity. Immediate action is required for restoring these habitats and conserving the water birds in Bangladesh.

RAMSAR convention[2]

All RAMSAR sites of Bangladesh are also Important Bird Area (IBA). These are namely Hakaluki haor, Tanguar haor and Sundarbans. These areas are the habitat of many important species of bird, particularly the migratory species, such as ducks. Ramsar Convention (Ramsar sites) is concerned with *Wetlands of International Importance*. The convention was signed in Ramsar (Iran) in 1971 and came into force in December 1975. This convention provides a framework for international cooperation for conservation of wetland habitats. The Ramsar convention was adopted to halt the continued destruction of wetlands, particularly those which support migratory waterfowl, and to recognise the ecological, scientific, economic and recreational values of wetlands. The convention places general obligations on contracting party states relating to the conservation of wetlands throughout their territories with special obligations pertaining to that *Wetlands of International Importance*. Ramsar convention agreed to conserve and protect their wetland resources and designate for conservation purposes at least one wetland site of international significance. A widely cited definition of wetlands is found in RAMSAR convention, such as: areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or saline, including areas of marine waters, the depth of which at low tide does not exceed six metres. Bangladesh signed the convention in 1972.

Chalan Beel in Natore District

The Key breeding and staging areas of Bangladesh are: Haor areas such as the Meghna estuary, Tanguar haor and Hail-Hakaluki haors, Chalan Beel, the Sundarbans and other coastal mangroves including Hatia and Nijhum Dweep, haor areas of the north west and off shore Islands.

The Sundarbans mangrove forest of Bangladesh are included within 139,699 ha (539 sq mi) of 3 Wildlife sanctuaries which are part of the Sundarbans World Heritage Site. The Ministry of Environment and Forests (MoEF) through its Department of Environment and Forest Department 'Wildlife Management and Nature Conservation Circle' is the main institutional structure for wildlife conservation including waterbirds and their habitats. The Ministry of

Land is the legal authority for land management including wetlands. Bangladesh is signatory to CBD, CMS, CITES and Ramsar Convention. No national level initiative has been taken for waterbirds. But self-funded waterbird census is undertaken each year in selected habitats.

According to Asian Water Bird Census bird population has been decreasing in south east areas including Bangladesh (Table 2 and 3).

Table 2. Water Bird Population Size in south Asian countries

Publication	Start year	End year	Minimum	Maximum	Estimate quality
WPE 1	0	0	10,000	13,000	
WPE 2	0	0	10,000	13,000	
WPE 4	0	0	6,000	9,000	
WPE 3	0	0	9,800	12,400	
WPE 5	2000	2000	6,000	9,000	
CSR 4	2000	2000	6,000	9,000	Expert opinion
CSR 5	2000	2000	6,000	9,000	Expert opinion

Source: Asian Water Bird Census Report

Table 3. Water Bird Population Trends south Asian countries

Publication	Start year	End year	Trend	Trend quality
WPE 1	1982	1982	STA	
WPE 2	1982	1982	STA	
WPE 4	1985	2005	DEC	
WPE 3	1990	2000	STA	
WPE 5	1996	2006	DEC	Poor
CSR 4	1995	2005	DEC	Poor
CSR 5	1996	2006	DEC	Poor

Source: Asian Water Bird Census Report

3.4 Current protection system

3.4.1 Overview

Wildlife conservation is the practice of protecting endangered plant and animal species and their habitats. Among the goals of wildlife conservation are to ensure that nature will around for the future generation to enjoy and recognize the importance of wildlife and wilderness lands to humans. Wildlife conservation has become an increasingly importance due to negative effects of human activity on wildlife. An endangered species is defined as a

population of living being that is at the danger of becoming extinct because of several reasons. Either they are few in number or are threatened by the varying environmental factors or predation parameters.

There are a variety of methods currently being implemented to save threatened species in Bangladesh. The most common are creation of protected areas, captive breeding and reintroduction, conservation legislation, and increased public awareness.

3.4.2 Institutional setup

The success of the Threatened Bird Management Action Plan should lie essentially in its implementation and follow-up. A key to the achievement of its effective implementation is the establishment and continuation of an administrative structure that will ensure its implementation and subsequent monitoring and reviewing. The Ministry of Environment and Forests, the focal point of the CBD is responsible for the conservation and management of bird diversity in the country. The responsibility of conserving and managing the bird diversity is shared by a number of different government bodies, including the Ministries of Agriculture, Fisheries and Livestock, Land, and Water Resources, WNCC, WCCU, etc. The Department of Forest is a specialized body dealing with the management of forest reserves, birds and protected areas. The Department of Environment is another specialized body under the MoEF, dealing primarily with the "brown" and "gray" issues and management of ECAs in the environment sector. Research institutions like BFRI, and some university departments are conducting research and action programmes on bird diversity documentation and management. Some NGOs include IUCN, Nature Conservation Management (NACOM), WildTeam, Center for *Natural* Resource Studies (CNRS), etc. are also engaged in carrying out action programmes related to bird diversity conservation and policy issues.

3.4.3 Protected areas of Bangladesh

The first and foremost work is to designate protected areas in order to make an effective and internationally recognized strategy for conserving species and ecosystems. Protected area as "an area of land and/or sea especially dedicated to the protection of biological diversity and of natural and associated cultural resources, managed through legal or other effective means." In Bangladesh there are several categories of protected areas declared for the protection of wildlife particularly the bird species. These are sanctuary, National park, game reserve, recreation park, wildlife refuges, etc. and some Ecologically Critical Areas (ECA) (see Appendix 5). The IUCN has defined six protected area management categories, based on primary management objective. These categories are defined in detail in the Guidelines for Protected Areas Management Categories published by IUCN in 1994 (Appendix 3). There are 52 protected areas of Bangladesh under different categories of protected systems (Appendix 4 and 5). These protected areas are important for the management of avian diversity in the country.

3.4.4 Benefit sharing arrangement

The Plantation established under social forestry program being harvested at the end of rotation (10 yrs) and the sale proceeds are distributed according to clause-20 of Social Forestry Rules-2004.

In case of woodlot/block and agro forestry plantation on lands under the control of Forest Department , beneficiaries and Forest Department are getting 45% each and 10% is being deposited as the TFF (Tree Farming Fund).

In case of Sal coppice forest conservation and development, Forest Department will get 65%, beneficiaries 25% and Tree Farming Fund 10%. In case of Strip Plantation: Forest Department 10%, land owning agency 20%, beneficiaries 55%, local union council 5% and tree farming fund 10%.

In all cases 10% of the sale proceed have been earmarked as Tree Farming Fund (TFF). The basic idea behind the creation of the TFF is to attain self-sustainability and reduce dependency on donor funds for the re-establishment of the tree cover or plantation, as the next crop.

3.4.5 Co-management

Co-management is usually applicable to the peripheral areas of reserved forests or protected areas for the conservation of habitats and wildlife including bird species. Co-management was first initiated by NSP and then IPAC project build up a foundation of sustainable management. In this management people are expected to be involved in different activities including raising plantations for income generation and to protect the biodiversity including bird diversity. Social forestry must be anchored on felt needs and problems of target beneficiaries. Participation of local people in the management activities are the key principle of social forestry.

The new Wildlife Act includes provisions for the participation of local stakeholders in the management and benefits of protected areas. The Nishorgo Support Project (NSP) and the Integrated Protected Area Co-management Project (IPAC) have developed a consistent approach over a longer period with regard to engaging stakeholders in sustainable natural resources management and the development of co-management of the protected areas. The focus of these plans emphasizes however the role of forest dependent communities in conservation, but not so much the management of biodiversity in the context of national and international conservation priorities.

In the beginning of 2014, co-management of the park is being developed by BFD with support of the CREL project (Climate-Resilient Ecosystems and Livelihoods). This initiative will result in the establishment of Co-Management Organizations, which will involve the local stakeholders in management decisions and benefit sharing. Structure and functions of the co-management committee has been showed in Appendix 6.

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Co-Management of protected areas is a policy target of Bangladesh under strategy of the NBSAP (GoB, 2005). The new Wildlife Act (2012) includes provisions for the participation of local stakeholders in the management and benefits of protected areas under Article 21: (1). The Government may introduce co-management system for proper utilization, conservation and management of natural resources of the sanctuary involving forest department, minor ethnic community living in the forests or local community on participatory basis to ensure active participation of all the parties therein. (2) The Government may, for the purpose of sub-section (1) constitute a committee named as co-management committee and may specify terms of reference of such committee.

Although the co-management approach can contribute significantly to sustainable management of natural resources and biodiversity conservation as a result of improved stakeholder collaboration and benefit sharing, the development of co-management also requires also to be followed critically. Based on current experiences in Bangladesh, some specific issues of concern are:

- co-management organizations and the motivation of its members appear usually dependent on external financial resources rather than self-sustenance and intrinsic motivation;
- apart from being a mechanism for shared resource management, co-management may be used as a vehicle for donor agendas, which may confuse the prime objectives of the co-management system;
- local politics and individual interests may strongly influence the functioning of co-management organizations and play an important role in the selection of its members; so far co-management organizations appear hardly to follow a strategic management plan, even when existing;
- protected area management plans need to address national and international responsibilities with regard to biodiversity conservation, which have, however, often a low priority at local level;

- responsibilities of the co-management organization and the role of FD field staff need to be clear to all actors in a co-management system. Under IPAC, separate Co-Movement Organisations for some PAs have been established and Co-management Plans developed. The plans have not been endorsed by BFD.

The co-management is a collaborative management approach used by government technical agencies to collaborate with local communities and other stakeholders in the conservation of forest lands, wetlands and other natural resources. To implement this approach, co-managers engage local stakeholders through a participatory approach that empowers them with a voice as well as defined role in decision making and provides sufficient economic incentives to engage their interest in the successful of agreed upon natural resources management objectives.

The co-management approach under implementation has some limitations:

- It is operating by virtue of a gazette notification by the Ministry of MoEF. It does not have the legal framework which is an urgent need. In absence of legal provisions and policy directives, truly co-management may be jeopardized. The legal framework should also address utilization of revenues generated by the activities as a means of long term sustainability of the management programme;
- At present the forest officials are observed as managers of forest that are to be cut and sold. This mind set must be transformed for conservation management of the resources in partnership with other stakeholders and local communities;
- There are chances that the co-management councils and committees are represented and dominated by the local elite setting aside the true beneficiaries of the communities;
- No success will accrue if the implementing community members are not involved from planning, implementation and monitoring;
- There are inadequate incentives for income generation ;
- There are chances that the community members do not get appropriate share of the entry fee earned due to misappropriation, etc.

It is too early to access the success of co-management. There are constraints. The attitude of the implementing officers for revenue collection needs to be changed. Frequent transfer of offers affects efficient execution of project activities. The real beneficiaries are the influential people of the locality instead of directly involved villagers. The officers for co-mangement practices have to be adequately trained up. A sustainable or revolving fund needs to be developed for smooth functioning.

4 Evaluation of values of avifauna

4.1 National importance

Diverse group of birds with their bright colors, distinct songs and calls, and showy displays add enjoyment to our lives. Birds are very visible, quite common, and offer easy opportunities to observe their diverse plumage and behaviours. Because of this, like other countries, birds are very popular to the people in Bangladesh who pursue bird watching and monitoring activities. In fact, bird watching is the fastest growing recreational pursuit not only in other countries but also in Bangladesh. According to the 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, USA spend over 2 billion dollars on commercial bird food! Adding all wildlife watching equipment together, including bird food, binoculars, spotting scopes, film, carrying cases, etc., zoo authority of the country spend money. These examples suggest that birds are not only important economically, but also serve a vital ecological role as well. Birds have critical links within the vast food chains and food webs that exist in the ecosystem. Claws are horny (sharp) and pointed, so it can be used to cutting glass. It is sold or supplied to foreigner by local hunters for earning money. Following are the values of bird species:

4.1.1 Cultural value

Some of our most enduring cultural symbols are birds, reflecting the many qualities that human beings admire in them and aspire to in themselves. Cranes, parrots, hornbills, hummingbirds, kingfishers, doves, sparrows and many species of shores birds. These bird species have played a role in shaping the ideas and values of human societies. Birds of prey have been particularly revered for their speed, agility and hierarchical dominance. Ancient gods such as Horus the Egyptian god of creation were often manifested as birds of prey, while eagles continue to be national symbols of strength and power to the present day. Today, birds are repeatedly used as logos, mascots and images that express vital qualities with which we wish to associate ourselves. Sometimes people use owls' body parts (dead or alive) in the cultural activities. Some Hindu people believe that owl is the bahan (vehicle) of Goddess Laxmi. In human cultures, birds featured through ages in the form of poetry, songs or stories.

4.1.2 Economic value

A detailed history of the human exploitation of birds is yet to be written, and the contribution of birds in natural balance and human development remains largely unacknowledged. However, the debt we owe them is immense. The domestication of the Red Jungle fowls was seminal events for human food security in the past. Domesticated geese, ducks, guinea fowl, turkeys and quail all make important contributions to human diets. In the past and still today wild birds and their eggs have also been supplied huge amounts of food to human communities. Birds are exploited as food, both for local consumption by some tribe and

commercially for export. In different country birds are extensively used as food. Some species of birds have been a good food source. Although this exploitation has been strictly regulated by the Forest Department. Seabird guano for fertiliser became so valuable to national economy that it drove major colonial expansions in the nineteenth century.

4.1.3 Birds in education and research

Many Non Government Organizations (NGO) and Non-profit organizations (NPO) study and conduct research on birds, often inviting the public to get involved. Most bird researches are conducted by Ornithologists, and the information gathered by the study of birds is used to gain insight into their behavior and how they relate, and adapt, to their environment. Studies of birds are important because their behavior is interesting and they are of great importance to the ecosystem. Birds also offer an indication of the overall health of the environment, often alerting environmentalists to potential problems. Bird research is important to work out conservation strategies. There are many different bird studies being conducted, for example, research is being conducted into bio-acoustics, which involves the development of new techniques to record and analyze bird sounds. Research into bird aviation hazards has saved the lives of many birds. Studies into migratory birds have helped scientists to discover their flyway and migratory routes and thus devise ways to conserve their stop-over points to ensure a safe migration.

Laboratory birds are used as experimental animal. They are used for different physiological tests and in pharmacology. They are used as an ideal organism in ecological, embryological, physiological and genetic research. They are exploited as model organism in ecological, embryological, physiological and genetic research.

4.1.4 Importance in medicine

Some body parts of the birds use as traditional medicine. Followings are the examples;

Ptarmigan

Raw ptarmigan breast meat is eaten by chronically ill people who have lost their appetite, and it is used in thin slices on boils, on the neck (for a sore throat), or on the eyelids of a snow-blinded person. Although, in Bangladesh there is no such record of body parts of bird use as traditional medicine. The dried neck skin is used to cover cuts and burns, and the thigh skin may be applied to a boil. Ptarmigan down mixed with rancid seal fat or just raw ptarmigan oil may be used to treat a cut.

Loon

It is a common cure to eat a whole loon or red-throated loon. Usualy raw, sometimes boiled, the whole bird must be eaten, if not at one meal then at least in one day. Often, the gall bladder or the top part of the esophogus must be eaten first. This treatment is for people who have tuberculosis, asthma, seizures, or children who have fainted during a fit. Also, dried loon intestines are chewed to relieve a stomach-ache.

Other birds

Goose oil is used raw on cuts, and the thinner bone of a goose wing is hollowed out and used as a "straw" to help extract pus from a boil. Raw owl oil is used on cuts and impetigo, and the skin from a black guillemot (pitsiulaaq) is used to clean the inner eyelid. Wing feathers of any bird are useful. The outer (soft) end of a feather is used as a dropper for earache drops (it is sharpened first) or used to test the temperature of boiling oil; if it burns, the oil ready. Eyes could be used for bright vision. Flesh of head and legs are used for pain killing of human body. Dipping the flesh of owl in oil and if massaged will ease body pain. Flesh as sukuti (dry meat) if chewed is good for asthma.

4.1.5 Bird feathers

Birds are beautiful due to their diverse feather colors. Body shapes of birds is remarkable. Many beautiful birds species are famous for being the world's most colorful animal species. The endangered birds like pheasants, migratory ducks, red munia, spotted munia, paradise flycatcher beautiful due to their colourful feathers. Diversity of avifauna can provides an endless aesthetic treat for the observer. Shore birds and water bird colonies supplied immense volumes of feathers for the fashion and bedding industries, the former supplemented by hummingbirds and birds-of-paradise.

4.1.6 Biological value

Ecological Importance

Agents of seed dispersal: Some birds transport a variety of things through the environment. For example, birds serve to spread seeds of various plants, thereby helping in plant dispersal. Frugivores birds of Bangladesh e.g., parakeets, hornbills, green pigeon, etc. consume various fruits and eventually deposit the seeds to other locations in their droppings. All seed eater and fruit-eating birds do the same thing. Insectivore passerine birds like drongo, flycatchers, flowerpeckers, sunbirds, etc. pollinate various nectar-producing plants, transporting pollen on their beaks and feathers from one flower to the next. Even animals can be spread. Some wading birds like egrets, cormorants, heron, sandpipers, etc. relocate fish eggs that get stuck to their legs, thereby aiding in fish dispersal to other parts of a river or marsh. Some birds, such as the house finch, spread an eye disease called avian conjunctivitis (Mycoplasmal Conjunctivitis) through direct contact with each other or through bird feeding stations that attract them. Sometimes, legal and illegal transportation of birds, especially the captive raised varieties such as poultry, can and has spread Avian Influenza A (H5N1) or "bird flu" across great distances in Europe, Africa and Asia. Research is ongoing, however, the precise roles played by migratory birds in the spread of H5N1 and its transmittal to domestic poultry and humans remain uncertain and continue to be debated by experts.

Birds play an important role in the ecosystem of the country and have complex interactions with other organisms and environment. They maintain a vital role in

ecosystem as primary or secondary consumers in many food chains. They are the best biological pest (invertebrate and vertebrate) controllers. Because of their importance in ecosystem, extinction of their population has significant impact on other organisms along with them. Avifauna is very important indicator to understand the habitat quality of an area. Therefore, species diversity and population abundance are used to identify habitat fragmentation, ecosystem pressure, harmful effects of pesticides and different anthropogenic events.

Birds have links in many ecosystems with food webs. Often unseen, they can be quite abundant in some habitats. Birds can exceed all other terrestrial vertebrates such as mammals and reptiles. Birds are important predators of many species of insect pests and other invertebrates. Removal of birds from a particular habitat can have drastic consequence by increasing insect populations. Therefore, removing birds from a particular place can affect drastically. Conservation of bird diversity is an important component for living in a healthy environment.

Biological control agent

If you have ever spent time on a summer evening looking up at the sky, you have undoubtedly seen swallows, swifts, drongos, bee eaters, and nighthawks swooping and gliding through the air. These aerial acrobats are consuming hundreds of insects, many of which we consider pests. These and other birds like drongos, shrikes, etc. consume insects such as mosquitoes, beetles, and harmful moths, etc. To feed their young, birds catch huge quantities of adult and larval insects, which are high in protein for growing chicks. Without birds, many of these insects would become even greater pests, consuming agricultural and forestry crops and produce, and our own blood. Therefore, it is true that birds acts as biological control agents of insects and other harmful animals. Birds, especially the insectivore birds, are economically useful in reducing the enormous number of insects that destroy crops or transmit diseases. Insectivore and rodentivores prey many different harmful insects and rats, respectively that destroy cultivated plants and causes diseases.

Bio-indicators

From the ecological perspective, birds are regarded as good ecological indicators. Due to the porous nature of their skin they are highly sensitive to any changes in their surroundings. Their skin sensitivity and dual habitat requirements makes them great indicator species. Take for example that a pollutant is introduced into a water body and that is a water source for any town. Without birds, the effects of pollution would not have been as visible in the 1950's and 1960's. Perhaps the most famous environmental pollutant, DDT, is an insecticide for controlling various forest and agricultural pests, which was banned in the United States in 1972. During that time, DDT was known to kill large numbers of insectivore birds. In North America and elsewhere, the robin was eating insects and other invertebrates that had fed on vegetation tainted with DDT. In Bangladesh many insectivore and piscivore birds die every year due to

consume pesticide infected insects and fishes. The amount of DDT used was lethal to bird species as well. Various raptors, such as the peregrine falcon, bald eagle, and osprey, which fed on DDT contaminated fish and other prey, were laying eggs with very thin shells (due to the disruption of calcium uptake within the female bird). The eggs could not hold the weight of the adult birds, and thus, most eggs failed to hatch. DDT is only one example, perhaps to the extreme, of the impacts possible to birds by environmental contaminants. Fortunately, chemicals sold and used in the United States today are not as lethal or persistent as those produced in the 1950s. But in Bangladesh this is totally ignored by both governmental level and non—governmental side. However, DDT and other chemicals banned in this country are still being manufactured and shipped to other countries with less strict regulations, and thus, are still impacting wild bird populations. Unfortunately, other ecological factors, such as habitat loss and degradation, are having an even greater impact on birds and other species. Many migratory bird populations are on a decline. These birds are telling us something else about the health of the environment, and the impacts we are having on it.

Note: Avian Flu is yet another way birds are bio-indicators, as was West Nile Virus several years ago, which has the potential to inform us of potential threats to our own health, even in Bangladesh avian flu is also a threat to human health.

4.1.7 Recreation value

Birds are also beneficial in the field of art and trade. People from early stage of civilization have faith on toad from the religious point of view. Beautiful birds trade internationally to buyer of zoo authorities to keep for watching in the Zoo. Protected areas that cover the ranges of endangered bird species have importance as recreation value. Assist the World Conservation Union in revising and updating existing lists of threatened species based on current knowledge.

4.2 International importance

An amazing hundreds of thousands of migratory ducks and waders used the wetlands, haor basins, beels and shore areas of Bangladesh during the freezing winter at the north pools. These species of birds are internationally important in order to make sustainable environments and biodiversity conservation. For examples, Tanguar haor, Hakaluki haor, Baikka beel, etc. are main feeding grounds of many species of ducks and waders (Appendix 4-5).

Along with Dunlin and Ringed Plover, Skimmer, Ruddy Shelduck, Pintail, Shoveller, Curlew, Whimbrel, Spoonbill, Blacked nacked Ibis, Red Shank, etc. are internationally important bird species. Population of those species has been decreasing day by day from Bangladesh territory as well as from other countries. Therefore, conservation of those migratory birds is important for both national and international organization in order to save them from extinction.

National and International Opportunities for Bird Conservation

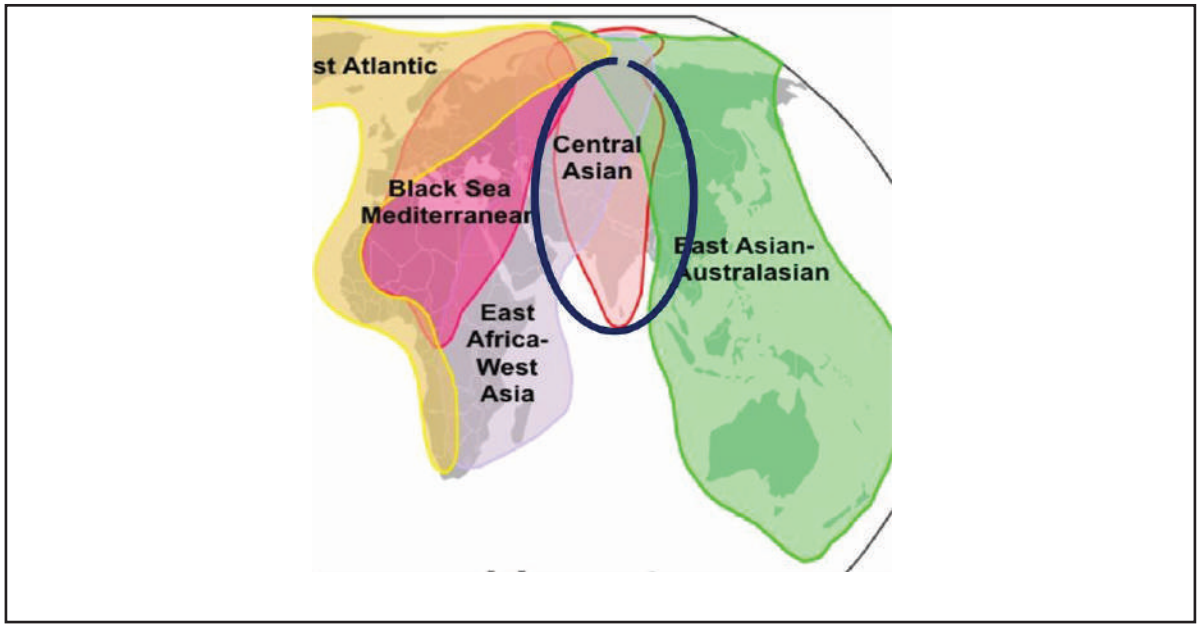
There are many National and International organizations have been working on the conservation and protection of bird species. Among the national organization, the Bangladesh Forest Department (BFD) and researchers from distinguished universities conduct research work by their own fund. Besides these, NACOM, CNRS, bird club, etc. conduct on various research works in order to save bird diversity and their habitats. Of the International organization, IUCN - International Union for Conservation of Nature and Natural Resources, Asian Water fowl research team, BirdLife International, World Wildlife Fund (WWF), WCS, etc. do allocate fund for bird research in the country and sometimes offer training for capacity building of the people working on bird conservation and also other wildlife conservation.

Bird migration

Migratory routes of Birds: Ornithologist of the country predicted that bird species travel the longest distance routes, for example from the North Pole via Mongolia and Himalayas to Bangladesh. It is possible to get information through signals on how high the birds fly, their routes and how many days they stay at each location on the way.

Central Asian Bird Flyway

The Central Asian Flyway (CAF) has also been referred to as the Central Asian-Indian Flyway and the Central Asian-South Asian Flyway (Wetlands International Headquarters, 2007). It covers a large continental area of Eurasia between the Arctic Ocean and the Indian Ocean and the associated island chains. The CAF comprises several important migration routes of water birds, most of which extend from the northernmost breeding grounds in Siberia to the southernmost non-breeding wintering grounds in West Asia, South Asia, the Maldives and the British Indian Ocean Territory. The remaining countries in the Central Asian Flyway are: Bangladesh, Bhutan, India, Iraq, Kuwait, Kyrgyzstan, Maldives, Myanmar, Nepal, Oman, Qatar and Yemen. According to the Ramsar definition, more than two-thirds of the country's landmass may be classified as wetlands. Bangladesh is a country dominated by wetland including estuaries, mangrove swamps namely the Sundarbans, freshwater marshes such as haor, swamps and rivers. There are about 650 bird species in Bangladesh, of which 244 are Migratory. About 100 species of migratory birds regularly or occasionally visit the country. Considering the present threats to waterbird conservation in the country, 31 migratory waterbird species are of high priority for future action for conservation. Of them 14 species are threatened.



Map: Central Asian Flyway for migratory birds.

4.3 Tourism

In the development of tourism local Communities can play important role through the conservation and proper management of beautiful bird species of the country. The diversity of colors, body shapes of birds is remarkable. Feathers of birds are very attractive to the people. Therefore, tourists go to the natural history museum to see the beautiful birds those keep as stuffing or go to the zoo to see the live birds. The sheer diversity provides an endless aesthetic treat for the observer. However, one of the most appealing characteristics of birds is their calling during breeding season. Local communities may sensitize to the importance of birds and the value of ecotourism in generating income, this goes hand- in–hand with conservation. For example, with conservation of migratory birds in the important bird areas it is possible to make attraction to the tourist and local visitors to come to that place. Haor areas in greater Sylhet can be the important tourist spot for the National and International tourists to observe many migratory birds come mainly in the winter season. Therefore, tourism sector of the country can develop tourism based on the watching of migratory birds. Similarly, coastal areas of the country can be the important tourist spot to observe many species of shorebirds including migratory ducks.

Sustainable tourism development guidelines and management practices are applicable to all forms of tourism in all types of destinations, including mass tourism and the various niche tourism segments. Sustainability principles refer to the environmental, economic, and socio-cultural aspects of tourism development, and a suitable balance must be established between these three dimensions to guarantee its long-term sustainability.

Thus, sustainable tourism should:

1. Make optimal use of environmental resources that constitute a key element in tourism development, maintaining essential ecological processes and helping to conserve natural heritage and biodiversity.
2. Respect the socio-cultural authenticity of host communities, conserve their built and living cultural heritage and traditional values, and contribute to inter-cultural understanding and tolerance.
3. Ensure viable, long-term economic operations, providing socio-economic benefits to all stakeholders that are fairly distributed, including stable employment and income-earning opportunities and social services to host communities, and contributing to poverty alleviation.
4. Sustainable tourism development requires the informed participation of all relevant stakeholders, as well as strong political leadership to ensure wide participation and consensus building. Achieving sustainable tourism is a continuous process and it requires constant monitoring of impacts, introducing the necessary preventive and/or corrective measures whenever necessary.
5. Sustainable tourism should also maintain a high level of tourist satisfaction and ensure a meaningful experience to the tourists, raising their awareness about sustainability issues and promoting sustainable tourism practices amongst them.

Forests including Bird Species for Eco-tourism

Eco-tourism is responsible for travel in natural areas that conserves the environment and improves the well-beings of the local people. This is a new concept in the country though it has developed in the last 15 years in different countries of the world. The marketing of eco-tourism in the world today has reached maximum sophistication and supply of goods and services has exceeded than its present demand. Now a day more and more people want to spend leisure time for watching wildlife and nature, so it is an important window of the hospitality Industry. The eco-tourism creates opportunities in areas having unique features or attributes in natural scenic beauty, birds and other wildlife and wilderness. Local communities have maximum opportunities to be benefited from the eco-tourism, which shall generate income for them that shall also help to conserve the nature. So it is believed that eco-tourism is a sustainable hospitality industry that shall benefit the nature and the community as well. Bangladesh has great potentialities for the development of eco-tourism opportunities in the country, as there are many sites of interest for levels of people. Some Potential Eco-tourism Sites are:

National Botanical Garder, Dhaka, Dhaka Zoo, Baldah Garden; Bhawal National Park Madhupur National Park; Ramsagar National park; Kaptai National Park ; Himchari National Park; Teknaf Game Reserve; Dulahazara Safari Park ; Sitakunda Botanical Garden and Eco-park; Madhab-kunda Eco-park Katka ; Kochikhali; Nilkamal; Dublar Char; Kuakata; Tanguar Haor.

5 Analysis of issues and threats

5.1 Conservation issues and threats

In Bangladesh there are many problems of seabird conservation at an ecosystem level as it is linked to human activities (e.g. fisheries, tourism and industrial pollution) and the resulting loss of habitat and deterioration of habitat quality. From a conservation point of view, it is crucial to study transfer processes in seabird populations (i.e. emigration, immigration and colonisation) in order to propose management measures. But it is difficult for the country like Bangladesh. The big challenges for the conservation of wader birds in the beel and hoar area are gradual increase of agricultural lands and human interferences for fishing and cultivation of crops. Due to the increase of food demands many wetlands has been taking under paddy cultivation that destroy the wetland habitats for birds. Forest birds, particularly the hole nesting birds cannot make nest due to absence of old and tall trees in the forest. Cutting of native fruit bearing tress also one of the main challenges for the conservation of frugivore birds in the country.

5.1.1 Habitat degradation

There are a variety of human activities that cause threats to birds and eventually species becoming threatened. The human activities are habitat destruction, fragmentation, and degradation, pollution by pesticides and fertilizers, introduction of non-native species, disease, climate change, and over-exploitation. In many cases, multiple causes act in concert to threaten populations. Though the causes underlying population declines are numerous, some traits serve as predictors of whether species are likely to be more vulnerable to the causes listed. For example, many species that have become endangered exhibit large body size, specialized diet and/or habitat requirements, small population size, low reproductive output, limited geographic distribution, and great economic value (McKinney, 1997).

Very few natural habitats for birds remain existed in the country. Moreover, that remains habitats has often been degraded to bear little resemblance to the wild areas which existed in the past. Bangladesh is losing habitats through degradation of multi storied heterogeneous natural forests and shrinkage of forest areas. There are many threatening processes driving declines in bird diversity and populations. Among them, spread of agriculture which puts 41 threatened birds of Bangladesh at risk, logging and wood harvesting impacting in total 650 bird species. In addition, residential and commercial development, hunting and trapping, changes to the fire regime, particularly at Bhawal NP and pollution are having serious negative impacts. All these threats are taken into account in the IUCN Red List evaluation of species and contribute to their classification as globally threatened (Critically Endangered, Endangered and Vulnerable). High-impact threats affect the majority of the population and cause rapid declines, while low-impact ones affect the minority and cause slower, albeit still significant and declines. These threatening process impact species' populations in many ways such as habitat destruction and degradation

(driven, for example, by logging and agricultural expansion) currently impacts all threatened birds.

5.1.2 Forest management

Forest management plan may affect for the deterioration of the quality of habitat that ultimately influence population status of wildlife species, including bird species that are listed under the Endangered Species, species at risk. Management alternatives and their associated activities may have many effects on birds. Alternatives that would increase activities such as road construction, timber harvest, livestock grazing, recreation, and mining could also increase habitat alteration and fragmentation, as well as disturbance to species.

Forest management plan strategies may cause disruption, vulnerability, and disease risk to bird species. Some species of birds are sensitive to human activities in close proximity during the breeding, nesting and wintering portions of their life cycles. Human activities, whether intentional or unintentional, can increase stress to some species and may reduce their reproductive success.

5.1.3 Habitat Fragmentation

The ability of terrestrial habitat to support viable populations of terrestrial species is dependent on vegetation quantity, quality, and distribution through both space and time. Habitat can be fragmented by natural events such as fire and insect and disease outbreaks, and human activities such as timber management, roads, dams, diversions and facility construction. Fragmentation of habitat is the isolating or splitting of similar habitat into smaller and more separated pieces. As pieces of habitat become smaller and farther apart, it becomes more difficult for bird species to make use of them and persist into the future.

Human activity other than habitat modification or fragmentation can influence some bird species through disturbances or disruption. Behavioural activities of bird and other wildlife in response to human activities generally take the form of avoidance, attraction, habituation, or indifference, as in no response (Knight and Temple, 1995). For example, an individual may be disturbed by human proximity during nesting when young are present, causing disruption to its reproductive cycle, but that same individual may be indifferent to human proximity during other seasons of the year.

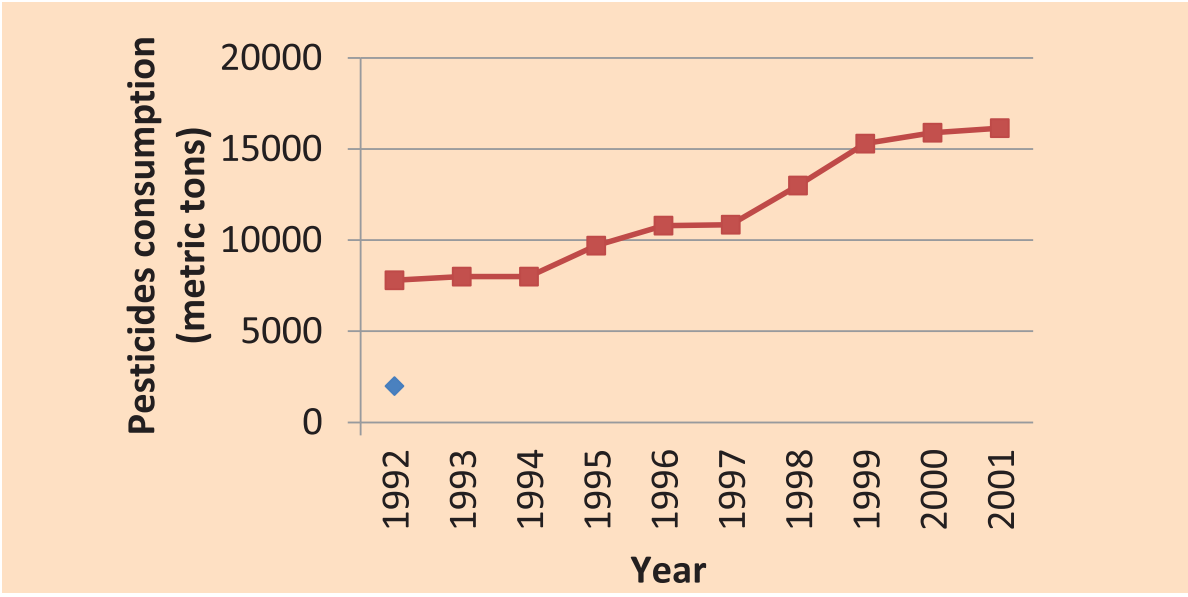
5.1.4 Climate change

Climate change represents an emerging and increasingly serious threat to species; one that often exacerbates existing threats. Because many types of plants and animals have specific habitat requirements, climate change could cause disastrous loss of bird species. A slight drop or rise of average rainfall will translate into large seasonal changes. Birds are sensitive wildlife to moisture change. So, they will be harmed by any change in moisture level. Moreover, sea level rise due to global warming may cause bird areas.

5.1.5 Pesticides and toxic chemical

These are hugely used to control certain plants (weeds in rubber plantation), insects and rodent pests from agriculture lands. Heavy and irrational use of chemical makes the environment toxic and many animals including birds suffer, sometimes leading to their disappearance. Every year different species of insectivore birds and piscivore birds died due to ingest poison infected insects and fishes. Although, we do not have any data regarding those problems. In human locality, use of Diclofenac and Ketfen are the main causes for the disappearance of vultures in Bangladesh. Currently, this is a major threat for the survival of vultures in the country. Many insectivore birds (e.g., drongos, shrikes, pied starling, etc.) have been died each year in the farmlands of the country due to consume insects those are died by insecticides. There is report on the trend of pesticide usage in Bangladesh done by Rahman et al. (1995). According to the survey conducted by them total pesticide consumption doubled over the past 6 years. Among the pesticides applied to agricultural crops, insecticides comprised more than 95% of the total used, fungicides, weedicides, and rodenticides made up the remaining 5%. By chemical composition, organophosphorus compounds comprised 60.4%, carbamates 28.6%, organochlorines 7.6% and others 3.4% of the total pesticides. It was found that those used the least were the most environmentally caustic pesticides. Although much is known about the potential impact of pesticides on the environment and health, more data is required to ascertain the present effects and future risks of increased pesticide use.

According to statistics from the Government of Bangladesh, consumption of pesticides increased from 7,350 metric tons in 1992 to 16,200 metric tons in 2001, more than doubling in the past decade (Figure 3). A substantial body of anecdotal evidence also suggests that pesticide poisonings and ecological damage have become common place in Bangladesh (Ramaswamy, 1992; Jackson 1991). Therefore, it is evident that increase use of pesticides is a big threat for the diversity of bird species and other wildlife species in the country.



Source: *Department of Plant Protection Wing, Bangladesh*

Figure 3. Trends in pesticide use in Bangladesh, 1992-2001.

Pollutants released to the environment are ingested by a wide variety of organisms. Aquatic animals suffer heavily from pollution of rivers and water bodies. Water quality is all over Bangladesh is declining industrial, agricultural and human waste. As a result fish eating birds has been facing problem to prey fish and other aquatic organisms as food.

Over-exploitation of resource: Exploitation of birds' populations for food has resulted in population crushes (over fishing, grazing for example). However, the largest threat perhaps indifference of public to birds, conservation issues in general.

Key Threats to Bird Diversity and Population in Bangladesh

The following table summarizes threats to bird diversity and their population in Bangladesh and their underlying causes. The examples of threats and their underlying causes provided in Table 4 incorporate many more specific instances that were highlighted during the consultations. Among the threats, habitat loss is considered as the single largest one. Among the underlying causes, the land tenure and user rights problems are considered most significant.

Table 4. Key threats to Biodiversity Nature of threat/ underlying cause

Threats	**Examples of specific threats/underlying causes**
Loss of habitat	Deforestation (for agricultural expansion, creation of settlements), urbanization, draining/ filling water bodies, destruction of fish breeding areas, hill slope cultivation and associated silting of water bodies, clear felling for plantation and Jhum cultivation and forest fire.
Over harvesting of resources	Unregulated/unscientific logging and hunting/trafficking in wildlife.
Natural calamities	Floods, droughts, etc.
Pollution	Disposal of untreated industrial wastes/oil spillage from ships Indiscriminate use of pesticides/fertilizers.
Awareness	Major focus of policy makers is on development and priority for poor stakeholders is financial improvement.
Institutional capacity constraints	Conflicting institutional mandates and responsibilities, many protected areas essentially "paper parks" and expertise in many government agencies focused on production rather than conservation.
Human population growth	Increasing demand for space/resources, change in agricultural practices and local culture.

5.2 Protection capacity enhancement

The most important issue is to protect forest cover in order to save bird species in the country. To do that proper management of forest by the BFD is important. Although, there are many challenges need to be handled properly by the BFD authority. Following changes are indentified here;

1. Growing human population pressure causes shrinkage of forests and the forest area in Bangladesh is reduced by 13,000 ha annually.
2. There is a big gap between demand of the increasing population and supply of resources from the forest ecosystems.
3. Due to heavy pressure on forest ecosystems and scarcity of land for human habitation and agriculture, occurrence of over-exploitation and encroachment of natural forests and plantations is quite common.
4. In the past, ruthless exploitation of natural forests over vast areas took place. About 50% of the forest lands are denuded or degraded for higher yield of wood per unit area. Only 6% areas of the country are under close canopy cover.
5. Old system of forest management is still in practice for higher revenue generation. Management often is not compatible to political/ social changes and conservation of nature. In many cases, sustainable yield in an area cannot be ensured for several reasons.
6. It is quite difficult to develop a complementary management of various resources in a forest. Emphasis on higher wood production may affect bird conservation as well as biodiversity

conservation in the country. So, management of various resources can be conflicting and it is not easy to evolve compatible management systems of the available resources.

7. Considerable proportion of hill forests is barren due to harvesting and subsequently not bringing the under vegetation cover. Denudation causes soil erosion, flood from runoff, siltation of river bed, management of watershed, and other services. Services from the forest ecosystems are greatly reduced.
8. Source of exotic rubber plants is from Malaysia. Latex yield from the rubber plantation is low being 0.5 ton/ha while in India it is ton 3/ha. Appropriate use of seeds and management are likely to considerably increase the yield of latex.
9. In order to meet the growing need of wood, there has been introduction of exotic species. Survival and growth of some exotic species are satisfactory. However, the exotic plants have a destructive impact on natural habitats and wildlife population.
10. Goal-oriented research studies have been undertaken in addition to basic research. Considerable research findings are available which can help improve management of forests and increase production of the ecosystems. Technology transfer and execution of research findings for higher return need to be ensured. At the moment, there is no organization responsible for the extension of research achievement from BFRI to the users.

5.3 Exploitation for consumption

Still many species of birds exploited every year for consumption. For example, white breasted water hen, baya, Moorhen, coot, kora, jungle fowl, green pigeons, doves, shore birds like, little stint, common sand piper, Curlew, whimbrel, all species of wild ducks, etc. Among these species some are included in threatened categories. Decline of population of these bird species mainly due to either captured or shoot by gun or poisoning by local illegal hunters. Unregulated hunting and poaching cause a major threat to many bird species, particularly the game birds like jungle fowl, peacock pheasant, water hen, cormorants, egrets and heron, many species of wader birds, hill myna, etc (see Table 5 and 6). Along with this mismanagement of Forest Department triggers the problems. Once hunting used to be treated as a matter of heroism. Fortunately, it is now considered as a disgrace in an enlighten society.

Local trade is one of the important factors responsible for the reduction of bird population and their diversity. Therefore, it is important to stop/control the local trade of bird species. It was reported that a total of 66 individuals belonged to 3 species of birds were rescued/ seized either alive or dead animals from the illegal traders in the country during April 2010 - February 2014 (Table 5).

Table 5. The locally traded bird species those were seized/rescued by the forest department with the help of Boarder Guard of Bangladesh (BGB) and police staffs during April 2010 - February 2014

Sl No.	Date	Animals	Quantity
1.	2012	Mynas	54
2.	March, 2012	Pond herons	6
3.	22.09.2013	Common myna	4
4.	22.09.2013	Pond herons	2

Another report made by the wildlife Crime Control Unit (Dhaka Wildlife Division) of Forest Department during 2007 – 2014. In this report, in total 12 groups of birds were recorded as trade species (Table 6).

Table 6. Wild bird species traded according to the Wildlife Crime 2007-2014 (Dhaka Wildlife Division);

Sl. No.	Species/Group	Seizures animals	Cases
1.	Doves/Pigeons	860	48
2.	Parakeets	799	46
3.	Munias/Sparrows	1264	32
4.	Mynas	299	32
5.	Water Birds	319	27
6.	Eagles/Kites/Falcons	19	10
7.	Lorikeets (Parrot)	372	3
8.	Owls	4	3
9.	Love Birds	17	1
10.	Koel	6	1
11.	Wood Pecker	2	1
12.	Drongo	1	1

Sometimes people capture or shoot bird for food and or sell in the local market. Locally some illegal bird traders sell some beautiful bird species as cage bird that may capture from the nature of the country. In total 961 individuals belonged to 13 species of birds were seized/ rescued by the Rajshahi Forest Division, Wildlife Management & Nature Conservation Division (see Appendix 11).

5.4 International trade

Law and enforce authorities should be aware about the Bangladesh wildlife (conservation & security) act 2012 in order to protect bird species and apply laws against the poachers, hunters and traders.

Illegal international trade in wild birds and their parts and derivatives is one of the most important causes of loss of avian diversity. Although, Bangladesh is not considered to be

an important source country for such kind of illegal activities, except very few species of birds of Bangladesh may be illegally exported in the neighbouring countries. For example, Hill myna, Parakeets, Lorikeets, Eagles, Hornbills, etc. export in other countries by illegal traders. A general idea of the smuggling activity in the country can be obtained from the following press reports:

According to the Newstoday.com 29 August, 2013: 220 Smuggled Birds seized in the Capital, The Times of India, Dec. 09, 2013: Bengal, a transit route for wildlife trafficking, Kolkata: Speaking to TOI, a senior forest official said, "West Bengal is a transit route an enroute for illegal wildlife trade because the state has a huge porous border and wildlife can be smuggled beyond the border to countries like Bangladesh, Thailand, Southern Eastern, China and gulf. In the last one month, Crime Control Unit of Bangladesh Forest Department have made raids at 29 places and arrested more than 45 people for smuggling rare and endangered species." "The seizure includes different kinds of birds like Hill Maina and other wildlife like, Taiko Geckos, turtles and meat and skin of different animals like tiger, bison and buffalo," the official said.

5.5 Conflicts due to crop and other resource damage

Recognizing the ecological significance of the habitats and its avian faunal biodiversity the Bangladesh Government passed various laws to punish the people who try to poach the birds, steal their eggs, or disturb their activities. Human- birds conflict in Bangladesh is not frequent and does not considered as serious case. It is not easy to know how much damage is really caused by birds. In Bangladesh, no any study was done yet to estimate the damage of crops caused by the bird species. Probably it is less important as population of birds species has been reducing day by day due to various man made causes like habitat degradation, illegal logging, developmental activities and urbanizations. However, the possible pest bird species, e.g., baya, munia, parakeets, ducks, sometimes doves and pigeons, etc. damage paddy field at the pre-harvesting time.

In terms of the amount of crop damage, red-vented bulbul damage garden crops, such as brinjal, green chilli, ripe papaya, particularly during winter, etc. Pigeons and doves sometimes damage legumes and eat germinated wheat, while sparrows and bayas damage ripe paddy. Some fish eating birds like cormorants, osprey, grey headed fishing eagle, Brahminy kite prey fishes from fish culture ponds. It is true that as a whole, crop damaged and fish farm damaged by bird species in Bangladesh is tending to decrease, probably due to the decrease of bird population in the country. As a result no any human-bird conflict has been prevailing in the country.

Current Methods to Repel problem Birds

Bangladeshi farmers use many methods to protect their crops from birds. The most effective way of doing this is to cover the field with netting. However, nets are costly and cannot be used in large fields. Another method farmer use to reduce the bird population. However, all wild birds are protected in Bangladesh, and cannot be hunted without special permission from the government. For these reasons, the most common method of protecting crops is to scare birds away. Stimuli which rouse aversion in the birds are used to drive them away from fields. These stimuli can be classified into two main groups, visual and acoustic. Visual way includes plastic bags, flags and streamers, and bird-scaring tapes. Plastic bags and flags set out in fields will flutter in the wind. They not only drive away birds already feeding in the field, but deter birds on the wing from coming down to land. Streamers made out of plastic bags are effective in driving away bulbuls and other bird species which eat garden crops. Another way is 'human effigies'. Since ancient times, scarecrows and effigies have been used to frighten birds away from crops. Recently, the mannequins used in shop windows have been used as scarecrows. They are very effective at keeping pigeons and doves away from crop fields. Some years ago, farmers began using balloons with eyespots painted on them. These were based on the fact that birds often show an aversion to eyespot patterns on wings or on the larvae of various insects. Another widely used method is to hang up the dead bodies of crows and other birds in fields. However, this does not have much effect.

Acoustic stimuli: Devices which scare away birds with a sudden loud sound also have a long history. These were wooden clappers that were banged together by pulling a string, or by the wind. In general, a device to scare birds with sound is effective over a wider area than one which uses visual effects.

Other stimuli used to scare birds: Transparent fine string stretched tightly over fields or rubbish dumps is sometimes used to keep crows away. This works because crows seem to hate their wings to touch the string. In conclusion, a number of methods are used to keep birds away from crops. However, all these methods have an important defect. Birds quickly become accustomed to them. The only solution to this problem of habituation is to change tactics, and never rely on any one tactic for too long. While birds eat and damage crops, they also eat insect pests, and play a role in preventing pest outbreaks. We should not try to reduce the number of birds too much. The best strategy is to drive birds away from fields in the most effective way possible, while allowing some birds to remain.

5.6 Zoonotic Diseases

Bird sometimes may threat to human health. A matter of concern to many people is bird flu research, especially with regard to its possible impact on humans. Bird flu or avian influenza is a dangerous viral disease affecting mostly poultry flocks. Bird flu research has revealed how it is spread and using these information scientists will be able to develop ways of keeping humans safe. Birdwatchers count the numbers of birds at their backyard feeder, at specific times between November and April. Research and study of birds is vital to learn more about them and develop ways to ensure they are here for the enjoyment of future generations.

6 Vision and objectives

6.1 Vision

The vision of the management action plan for bird species is to protect the bird species particularly the threatened species through proper management and monitoring of their habitats. The main vision is to keep diversity and population status of bird species of the country stable. All migratory and resident species of birds will be protected in their respective habitats such as in the wetland, forest and along the shore areas. Destruction of bird habitats will be stopped. All aquatic habitats, particularly the RAMSAR sites and IBAs will be pollution free and no disturbance for the birds will exist. Hunting and illegal trading of bird species will not be continued after implementation of bird management action plan.

6.2 Problems, barriers and challenges

Habitat destruction and fragmentation are the main problems for the survival of birds. Beside this, pollution of aquatic habitats by the industrial wastes and agricultural chemicals such as pesticides, fertilizers and other toxic chemicals are the mentionable threats for aquatic birds such as waterfowl and waders. Logging and wood harvesting are also important threats and problem for the protection of forest birds particularly the hole nesting birds, e.g. hornbills, barbets, white winged wood ducks, hill myna and red-breasted parakeet. Habitat can be fragmented by human activities such as forest fire, timber collection, construction of roads, dams, diversions and urbanization. These human activities are the big challenges for the conservation and protection of bird species. Hunting, capturing and poisoning of migratory and some resident birds may cause decline of population and species diversity. Therefore, preventing of those illegal activities are also big challenges for the conservation of bird species particularly, the migratory ducks and shore birds. Flood and drought some may cause problem for particular birds such as piscivore birds. Awareness creation among the local people is also the challenges. Because it is very difficult to protect our bird species without creating awareness among our local people, particularly in the important bird areas like haor basins, coastal islands, big river areas and adjacent river island, etc. Implementation of forest department legislation is also the challenges. Getting funds for bird monitoring and research is also a challenge for the forest department and other agencies involved in bird conservation that need to be addressed for the conservation of bird.

6.3 Objectives

The overall objective of this action plan is "to protect resident and migratory bird species, population status and their potential habitats where they live and forage in order to conserve sustainable bird population and their diversity".

6.4 Specific objectives

The specific objectives are:

1. To take measures for increasing the population of bird species particularly the threatened bird species of the country such as, skimmer, masked finfoot, lesser adjutant, white-winged wood duck and other threatened species
2. To provide better way using of natural resources those are related to bird species
3. To improve habitat quality through controlling pollution and habitat destruction and to restore habitats of birds, particularly the habitat of threatened species
4. To share knowledge between policy makers and academicians/researchers about the importance of avian diversity that may help to conserve birds and their critical habitats
5. To identify the most efficient tools, strategies and to find better way for monitoring bird species and their population status
6. To develop a common strategy like arranging awareness program for controlling illegal trade of bird species and engage local people in conservation activities
7. To develop capacity of the institution and officials related to bird conservation activities.

6.5 Strategies

Following are the strategies;

1. Development of knowledge on bird diversity is the first step to implement the bird management Action Plan. All of the information on the bird species and their status in the country need to be reviewed. A fair amount of information are also exists on the habitats of birds and their conservation status. So that all initiatives regarding the conservation of bird species has to be taken to increase population and their diversity. But the major gaps that are available in the current monitoring system are to update the status of threatened bird species of the country. Therefore, a management action Plan (five year) has to be formulated for monitoring and evaluation of avifauna to estimate the current status of each species, particularly the threatened birds. It is an initiative to characterize the appropriate bird diversity monitoring and evaluation under the action plan in concerned PAs.
2. One of the most grievous threats for degradation of habitats in all protected and non-protected areas of the country. Alternation of habitat utilization and cultivation patterns, expansion of agricultural lands, urbanization, expansion of road networks, unplanned embankments and other man made factors have tremendous pressure in damaging habitats of birds throughout the country. Before starting any developmental activities, proper measures must be taken to reduce the environmental impact.
3. **Environmental pollution:** Pollution is one of the biggest threats to bird diversity in Bangladesh. So that it is very important to take measure for the reduction of pollution, particularly in the aquatic bodies. Water pollution is the most widespread menace,

exacerbated by chemical fertilizers, insecticides, industrial effluents, etc; also, massive insecticides contamination of freshwater aquatic bodies has occurred countrywide—all of which largely destroyed freshwater fishes that was the important sources of food for fish eating birds. Therefore, to save the bird species it is necessary to steps in order to save the aquatic organism including fish live in the water bodies. Treatment of polluted water and air has to be taken before discharging the industrial wastes and gases emitted from the industries. Habitat restoration and sustainable conservation of habitat of birds have to be done for present and future wellbeing of the country. Therefore, exploitation of natural resources should be carefully handled in order to protect bird species of the country

4. Sharing of knowledge is important for researchers and academicians regarding the research and monitoring of bird species. Many public organizations are conducting research and implementing activities related to bird diversity in the country. But there is no central database accessible to the public or any other organization to maintain the database. People have no idea where to find information and seek help in dealing with the research on bird species.
5. **Enforcement and monitoring:** Compounding the problems caused by conflicting and incomplete laws and fragmented governmental mandates, enforcement is rarely effective. Bird monitoring is essential as the basis for enforcement. Monitoring is valuable in understanding the status and distribution of bird species and their habitats quality. With the exception of flagship species such as population of king vulture, white winged wood duck, etc. have to be monitored systematically in Bangladesh. Therefore, initiative will be taken to identify the most efficient tools, strategies and activities to do sustainable management of bird.
6. **Awareness creation on biodiversity and its value:** Most Bangladeshis' do not even know about the importance of bird species in Bangladesh. Even the educated system of the country cannot reduce hunting and trading of wild birds as well as cannot protect habitats of bird species. Many policy makers are not aware of the need to make balance between developmental works and conservation. Therefore, awareness creation among people has to be taken in order to conserve avian diversity of the country. During the consultations, it became evident that local communities are not involved in either the management or the sustainable development of bird diversity resources. So that initiative must be taken to involve local communities in order to conserve bird diversity.
7. **Coordination in management and planning:** Because many laws affect bird diversity, and a variety of agencies have the mandate for their implementation. There is an obvious need for coordination and cross-sectoral integration. Despite this, currently no provision for cross-sectoral planning in the country. Different research NGOs have so far paid little attention to do work on bird diversity and their conservation. So that capacity building program among stakeholders and researchers will be taken.

7 Management actions (5 year work plan)

7.1 Updating data on population status, species diversity and management action of birds

It is expected that bird diversity and population status of the country will be stable by the implementation of management action plan. All migratory and resident species of birds will be protected in their respective habitats such as in the wetland, forest and along the shore areas. The status of birds with regard to species may look impressive but the population size and the range of distribution of important birds have declined considerably in recent decades. Many species are endangered or threatened with extinction. Reduction of human pressure on animals and maintenance of wildlife natural habitats will play a vital role for the management and conservation of vulnerable plants and bird species that need to be taking care off. However, threatened birds can be protected and conserved through conducting bird census every year. So that forest department can take conservation measure of birds based on the data obtained from the census.

The implementation mechanism may propose as;

- It should be cross-sectoral, involving all relevant government agencies
- It should be participatory
- Different sectors of the society should contribute to this common effort
- It should mainly aim at (a) providing guidance to the system, (b) encouraging activities related to the management plan, (c) registering all work undertaken/accomplished addressing bird diversity issues across the country, (d) facilitating coordination between different organizations and sectors, (e) exchanging experiences and lessons learned and (f) assessing general progress towards bird diversity conservation.
- An 'Apex Body' is proposed to ensure the implementation and subsequent monitoring and review of the action plan. Until an apex body is formed, WNC of BFD will have to take the initiative to facilitate inter-agency coordination, review and monitoring.
- A formal institutional set-up for the conservation of the "Green Sector" of environment has been strongly emphasised in the National Conservation Strategy (NCS) and NEMAP document. This is also a demand of the environmental activists, conservation activists, civil society, NGOs and others to have a permanent institutional set-up to deal with bird diversity conservation issues of the country in a coordinated and integrated manner.

7.2 Management of birds' habitats

Management of bird habitat is a difficult task in Bangladesh. Some areas of Bangladesh Forest Department (BFD) declared as protected areas such as Wildlife Sanctuaries, National Parks, game reserves, etc. These PAs are surrounded by enormous number human population who are directly or indirectly dependent on forest resource. Some of these people belong to ethnic groups. Fortunately, these people lived with the nature and they have some moral obligation for the conservation of the nature and natural resources. Depletion of forests and biodiversity due to human pressure, agricultural expansion, over exploitation of forest resources and encroachment of forest land has to be stopped. Therefore, it is necessary to identify the most efficient tools, strategies and do activities for evaluation to address threats for bird habitats and improve current capabilities for the better management.

7.2.1 Sustainable Forest Management

In the context of the lessons learnt, there is a discussion about the sustainable management of forest. Since most of the forest and biodiversity resources are degraded, protection and conservation of these resources are the main focus in this area (Planning Commission 2013). The key elements of the sustainability include:

- protection and expansion of forests and forest resources;
- retaining the integrity of hill ecosystems that sustain plant and animal biodiversity;
- enhancing forest biodiversity and wildlife conservation through expanding protected area;
- expansion of social forestry and agroforestry that can provide habitats for particular species of birds;
- adopting co-management approach with community participation for protecting the forest and avifauna;
- restoring ecosystems and rehabilitating endangered species;
- plantation of the wet land with special emphasis on maintaining the integrity of wetland ecosystems;
- further development of coastal green belt and promoting people's ownership of social forestry;
- No utilization of forest land for urbanization, industrialization and conversion to agricultural land.

Management of some important bird habitats are;

Bhawal National Park (5022 ha) is situated in Gazipur District approximately 60 km north of Dhaka city. Avifauna has been declining gradually, but it receives a very high number of tourists. The main activities for conservation of this habitat are to control encroachment and illegal intervention of people.

Dudh Pukuria-Dhopachari Wildlife Sanctuary (4717 ha) is located in Chittagong District on the foot slopes of the Chittagong Hills. Bird diversity and their population are relatively high. Initiative has to be taken immediately to control illegal resource extraction and encroachment.

Nijhum Dweep National Park (16,352 ha) is an island at the mouth of the estuary of Meghna river. A considerable part of the area is planted with mangroves, which have settled very well

and a very successful introduction of Chital deer resulted in a good number of population presently surviving. The area is very important habitat for many rare species of shore birds and migratory ducks. Control of the number of tourist, deforestation, illegal cutting of tress by local people are necessary immediately to protect the bird diversity and population.

Sundarbans (West) Wildlife Sanctuary (71.502 ha) in Satkhira District is on the coast in the Sundarban mangrove forest and it shares the international border with the Sundarban forest in India on the western side. An integrated (co)management plan for the entire Sundarban was completed by IPAC and covers the period 2010 to 2020. The SEALS project has updated biodiversity status including bird diversity of the three sanctuaries in the Sundarban, and SRWP will include both elements in a management plan for the West Sanctuary. This area also needs to be taken under 5-year management plan for the protection of threatened bird species.

7.2.2 Social Forestry

For the success of social forestry an effective awareness program has to be launched and participatory forestry or co-management of forest resources has to be undertaken in a wider scale (Bangladesh Gazette, 2009). It is a multi-sectoral approach led by the Bangladesh Forest Department and other technical agencies are involved in the conservation of biodiversity and management of protected areas in the terrestrial and aquatic ecosystems of Bangladesh.

If these are done the following will unfold one after the other in the sequence as mentioned below:

- The people in general and the people living nearby the forests in particular, will be fully aware of the environmental values of the forests and shall understand its role not only at local level but also at national level.
- Once they acquire this awareness they will oppose the illegal felling from the forests.
- As the local people will become participants of forests and forestry, they will start receiving substantial gain. Thus they will get into the ownership. Once that is there, they will look for its sustainability.
- At this stage they will not only remain passive supporters of conservation but will also become vocal opponent to any destruction or illegal felling.
- This will stop all sorts of illegal felling from the forests of the country and the existing strength (number of manpower) FD personnel will be able to protect the forest.
- Bangladesh has bright prospects to increase production of forest resources through intensive practice of social forestry. Once forest resources develop the bird species and their population has also increased. To this end, Government should earnestly promote co-management practices of natural resources.

7.2.3 Recording climate data

The physical environment comprises soil, water, air, temperature, rainfall and humidity that are required for the existence of plants and animals. Habitats basically contain many food chains and food webs where both plant and animals interacted with their physical

environment. Recording of climatic data will be done to enumerate the impact of climatic changes on bird diversity.

7.3 Control of pollution

It is expected that habitat destruction of bird species will be stopped. All aquatic habitats, particularly the RAMSAR sites and IBAs become pollution free and no disturbance for the birds will exist. Hunting and illegal trading of bird species will not be continued after implementation of bird management action plan. Forest department and Department of environment have to work collaboratively in order to control pollution both in terrestrial and aquatic habitats. Discharge of industrial waste to the aquatic habitat e.g., in the rivers, ponds and other large water bodies has to be stopped. To control pollution Forest and Environment Ministry can create pressure to the authorities of industries to establish pollution control treatment plan. Hopefully, habitat quality will be improved through controlling air and water pollution, stopping habitat destruction and restoring of habitats of birds, particularly the habitat of threatened species.

7.4 Knowledge sharing

It is expected that knowledge on bird conservation will be shared among researchers, NGOs and stakeholders through organizing workshops and regular training programs. In this connection Bangladesh Forest Department can coordinate to arrange meetings and workshops on the researches of birds done by different organizations and professionals. As a result opportunities can be created for researchers and forest staffs to share knowledge about the output of the research works. A central database can be established for accessible to the public or organization or body to maintain the research output on birds of the country.

7.5 Protection capacity enhancement

Enforcement and monitoring: Compounding the problems caused by conflicting and incomplete laws and fragmented governmental mandates, enforcement is rarely effective. Bird monitoring is essential as the basis for enforcement. Monitoring is valuable in understanding the status and distribution of bird species, habitats and threatened species. With the exception of flagship species such as population of king vulture, white winged wood duck, etc. have been monitored systematically in Bangladesh. SMART patrolling is necessary to operate year round in order to control illegal trade of bird species.

7.6 Conservation awareness

Awareness creation among mass people and stakeholders may reduce poaching and illegal hunting of bird species. Providing training is essential in order to ensure capacity building of stakeholder regarding the conservation of birds. To achieve effective training, structured programme is inevitable which may based on actual training needs and integrated in the human resource management strategy of the organisation. The development of a training programme during inception enables efficient planning resources and training outputs. Training with the objective to enhance the performance of an organisation requires focusing on the needs related to the tasks and roles of the organisation's staff members participating in the training. Training is therefore distinctly different from formal education, where the curriculum objectives and standards are set by the training institute. However, bird species and their habitats will be conserved by raising awareness about the importance of natural heritage and important bird species among local people, elite persons and stakeholders.

- Training on bird management and protection for illegal bird traders should focus on tasks and needs related to the mission and objectives of WNCC.
- Capacity building for bird conservation and cooperation for addressing the trans-boundary illegal wild bird trades
- Wild bird conservation promoted for improved management of Protected Areas and effective bird protection.

7.7 Coordination in management and planning

Forest Department of the People's Republic of Bangladesh is responsible for preservation, conservation and management of birds in the country. The Chief Conservator of Forests is the Chief Wildlife Warden. There is a circle named Wildlife and Nature Conservation Circle administered by an officer in the rank of Conservator of Forest. There are Seven Wildlife Management and Nature Conservation Divisions under this Circle. Each of the Division is administered by a Divisional Forest Officer. In addition, there are two Botanical Gardens in the country. Responsibilities, communication channels and coordination mechanisms among these stakeholders and other agencies, ministries and departments remain poorly defined and unclear. Hence the need for effective coordination among the various involved organisations is essential. Therefore, commissioning an ‘apex body’ for steering the coordination efforts of biodiversity conservation, sustainable management and equitable benefit sharing is an urgent need.

Table 7. Five year activity work plan

Task	Responsible officer	Timing	Activities	Requirements	Indicators
1 Updating and management of population status and species diversity	Staffs of BFD	Yearly	Regular survey on plants, birds, estimate bird diversity and their food availability	• GPS, camera and binocular • Skilled manpower • Budget	Abundance and availability of bird species and their occurrence
2.1 Management of birds' habitats	Staffs of BFD	Yearly	Management of protected areas and reducing forest logging	• Relevant equipments • Skilled manpower • Budget	ha of protected areas ha of forest logging
2.2 Recording climate data	Staffs of BFD		Data collection on rainfall, temperature and humidity	• Climate measuring equipments	Update data on climate change
3 Control of pollution	Staffs of BFD		Soil, Water, Air quality estimation	• Skilled manpower • Pollution measuring kits	Sustainable pollution free aquatic and other habitats
4 Knowledge sharing	Staffs of BFD, NWC	Continuously	Orientation, Training, Partnership with similar organizations regarding research on bird species	• Resource person • Field equipments • Laboratory facilities • Budget	Regular information dissemination, Documentation, Number of trained person
5 Protection capacity enhancement	Staffs of BFD	Continuously	SMART patrolling, enforcement	• Manpower • Liaison with stakeholders • Budget	Number of poaching record, Increasing of bird diversity and species richness
6 Conservation awareness	Staffs of BFD, community people	Yearly	Awareness workshops, publicity, capacity building through training	• Resource person • Association with local people • Budget	Number of awareness sessions, number of stakeholders covered
7 Coordination in management and planning	Staffs of BFD	Yearly	Coordination between researchers and stakeholders including NGOs	• Skilled planners • Budgeting,	Number of meetings, Number of organizations involved in bird conservation

8 Monitoring and review

8.1 Biological monitoring

Biological monitoring means survey and assessment of biological components in an area. This includes occurrence and abundance of both plants and animal species that are important indicators for biological monitoring, particularly of bird species, but also other vertebrates or invertebrates may be used as indicator species for the assessment of status of ecosystems. Biological monitoring is important to assess the impact of threats and to determine the effectiveness of management measures. This type of monitoring is usually done by carrying out bird surveys, focusing specific taxonomic groups at regular intervals. Usually two data sources are commonly used for biological monitoring like; surveys/ census (regular and systematic) and sightings (by forest staff, visitors, etc). However, following may be the key approaches for biological monitoring; Participatory approaches like Bangladesh Forest Department in participation with neighbouring community and other stakeholders of the Protected Areas should monitor the bird species and their population increasing/ decreasing. These can be done with basis of baseline document, assessment of ecosystem, updated Threatened Species' List of IUCN, learning and target oriented (how much work plan prepared in relation to availability of budget).

The monitoring of threats and impacts enables anticipating management measures. At animal level occurrence of disease and mortality changes are the main indicators used. Water quality can be measured to assess the pollution levels. Effects of ecological changes and land-use on the habitat are monitored by direct observations on the vegetation and terrain and using remote sensing techniques. Bird species can be monitored following data sheets (Appendix 12).

The bird action plan mainly deals with the management of threatened bird species. Survey method might select on the basis of simplicity and effectiveness so that the field level staff of Bangladesh Forest Department, local stakeholders including community with little or no education could participate in the biodiversity monitoring process. For example, it is evident that strip transect sampling method found most suitable under Nishorgo Support Project by Khan and Aziz (2008) to estimate the population densities of eight indicator species of birds in five PAs (Lawachara National Park, Satchari National Park, Rema-Kalenga Wildlife sanctuary, Chunati Wildlife Sanctuary and Teknaf Wildlife Sanctuary) like Red Jungle fowl, *Gallus gallus*, Oriental Pied Hornbill, *Anthracoceros albirostris*, Red-headed Trogon- *Harpactes erythrocephalus*, Greater Racket-tailed Drongo, *Dicrurus paradiseus*, White-rumped Shama, *Copsychus malabaricus*, Hill Myna, *Gracula religiosa*, White-crested Laughing thrush, *Garrulax leucolophus* and Puff-throated Babbler, *Pellorneum ruficeps.*

The main reason for the selection of those species are: (a) they are primarily forest birds; (b) they live in different vertical strata of the forest (jungle fowl, laughing thrush and babbler in lower stratum; trogon, drongo and shama in middle stratum; and hornbill and myna in upper stratum); (c) they are noisy (and thus less likely to be missed during counts); and (d) they are resident breeding birds. It was assumed that the improvement or degradation of the forest condition would have a direct impact on the feeding and breeding of these species, which in turn would show changes in population densities.

8.2 Management monitoring

Management measures should be taken through increasing of population by improving the breeding facilities and conservation activities. There are some methods currently being implemented to save threatened bird species. The most common are creation of protected areas, captive breeding and reintroduction, conservation legislation and increased public awareness.

Wildlife conservation is the practice of protecting wild plant and animal species and their habitats. Among the goals of wildlife conservation are to ensure that nature will be around for future generations to enjoy and to recognize the importance of wildlife, particularly birds and wilderness areas to human. Many agencies dedicated to bird conservation, which help to implement policies designed to protect birdlife. Numerous independent and non-profit organizations also promote various birdlife conservation issues. Wildlife, particularly bird species becoming threatened or extinct due to several reasons. The reasons can include that the species has a very low population or is threatened by the varying environmental or prepositional parameters.

Decline of bird species can be attributed to those with obvious causes like habitat destruction, alteration, fragmentation, climate change, radiation, chemical contamination, pollution and diseases of viral, fungal, bacterial infection as evident from various parts of the world and those mysterious declines with no obvious cause. Looking from another perspective, the threat to the bird species can be attributed to changes in physical environment and biotic environment. Changes in the physical environment include Ultra-Violet (UV) radiation, climate change, acid rain, pesticides, herbicides and fertilizers, where as the biotic environment includes, fragmentation, demographic effects, genetic effects, diseases and synergistic interactions. The influence of these factors operates at two levels, either singly and/or synergistically.

There are a variety of human activities that contribute to species becoming threatened, including habitat destruction, fragmentation, and degradation, pollution, introduction of non-native species, disease, climate change, and over-exploitation. In many cases, multiple causes act in concern to threaten populations. Though the causes underlying population declines are numerous, some traits serve as predictors of whether species are likely to be more vulnerable to the causes listed. For example, many species that have become endangered exhibit large body size, specialized diet and/or habitat requirements,

small population size, low reproductive output, limited geographic distribution, and great economic value (McKinney, 1997).

8.3 Purpose of monitoring

Monitoring of bird survey is the important task to understand whether it is properly done, timely conducted and operated by skilled person. Therefore, BFD staff should monitor or supervise the activities performed in the conservation of bird.

8.4 Monitoring indicators and responsibilities

Data on abundance of bird species and their population will be available for presentation. Staffs of wildlife and nature conservation circle (WNCC) can take the responsibilities to monitor activities related to bird conservation.

8.5 Methodologies

Both direct and indirect survey methods will be implemented to monitor species diversity, impact of human activities on habitat destruction and fragmentation. Regular monitoring can be effective to achieve the goals.

8.6 Birds monitoring and review plan

An schedule of monitoring and review plan is presented in table 8.

***Table 8*: Birds monitoring and review plan**

Task	Responsible officer	Timing	Activities	Requirements	Indicators
Bird survey	Staff of BFD & External Monitoring	Yearly	Field survey	Baseline data, estimated data	Bird abundance
Habitat survey	Staff of BFD & External Monitoring	Yearly	Field survey Remote sensing	Baseline data, estimated data	Availability of habitat types
Monitoring pollution status	Staff of BFD & External Monitoring	Yearly	Field sampling	-	Updated climate data
SMART patrolling	Staffs of BFD in association with community people	Yearly	Data collection Uploading analysis		See MIST framework
Management monitoring	Staffs of BFD	Yearly	Review the Planning document	Budgeting, Tourism arrangement	Functioning tourism activities
Review 5-year work plan	Staffs of BFD	Every 5 years	Covering chapter 7 and 8	-	Updated 5 year work plan
Review management plan	Staffs of BFD including other related department	Every ten years	Covering chapter 1 – 6.	-	Updated management plan

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Appendix

Appendix 1. Status and distribution of threatened birds of Bangladesh

Class – Aves (birds)

Order and Family Name	Scientific Name and Common Name	Local Status	Distribution
O - Anseriformes F - Dendrocygnidae	*Asarcornis scutulata* 1. White winged wood duck	CR	Pablakhali (SE)
F - Anseridare	*Sarkidiornis melanotos* 2. Comb duck	CR	Widely distributed throughout the country
O- Galliformes F- Phasianidae	*Francolinus francolinus* 3. Black francolin/black partridge	CR	Northeast, southeast, northwest
F- Phasianidae	*Francolinus gularis* 4. Swamp francolin	CR	Noakhali, southeast
F- Phasianidae	*Lophura leucomelanos* 5. Kalij pheasant	EN	Mixed evergreen forest
F- Phasianidae	*Perdicula manipurensis* 6. Bush Quail	EN	North and southeast of the country
F- Phasianidae	*Polyplectron bocalcaratum* 7. Grey peacock pheasant	CR	Mixed evergreen forest
O – Piciformes F - Picidae	*Dendrocopos hyperythrus* 8. Rufous-bellied Woodpecker	VU	South-eastern part
O-Bucerotiformes F-Bucerotidae	*Anthracoceros albirostris* 9. Oriental pied hornbill	EN	Mixed evergreen forest
F-Bucerotidae	*Buceros bicornis* 10. Great hornbill	CR	Mixed evergreen forest
F-Bucerotidae	*Ocyceros birostris* 11. Grey hornbill	EN	Mixed evergreen forest
O-Trogoniformes F-Trogonidae	*Harpectus Erythrocephalus* 12. Red- headed Trogon	EN	Mixed evergreen forest
O-Coraciiformes F-Coraciidae	*Eurystomus orientalis* 13. Dollarbird	CR	Mixed evergreen forest, Jamalpur
F-Alcidinidae	*Alcido Hercules* 14. Blyth's kingfisher	EN	Mixed evergreen forest, Sundarban
F-Halcyonidae	*Halcyon coromandra* 15. Ruddy kingfisher	VU	Sundarban
O-Strigiformes F-Strigidae	*Bubo nipalensis* 16. Spot-bellied eagle owl	EN	Mixed evergreen forest
F-Strigidae	*Ketupa flavipes* 17. Tawny Fish Owl	EN	Coastal Islands, St. Martin
F-Strigidae	*Ketupa (=Bubo) zeylonensis* 18. Brown fish owl	EN	Costal islands, St. Martin, occasionally in other parts of the country.
O-Ciconiformes	*Leptoptilos dubius*	CR	Wetland and widely distributed

F-Ciconiidae	19. Greater adjutant		
F-Ciconidae	*Leptoptilos javanicus* 20. Lesser adjutant	EN	Wetland and widely distributed including Sundarban
F-Charadriidae	*Vanellus duvaucelii* 21. River Lapwing	EN	Sundarban
F-Laridae	*Rynchops albicollis* 22. Skimmer	EN	Coast, large river
F-Laridae	*Sterna acuticauda* 23. Black-bellied Tern	EN	West side
F-Ciconidae	*Mycteria leucocephala* 24. Painted stork	CR	Coastal area and Sundarban
F-Ardeidae	*Gorsachius melanolophus* 25. Tiger bittern	CR	Widely distributed
F-Threskiornithidae	*Platalea leucorodia* 26. Eurasian Spoonbill	CR	Coast, Padma
F-Phalacrocoracidae	*Anhinga rufa melanogaster* 27. Darter	VU	Widely distributed
O-Falconiformes F-Accipitridae	*Haliaeetus leucogaster* 28. White-bellied sea eagle	EN	Sundarban, coastal area
F-Accipitridae	*Haliaeetus leucoryphus* *29.* Pallas's fishing eagle	CR	Sundarban, widely distributed
F-Accipitridae	*Sarcogyps calva* 30. King vulture	CR	Widely, now in Sylhet
O-Columbiformes F-Columbidae	*Treron apiculata* 31. Pin-tailed green pigeon	CR	Mixed evergreen forest
F-Columbidae	*Columba punicea* 32. Pale capped pigeon	CR	Mixed evergreen forest
O-Cuculiformes F-Centropodidae	*Phaenicophaeus leschenaultia* 33. Sirkeer Malkoh	EN	North-west, Chittagong
O-Psittaciformes **F-Psittacidae**	*Psittacula eupatria* 34. Alexandrine parakeet	CR	Mixed evergreen forest
O- Caprimulgiformes J - Caprimulgidae	*Caprimulgus indicus* 35. Grey Nightjar	EN	Widely distributed
0-Gruiformes F-Heliornithidae	*Heliopais personata* 36. Masked Finfoot	EN	Sundarban
O-Passeriformes F-Muscicapidae	*Cochoa purpuria* 37. Purple Cochoa	EN	South – east region
F-Sylviidae	*Garrulax galbanus* 38. Yellow-throated laughing thrush	CR	MEF
F-Sylviidae	*Paradoxornis flavirostris* 39. Black-breasted Parrotbill	CR	MEF
F-Sylviidae	*Pellorneum albiventre* 40. Spot-throated Babbler	CR	MEF
F-Nectariniidae	*Arachnothera magna* 41. Streaked Spider hunter	EN	Hill forests

Appendix 2. **List of important bird species of Bangladesh**

Key- Status Code: Global status: LC= Least Concerned, VU= Vulnerable, NT= Near Threatened, CR= Critically Endangered. National status: VC= Very Common, C= Common, UC= Uncommon, R= Rare, V= Vagrant,

Sl. No	**Scientific Name**	**English Name**	**Status** Global-National
ORDER: GALLIFORMES **Family: Phasianidae**			
1.	*Coturnix coturnix*	Common Quail	LC, C
2.	*Gallus gallus*	Red Junglefowl	LC, C
3.	*Lophura leucomelanas*	Kalij Pheasant	LC, UC
4.	*Polyplectron bicalcaratum*	Gray Peacock Pheasant	LC, R
5.	*Coturnix coturnix*	Common Quail	LC, C
ORDER: ANSERIFORMES **Family: Dendrocygnidae**			
6.	*Dendrocygna javanica*	Lesser Whistling-duck	LC, C
ORDER: PICIFORMES **Family: Picidae**			
7.	*Celeus brachyurus*	Rufous Woodpecker	LC, C
8.	*Chrysocolaptes lucidus*	Greater Flameback	LC, C
9.	*Dendrocops canicapillus*	Gray-caped Pygmy Woodpecker	LC, C
10.	*Dendrocopos macei*	Fulvous-breasted Woodpecker	LC, C
11.	*Dinopium benghalense*	Black-rumped Flameback	LC, C
12.	*Dinopium javanense*	Common Flameback	LC, UC
13.	*Jynx torquilla*	Eurasian Wryneck	LC, C
14.	*Mulleripicus pulverulentus*	Great Slaty Woodpecker	LC, R
15.	*Picus canus*	Gray-headed Woodpecker	LC, C
16.	*Dinopium javanense*	Common Flameback	LC, UC
17.	*Picus flavinucha*	Greater Yellownape	LC, C
18.	*Sasia ochracea*	White-browed Piculet	LC, UC
Family: Megalaimidae			
19.	*Megalaima asiatica*	Blue-throated Barbet	LC, C

20.	*Megalaima australis*	Blue-eared Barbet	LC, C
21.	*Megalaima haemacephala*	Coppersmith Barbet	LC, C
22.	*Megalaima lineata*	Lineated Barbet	LC, C
	ORDER: BUCEROTIFORMES **Family: Bucerotidae**		
23.	*Anthracoceros albirostris*	Oriental Pied Hornbill	LC, UC
ORDER: UPUPIFORMES **Family: Upupidae**			
24.	*Upupa epops*	Common Hoopoe	LC, C
ORDER: TROGONIFORMES **Family: Trogonidae**			
25.	*Harpactes erythrocephalus*	Red-headed Trogon	LC, UC
	ORDER: CORACIIFORMES **Family: Coraciidae**		
26.	*Coracias benghalensis*	Indian Roller	LC, C
27.	*Eurystomus orientalis*	Dollarbird	LC, UC
	Family: Alcedinidae		
28.	*Alcedo atthis*	Common Kingfisher	LC, C
29.	*Alcedo meninting*	Blue-eared Kingfisher	LC, R
Family: Halcyonidae			
30.	*Halcyon smyrnensis*	White-throated Kingfisher	LC, Cc
31.	*Pelargopsis capensis*	Stork-billed Kingfisher	LC, UC
Family: Cerylidae			
32.	*Ceryle rudis*	Pied Kingfisher	LC, C
Family: Meropidae			
33.	*Merops leschenaulti*	Chestnut-headed Bee-eater	LC, C
34.	*Merops orientalis*	Green Bee-eater	LC, C
35.	*Merops philippinus*	Blue-tailed Bee-eater	LC, C
36.	*Nyctyornis athertoni*	Blue-bearded Bee-eater	LC, UC
ORDER: CUCULIFORMES **Family: Cuculidae**			
37.	*Cacomantis merulinus*	Plaintive Cuckoo	LC, C
38.	*Cacomantis sonneratii*	Banded Bay Cuckoo	LC, R
39.	*Chrysococcyx*	Violet Cuckoo	LC, UC

40.	*Clamator coromandus*	Chestnut-winged Cuckoo	LC, UC
41.	*Cuculus mieropterus*	Indian Cuckoo	LC, C
42.	*Eudynamys scolopacea*	Asian Koel	LC, C
43.	*Hierocoecyx varius*	Common Hawk Cuckoo	LC, C
44.	*Phaenicophaeus tristis*	Green-billed Malkoha	LC, C
45.	*Surniculus lugubris*	Drongo Cuckoo	LC, C
Family: Centropodidae			
46.	*Centropus bengalensis*	Lesser Coucal	LC, C
47.	*Centropus sinensis*	Greater Coucal	LC, C
ORDER: PSITTACIFORMES **Family: Psittacidae**			
48.	*Loriculus vernalis*	Vernal Hanging Parrot	LC,UC
49.	*Psittacula alexandri*	Red-breasted Parakeet	LC, C
50.	*Psittacula finschii*	Gray-headed Parakeet	LC,R
51.	*Psittacula krameri*	Rose-ringed Parakeet	LC, C
ORDER: APODIFORMES **Family: Apodidae**			
52.	*Apus affinis*	House Swift	LC, C
53.	*Cypsiurus balasiensis*	Asian Palm Swift	LC, C
ORDER: STRIGIFORMES **Family: Tytonidae**			
54.	*Tyto alba*	Barn Owl	LC,UC
Family: Strigidae			
55.	*Athene brama*	Spotted Owlet	LC, VC
56.	*Glaucidium cuculoides*	Asian Barred Owlet	LC, C
57.	*Ninox scutulata*	Brown Hawk Owl	LC, C
58.	*Otus bakkamoena*	Collared Scops Owl	LC, C
59.	*Otus sunia*	Oriental Scops Owl	LC,UC
Family: Caprimulgidae			
60.	*Caprimulgus macrurus*	Large-tailed Nightjar	LC, UC
ORDER: COLUMBIFORMES **Family: Columbidae**			
61.	*Chalcophaps indica*	Emeral Dove	LC, C

62.	*Columba livia*	Rock Pigeon	LC, C
63.	*Ducula aenea*	Green Imperial Pigeon	LC, R
64.	*Streptopelia chinensis*	Spotted Dove	LC, C
65.	*Streptopelia orientalis*	Oriental Turtle Dove	LC, UC
66.	*Streptopelia tranquebarica*	Red Collared Dove	LC, C
67.	*Treron apicauda*	Pin-tailed Green Pigeon	LC, V
68.	*Treron bicineta*	Orange-breasted Green Pigeon	LC, UC
69.	*Treron curvirostra*	Thick-billed Green Pigeon	LC, R
70.	*Treron phoenicoptera*	Yellow-footed Green Pigeon	LC, UC
71.	*Treron pompadora*	Pompadour Green Pigeon	LC, R
ORDER: GRUIFORMES **Family: Rallidae**			
72.	*Amaurornis phoenicurus*	White-breasted Waterhen	LC, UC
ORDER: CICONIIFORMES **Family: Scolopacidae**			
73.	*Actitis hypoleucos*	Common Sandpiper	LC, C
74.	*Gallinago gallinago*	Common Snipe	LC,C
Family: Jacanidae			
75.	*Metopidius indicus*	Bronze-winged Jacana	LC, UC
Family: Charadriidae			
76.	*Vanellus duvaucelii*	River Lapwing	LC, UC
77.	*Vanellus indicus*	Red-wattled Lapwing	LC, C
78.	*Vanellus malabaricus*	Yellow-wattled Lapwing	LC, UC
Family:Laridae			
79.	*Larus brunnicephalus*	Brown-headed Gull	LC, C
Family: Accipitridae			
80.	*Accipiter badius*	Shikra	LC, VC
81.	*Accipiter virgatus*	Besra	LC, R
82.	*Aviceda jerdoni*	Jerdon's Baza	LC, R
83.	*Aviceda leuphotes*	Black Baza	LC, UC
84.	*Haliastus indus*	Brahminy Kite	LC, VC
85.	*Ichthyophaga ichthyaetus*	Gray-Headed Fish Eagle	LC, C
86.	*Milvus migrans*	Black Kite	LC, C

87	*Spilornis cheela*	Crested Serpent Eagle	LC, C
Family:Falconidae			
88.	*Falco tinnunculus*	Common Kestrel	LC, VC
Family: Phalacrocoracidae			
89.	*Phalacrocarax carbo*	Great Cormorant	LC, C
90.	*Phalacrocarax niger*	Little Cormorant	LC, C
Family: Ardeidae			
91.	*Ardeola grayii*	Indian Pond Heron	LC, C
92.	*Bubulcus ibis*	Cattle Egret	LC, C
93.	*Casmerodius albus*	Great Egret	LC, C
94.	*Egretta garzetta*	Little Egret	LC, C
95.	*Gorsachius melanolophus*	Malayan Night Heron	LC, R
96.	*Ixobrychus cinnamomeus*	Cinnamon Bittern	LC, C
97.	*Ixobrychus sinensis*	Yellow Bittern	LC, UC
98.	*Mesophoyx intermedia*	Intermidiate Egret	LC, C
ORDER: PASSERIFORMES **Family: Pittidae**			
99.	*Pitta nipalensis*	Blue-naped Pitta	LC, R
100.	*Pitta sordida*	Hooded Pitta	LC, UC
Family: Irenidae			
101.	*Chloropsis aurifrons*	Golden-fronted Leafbird	LC, C
102.	*Chloropsis cochinchinensis*	Blue-winged Leafbird	LC, UC
103.	*Irena puella*	Asian Fairy Bluebird	LC, UC
Family: Laniidae			
104.	*Lanius schach*	Long-tailed Shrike	LC, C
105.	*Lanius tephronotus*	Gray-backed Shrike	LC, UC
106.	*Lanius collurioides*	Brown Shrike	LC, C
	Family: Corvidae		
107.	*Aegithina tiphia*	Common Iora	LC, C
108.	*Artamus fuscus*	Ashy Woodswallow	LC, C
109.	*Cissa chinensis*	Common Green Magpie	LC, UC
110.	*Coracina macei*	Large Cuckooshrike	LC, C
111.	*Coracina melanoptera*	Black-headed Cuckooshrike	LC, C

112.	*Corvus macrorhynchos*	Large-billed Crow	LC, C
113.	*Corvus splendens*	House Crow	LC, C
114.	*Dendrocitta vagabunda*	Rufous Treepie	LC, C
115.	*Dicrurus aeneus*	Bronzed Drongo	LC, C
116.	*Dicrurus hottentottus*	Spangled Drongo	LC, UC
117.	*Dicrurus macrocercus*	Black Drongo	LC, C
118.	*Dicrurus paradiseus*	Greater Racket-tailed Drongo	LC, C
119.	*Dicrurus remifer*	Lesser Racket-tailed Drongo	LC, UC
120.	*Hemipus picatus*	Bar-winged Flycatchershrike	LC, C
121.	*Hypothymis azurea*	Black-naped Monarch	LC, C
122.	*Oriolus traillii*	Marion Oriole	LC, R
123.	*Oriolus xanthornus*	Black-hooded Oriole	LC, C
124.	*Pericrocotus cinnamomeus*	Small Minivet	LC, C
125.	*Pericrocotus flammeus*	Scarlet Minivet	LC, C
126.	*Rhipidura albicollis*	White-throated Fantail	LC, C
127.	*Tephrodornis gularis*	Large Woodshrike	LC, C
128.	*Tephrodornis pondicerianus*	Common Woodshrike	LC, C
129.	*Terpsiphone paradisi*	Asian Paradise-flycatcher	LC, UC
	Family: Muscicapidae		
130.	*Copsychus malabarichus*	White-rumped Shama	LC, C
131.	*Copsychus saularis*	Oriental Magpie Robin	LC, C
132.	*Culicicapa ceylonensis*	Gray-headed Canary Flycatcher	LC, C
133.	*Cyornis poliogenys*	Pale-chinned Flycatcher	LC, C
134.	*Enicurus immaculatus*	Black-backed Forktail	LC, C
135.	*Eumyias thalassina*	Verditer Flycatcher	LC, C
136.	*Ficedula parva*	Red-throathed Flycatcher	LC, VC
137.	*Saxicola caprata*	Pied Bushchat	LC, C
138.	*Saxicola torquata*	Common Stonechat	LC, C
139.	*Zoothera citrina*	Orange-headed Thrush	LC, UC
140.	*Zoothera dauma*	Scaly Thrush	LC, V
Family: Sturnidae			
141.	*Acridotheres fuscus*	Jungle Myna	LC, C
142.	*Acridotheres tristis*	Common Myna	LC, C

143.	*Aplonis panayensis*	Asian Glossy Starling	LC, R
144.	*Gracula religiosa*	Hill Myna	LC, UC
145.	*Sturnus contra*	Asian Pied Starling	LC, C
146.	*Sturnus malabaricus*	Chestnut-tailed Starling	LC, C
	Family: Certhiidae		
147.	*Parus major*	Great Tit	LC, C
Family: Hirundinidae			
148.	*Hirundo rustica*	Barn Swallow	LC, C
Family: Pycnonotidae			
149.	*Alphoixus flaveolus*	White-throated Bulbul	LC, C
150.	*Lole virescens*	Olive Bulbul	LC, UC
151.	*Pycnonotus atriceps*	Black-headed Bulbul	LC, UC
152.	*Pycnonotus cafer*	Red-vented Bulbul	LC, C
153.	*Pycnonotus jocosus*	Red-whiskered Bulbul	LC, C
154.	*Pycnonotus melanictcrus*	Black-crested Bulbul	LC, C
Family: Cisticolidae			
155.	*Cisticola juncidis*	Zitting Cisticola	LC, C
156.	*Prinia criniger*	Striated Prinia	LC, R
157.	*Prinia hodgsonii*	Gray-breasted Prinia	LC, C
158.	*Prinia inornata*	Plain Prinia	LC, C
Family: Zosteropidae			
159.	*Zosterops palpebrosus*	Oriental White-eye	LC, C
Family: Sylviidae			
160.	*Alcippe nipalensis*	Nepal Fulvetta	LC, R
161.	*Gampsorhynchus rufulus*	White-hooded Babbler	LC, R
162.	*Garrulax leucolophus*	White-creasted Laughingthrush	LC, U
163.	*Garrulax pectoralis*	Greater Necklaced Laughingthrush	LC, C
164.	*Garrulax ruficollis*	Ruffous-necked Laughingthrush	LC, C
165.	*Macronous gularis*	Striped Tit Babbler	LC, UC
166.	*Malacocincla abbotti*	Abbott's Babbler	LC, UC
167.	*Megalurus palustris*	Strited Grassbird	LC, C
168.	*Orthotomus atrogularis*	Dark-necked Tailorbird	LC, C
169.	*Orthotomus sutorius*	Common Tailorbird	LC, C

170.	*Pellorneum ruficeps*	Puff-throated Babbler	LC, C
171.	*Phylloscopus fuscatus*	Dusky Warbler	LC, C
172.	*Phylloscopus reguloides*	Blyth's Leaf Warbler	LC, C
173.	*Pomatorhinus hypoleucos*	Large Scimiter Babbler	LC, R
174.	*Stachyris nigriceps*	Gray-throated Babbler	LC, UC
175.	*Timalia pileata*	Chestnut-caped Babbler	LC, UC
176.	*Turdoides striatus*	Jungle Babbler	LC, C
177.	*Yuhina zantholeuca*	White-bellied Yuhina	LC, R
Family: Nectariniidae			
178.	*Aethopyga siparaja*	Crimson Sunbird	LC, C
179.	*Anthreptes singalensis*	Ruby-checked Sunbird	LC, C
180.	*Arachnothera longirostra*	Little Spiderhunter	LC, C
181.	*Arachnothera magna*	Streaked Spiderhunter	LC, UC
182.	*Dicaeum agile*	Thick-billed Flowerpecker	LC, R
183.	*Dicaeum chrysorrheum*	Yellow-vented Flowerpecker	LC, UC
184.	*Dicaeum cruentatum*	Scarlet-backed Flowerpecker	LC, C
185.	*Dicaeum erythrorynchos*	Pale-billed Flowerpecker	LC, V
186.	*Nectarinia asiatica*	Purple Sunbird	LC, C
187.	*Nectarinia sperata*	Purple-throated Sunbird	LC, C
	Nectarinia zeylonica	Purple-rumped Sunbird	LC, C
Family: Passeridae			
188.	*Anthus hodgsoni*	Olive-backed Pipit	LC, C
189.	*Anthus rufulus*	Paddyfield Pipit	LC, C
190.	*Dendronanthus indicus*	Forest Wagtail	LC, R
191.	*Lonchura malacca*	Black-headed Munia	LC, UC
192.	*Lonchura punctulata*	Scaly-breasted Munia	LC, C
193.	*Lonchura striata*	White- rumped Munia	LC, U
194.	*Motacilla alba*	White Wagtail	LC, C
195.	*Motacilla citreola*	Citrine Wagtail	LC,C
196.	*Motacilla maderaspatensis*	White-browed Wagtail	LC, R
197.	*Passer domesticus*	House Sparrow	LC, C
198.	*Ploceus philippinus*	Baya Weaver	LC, C

Appendix 3. Categories of protected areas in Bangladesh

Category I(a) Strict Nature Reserve (Protected area managed mainly for science): Area physiological features and/or species, available primarily for scientific research and/or environmental of land and/or sea possessing some outstanding or representative ecosystems, geological or monitoring.

Category I(b) Wilderness Area (Protected area managed mainly for wilderness protection): Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.

Category II National Park (Protected area managed mainly for ecosystem protection and recreation): Natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.

Category III Natural Monument (Protected area managed mainly for conservation of specific natural features): Area containing one or more specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance.

Category IV Habitat/Species Management Area (Protected area managed mainly for conservation through management intervention): Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.

Category V Protected Landscape/Seascape (Protected area managed mainly for landscape/sea scape conservation and recreation): Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.

Category VI Managed Resource Protected Area (Protected area managed mainly for the sustainable use of natural ecosystems): Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.

Appendix 4. **List of Protected Areas (PAs) of Bangladesh for *in situ* Conservation**

Sl. No.	Name of the site	Forest Type	Area (Hectare)	Established
1	Bhawal National Park	Sal forest	5,022.00	1974
2	Madhupur National Park	Sal forest	8,436.00	1982
3	Lawachara National Park	Tropical evergreen & semi evergreen forests	1250.00	1996
4	Satchari National Park	Tropical evergreen & semi evergreen forests	243.00	2005
5	Ramsagar National Park	Plantation forest	27.75	2001
6	Himchari National Park	Tropical semi evergreen forests	1729.00	1980
7	Kaptai National Park	Tropical mixed evergreen & plantation forests	5464.00	1999
8	Medha Kassapia National Park	Rain forests	396.00	2004
9	Nijhum Dweep National Park	Mangrove forests	16352.00	2001
10	Khadimnagar National Park	Tropical evergreen forests	679.00	2006
11	Baroiyadhala National Park	Mixed Tropical Evergreen forests	29,33.61	2010
12	Hatibandha National Park	Sal forest	33.03	2005
13	Jaflong National Park	Mixed plantation forest	2033.88	2005
14	Dhamirhat-Alta Dighi National Park	Sal forest	264.00	2005
15	Kuakata National Park		1613.00	2010
16	Nababgonj National Park		517.61	2010
17	Kadigarh National Park		344.13	2010
18	Singra National Park		305.69	2010
19	Birgonj National Park			
Wildlife Sanctuary				
20	Sundarban East (Katka Kachikhali) Wildlife Sanctuary, bagerhat	Mangrove forests	31226.00	1996
21	Sundarban South (Nilkamal), Khulna	Mangrove forests	36970.00	1996
22	Sundarban West (Mandarbaria) Wildlife Sanctuary, Satkhira	Mangrove forests	71502.00	1996
23	Rema Kalenga Wildlife Sanctuary	Tropical wet evergreen forests	1795.00	1981
24	Char Kukri-Mukri Wildlife Sanctuary	Mangrove forests	40.00	1981
25	Publakhali Wildlife Sanctuary	Tropical semi evergreen	42087.00	1983

Sl. No.	Name of the site	Forest Type	Area (Hectare)	Established
		& evergreen forests		
26	Chunati Wildlife Sanctuary	Tropical semi evergreen & evergreen forests	7764.00	1980
27	Fashiakhali Wildlife Sanctuary	Mixed evergreen forest	1302.00	2007
28	Teknaf Wildlife Sanctuary	Semi-evergreen and evergreen forest	11615.00	1983
29	Hajarkhil Wildlife Sanctuary	Mixed evergreen forest	2908.00	2010
30	Dudpukuria-Dhopachari Wildlife Sanctuary	Mixed evergreen forest	4716.57	2010
31	Sangu Wildlife Sanctuary	Mixed evergreen forest	2332.00	2010
32	Tengragiri Wildlife Sanctuary		4048.00	2010
33	Dudhmukhi Wildlife Sanctuary		170.00	2012
34	Chadpai Wildlife Sanctuary	Mangrove forests	560.00	2012
35	Dhangmari Wildlife Sanctuary	Mangrove forests	340.00	2012
36	Shilanda-Nagdemra Wildlife (dolphin) Sanctuary		24.17	2013
37	Nagarbari-Mohanganj Dolphin Sanctuary		408.11	2013
Safari Park/Eco park				
38	Bangabandhu (Dulahazara) Safari Park (Cox's Bazar)	Tropical semi evergreen & evergreen forest	900.00	1990
39	Bangabandhu Safari Park (Gazipur)	Sal forest	1542.50	2010
40	Hatibandha	Sal forest	33.03	2005
41	Modhutila Ecopark, sherpur		100	1999
42	Banskhali Ecopark		1200	2003
43	Kuakata Ecopark		5661	2005
44	Tilagar Ecopark		45.34	2006
45	Borshijora eEopark		326.07	2006
46	Madhabkundu Ecopark		265.68	2001
Marine Protected Area/ECA/Mangrove Area				
47	Sonadia	Mangrove plantation forest	3500.00	-
Important Bird Area (Migratory)				
48	Hakauki Haor	Wetlands	4400.00	18383
49	Baikka Beel	Wetlands	200.00	
Botanical Garden				
50	National Botanical Garden	Mixed plantation	83.00	1961
51	Sitakundu Botanical Garden-Eco park	Mixed plantation	809.71	2001
52	Baldha Garden	Mixed plantation	1.37	1909

Appendix 5. **List of Ecologically Critical Areas (ECAs) of Bangladesh**

Sl. No	Name of the ECAs/Wetlands	District	Area (ha)
1	Sundarbans (10 km periphery buffer around the forest) *	Bagerhat, Khulna and Satkhira	7,62,034 Ha
2	Teknaf Peninsula	Cox's Bazar	10,465 Ha
3	St. Martin's Island	Cox's Bazar	590 Ha
4	Sonadia Island	Cox's Bazar	4,916 Ha
5	Hakaluki Haor	Moulavibazar and Sylhet	18,383 Ha
6	Tangua Haor *	Sunamganj	9,727 Ha
7	Marjat Baor, Jhenaidah	Jhenaidaha	200 Ha
8	Gulshan-Baridhara Lake, Dhaka	Dhaka	53.59 Sq. KM
9	Buriganga River (around Dhaka city)	Around Dhaka city	River and either side of its foreshore
10	Turag River (around Dhaka city)	Around Dhaka city	River and either side of its foreshore
11	Sitalakhya River (around Dhaka city)	Around Dhaka city	River and either side of its foreshore
12	Balu River (around Dhaka city)	Around Dhaka city	River and either side of its foreshore

Reference: Department of Environment, 2009, from Gazette notification

*** = also designated as RAMSAR Sites (Source: Department of Environment)**

Sonadia Island (MPA) and Hakaluki Haor ECAs also mentioned in the Table-3.1

Appendix 6. Structures and functions of the co-management committee

A two-tier institutional structure for sustainable forest management in protected areas based on the principles of co-management has been proposed here:

Protected Area Conservation Council: It is the first tier of thestructure, and would take area specific name such as, Lawachara National Park Conservation Council, Satchuri National Park Conservation Council, Tekhnaf Game Reserve Conservation Council, etc.

Protected Area Conservation Co-Management Committee: This is the second tier of the structure and would also take area specific name such as, Lawachara National Park Co-Management Committee, Tekhnaf Game Reserve Co-Management Committee, Satchuri National Park Co-Management Committee, etc.

The Council and the Committees will be formed within a defined landscape. For all practical purposes and based on objective realities the landscape, for the Northern Sites, has been delineated as an area covering one kilometer around the protected areas and for the southern sites the delineated area is two kilometers. If the spatial coverage of the landscape is large, it will be divided into smaller segments, if possible, aligning with the Union Parisad (UP) boundaries. It is expected that such lining up with the UP boundaries will help in avoiding conflicts of authority and consequent indifference and lack of cooperation that could emerge if UP representatives from two different Union Parisads were together in the same committee.

Protected Area Conservation Council will have a broad-based structure, drawing people from different strata of the community from the total landscape. The total number of members will not exceed 50. The members shall meet twice a year, once after six months and another at year end in the Annual General Meeting. The DFO or ACF will serve as the Chairperson of the Council.

Protected Area Conservation Co-Management Committee will consist of 15 to 20 members, elected by the Council following a structured guideline. The ACF will serve as the Chairperson to the Committee. The guideline will not only indicate how many people could be elected from each of the representative group noted above but will also provide election procedures and norms and the tasks to be performed by the committee. The committee will have a Chair Person, Vice-Chairperson, and a Secretary. Half of the members of the committee will retire voluntarily every year and new members will be elected in the vacant posts. A member can not be elected in two consecutive years; attention shall be paid on ensuring that all members get elected eventually.

The Co-Management Committee will be primarily responsible for overall management of the protected area. If the landscape of the protected area is too big, the Co-management Committee will segment the landscape into multiple sectors and form an informal action committee in each sector to undertake actions aimed at protecting the forest and conserving bio-diversity. The Committee will prepare an action plan for protecting the forest specifying roles and responsibilities of specific people selected for the purpose.

In the composition of the protected area co-management committee a total of 50 members was selected. The composition of the Protected Area conservation council will be as follows:

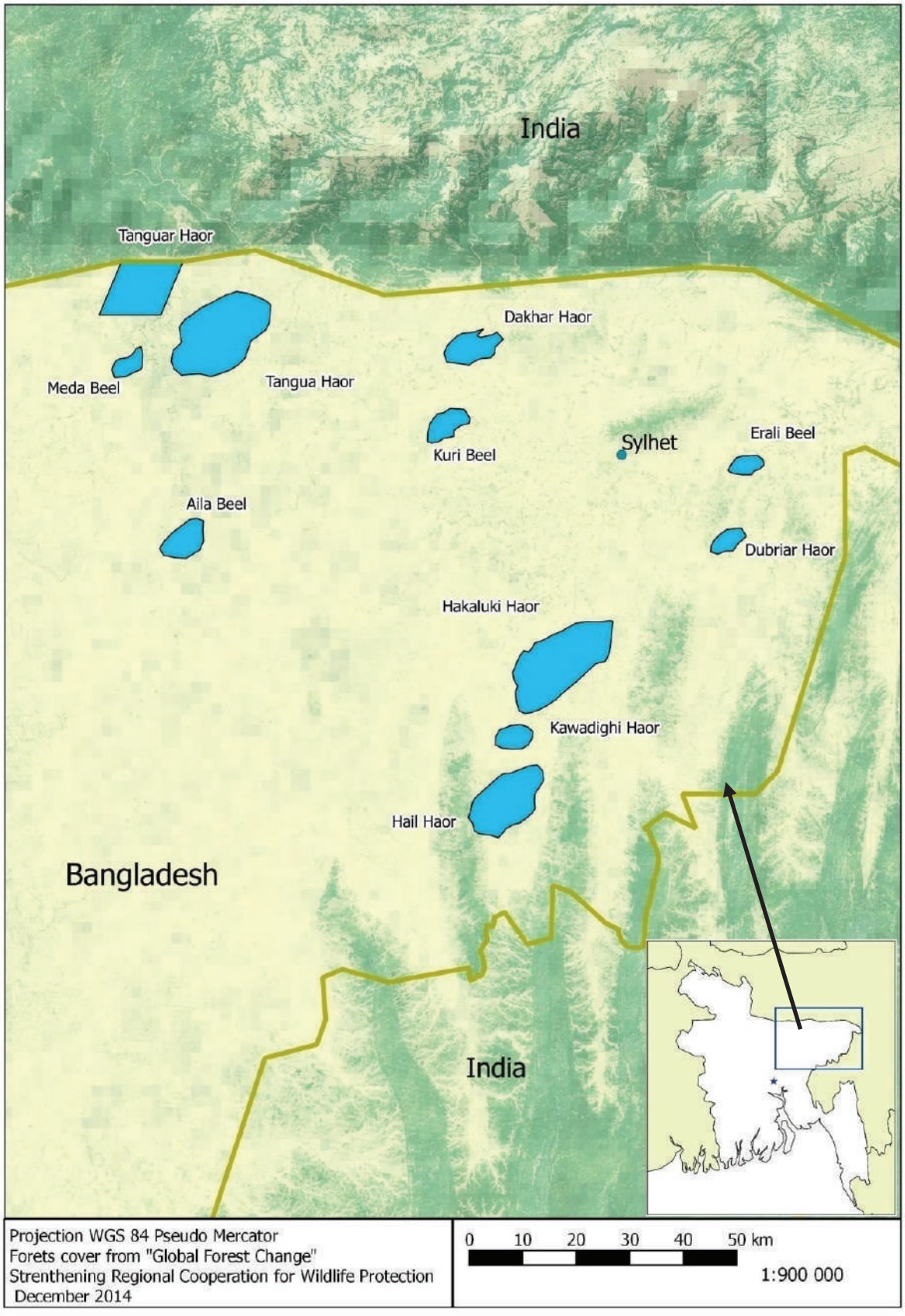
- DFO/Assistant Conservator of Forest (ACF)
- 9 Representatives from NGO Organized Federations/Groups
- 12 Representatives from the Local Government
- 7 Representatives from Local Elite: Teachers, Doctors, Social Activists, Journalist, Religious Leaders, others.
- 5 Representatives from Resource Owning Group: Sawmill Owners, Brickfield Owners, Timber Traders, Furniture Shop Owners, Large Land owners, Representatives from Bazaar Committees, Representative from Tea gardens.
- 2 Representatives from the Forest Department: Range Officer/Beat Officer
- 2 Representatives from Law Enforcing Authorities: BDR, Police, Ansar/VDP
- 5 representatives from NGOs/CBOs
- 3 Representatives from Ethnic Communities
- 5 Representatives from Other Government Departments: Dept of Agricultural Extension (DAE), Ministry of Health and Family Planning (MOHFP), Department of Fisheries, Department of Land.

ACF/Range Officer-Convener (Total number of members: Maximum 19, Ideal 15)

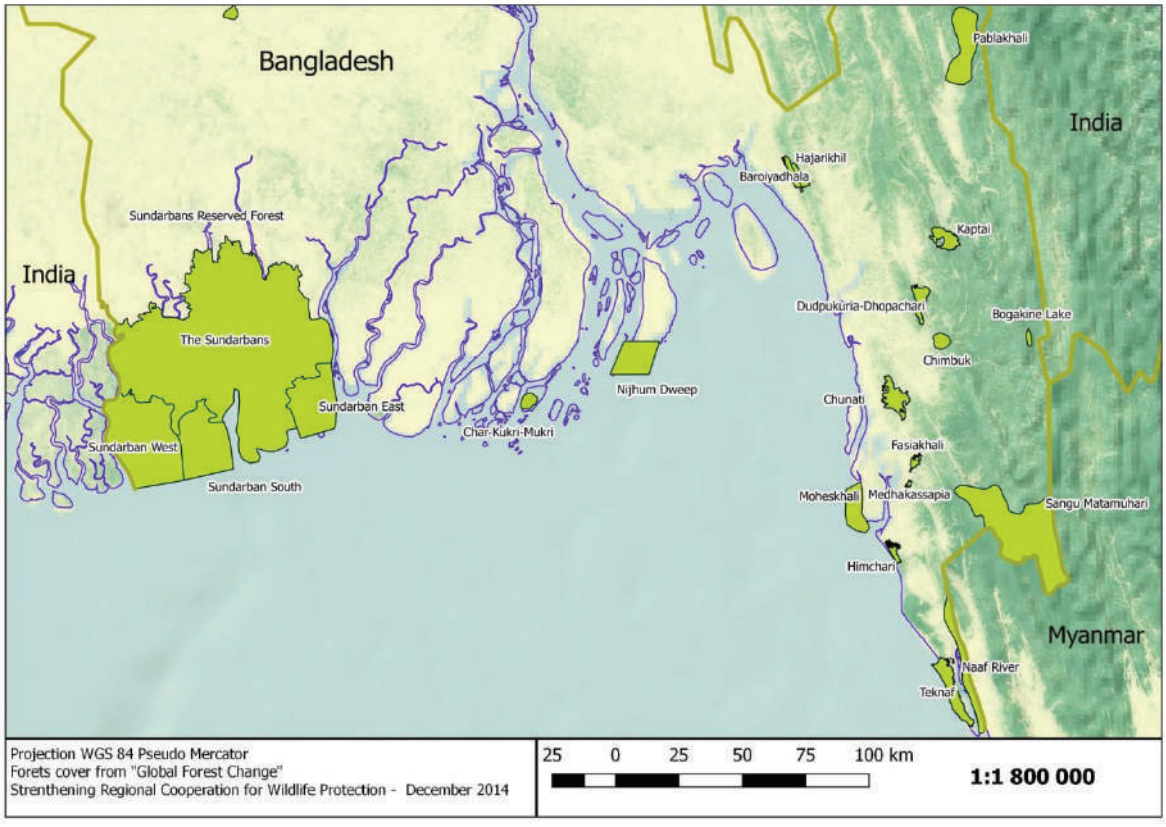
- 3 Representatives from Forest Villages: Village Headman/Minister
- 2 Representatives from NGO-Organized Federations/Groups
- 2 Representatives from the Local Government
- 2 Representatives from NGOs
- 1 Representative from CBOs
- 3 Representatives from Local Elite
- 2 Representatives from Resource Owning Group
- 1 Representatives from Law-Enforcing Authorities
- 2 Representatives from the Government Department

Appendix 7. Most potential habitats of birds in Bangladesh territory

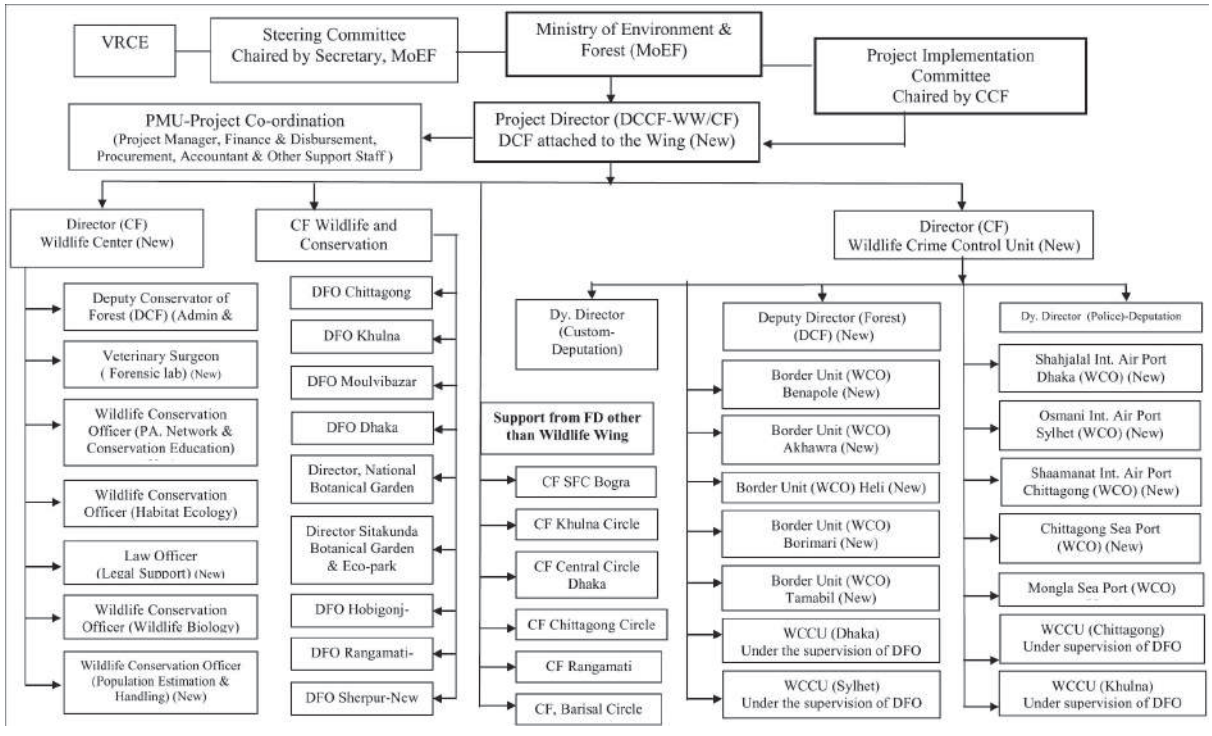
Appendix 8. Important haor basins of Bangladesh where birds species need to be conserved



Appendix 9. Coastal habitats of bird species of Bangladesh



Appendix 10. Proposed organogramme of Wildlife and Nature Conservation Circle



Appendix 11. Bird species seized/ rescued at Rajshahi Forest Division, Wildlife Management & Nature Conservation Division, Rajshahi

Sl no	Date	Rescued Wildlife	No.	Penalty/Acquittal
1.	18.04.13	Dove	11	1 yr. imprisonment
2.	25.05.13	Birds	45	Offender released by undertaken.
3.	17.9.13	Parakeet	256	6 months imprisonment each
4.	15.10.13	Common Mayna & dove	15	Air gun destroyed by the local people
5.	29.10.13	Parakeet & dove	16	Offender released on undertaken by the local people.
6.	6.12.13	Parakeet Dove	6 12	Offenders released on undertaken with the request of the local elites.
7.	9.12.13	Munia	30	15 days imprisonment
8.	19.12.13	Parakeet, bulbul, common myna	16	Offender was handover to the Police station,Mohadevpur
9.	20.12.13	Painted snipe	47	6 months imprisonment
10.	24.12.13	Migratory bird	5	Offenders released on undertaken with the request of the local elites.
11.	13.01.14	Dove	4	Offender released on undertaken with the request of the local elites.
12.	19.01.14	Dove Parakeet	2 3	Offender released on undertaken with the request of the local elites.
13.	09.02.14	Parakeet, dove	10	Offender released on undertaken with the request of the local elites.
14.	13.02.13	Lesser adjutant	1	3 months imprisonment each
15.	26.03.14	Parakeet	2	Offenders were released on undertaken with the request of the local elites.
16.	04.04.14	Parakeet	2	Offender were released on undertaken
17.	20.04.14	Bank myna	3	Offender were released on undertaken
18.	11.05.14	Dove Waterhen & Parakeet	9 2	5000 Tk penalty or 1 month imprisonment
19.	14.05.1	Dove	11	Offender were released on undertaken
20.	10.07.14	Parakeet	1	Offender were released on undertaken
21.	13.07.14	Parakeet Munia	80 150	5 months imprisonment and 5000 Tk penalty
22.	16.07.14	Pond Heron	3	Offender were released on undertaken
23.	17.09.14	Common Myna	12	Offender were released on undertaken
24.	17.09.14	Pond heron & Lattle egret	8	1 month and 10 days imprisonment
25.	17.09.14	Pond heron, Lattle egret	28	1 month imprisonment each
26.	17.09.14	Pond heron & Lattle egret	118	2 months imprisonment each
27.	18.09.14	Asian openbill Common Myna	5 23	Physical punishment &undertaken
28.	20.09.14	Parakeet Munia	11 14	Offender were released on undertaken

Appendix 12 **Bird survey form.**

Survey Form No. 4

Fixed Width transect Survey Form

1. Area Code: . . . . District code. . . . . Site name:. . . . . ..
Start in:. . . . . .
2. Transect No:. . . . . Time out :.....
3. Date:. . . . . Observers' name:. . . . . .
Thana:. . . . . .Union:. . . . . .
4. District:. . . . . Village:. . . . . .
5. Habitat:. . . . . .
6. Dominent Plant species:. . . . . .
7. Transect length:. . . . . Transect width:.
8. Start GPS point:. . . . . .
. . . . . End GPS point:. . . . . .

Animal observed

Local name	Species name	No. observed	Microhabitat	Remarks

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পরিবেশ ও বন মন্ত্রণালয়
পরিকল্পনা শাখা-৫
www.moef.gov.bd

নং-২২.০০.০০০০.০৮২.১৪.০৩.২০১৬-১৫৭ তারিখঃ ২৭/০৬/২০১৬ খ্রিঃ

বিষয়ঃ **Submission of Management Plan (Five), Wildlife Conservation Master Plan and Species Conservation Plan and Ecotourism Management Plan (Three).**

সূত্রঃ বন অধিদপ্তরের পত্র নং-২২.০১.০০০০.০১১.(প্রঃ).ডব্লিউ-১৬ (পার্ট-২).২০১৬-২৪৬, তারিখঃ ১২/০৪/২০১৬।

উপর্যুক্ত বিষয় ও সূত্রস্থ পত্রের প্রেক্ষিতে জানানো যাচ্ছে যে, বন অধিদপ্তর কর্তৃক বাস্তবায়নাধী "Strengthening Regional Cooperation for Wildlife Protection (SRCWP)" শীর্ষক প্রকল্পের আওতায় প্রণীত ১২টি প্ল্যান (যথাঃ ৫টি Management Plan, ৩টি Ecotourism Management plan, ২টি Action Plan, ১টি Master Plan এবং ১টি Management Strategy) অনুমোদন করা হল এবং প্ল্যানসমূহ বাস্তবায়নের নিমিত্ত পৃথকভাবে ৫টি প্রাথমিক প্রকল্প প্রস্তাব (PDPP) প্রণয়ন করে মন্ত্রণালয়ে প্রেরণের জন্য নির্দেশক্রমে অনুরোধ করা হল।

০২। উল্লেখ্য আলোচ্য **৫টি Management Plan** (যথাঃ1. Nijhum Dwip National Park Management Plan 2. Dudpukuria-Dhopachari Wildlife Sanctuary Management plan 3. Bhawal National Park Management plan 4.Altadighi National Park Management plan 5. Sundarban West Wildlife Sanctuary Management plan) বাস্তবায়নের নিমিত্ত একটি Umbrella প্রকল্প, **৩টি Ecotourism Management plan** (যথাঃ1. Nijhum Dwip National Park Ecotourism Management plan, 2. Bhawal National Park Ecotourism Management plan 3.Altadighi National Park Ecotourism Management plan) বাস্তবায়নের নিমিত্ত পৃথক একটি Umbrella প্রকল্প, **২টি Action Plan** (যথাঃ1. Action Plan for The Management of Herpetofauna in Bangladesh, 2. Action Plan for The Management of Birds in Bangladesh) সমন্বয় করে একটি প্রকল্প এবং **Master Plan** (যথাঃ 1.Bangladesh Wildlife Conservation Master Plan) ও **Management Strategy** (যথাঃ 1. Mammal Management Strategy With Emphasis on Human-Wildlife Conflicts in Bangladesh) এর জন্য পৃথক ২টি প্রকল্প সহ মোট ৫টি প্রকল্প গ্রহণ করা যেতে পারে। প্রস্তাবিত প্রকল্পসমূহ বাস্তবায়নের নিমিত্ত ইআরডির মাধ্যমে উন্নয়ন সহযোগী সংস্থার সহায়তা চাওয়া যেতে পারে এবং বৈদেশিক সাহায্য না পাওয়া গেলে প্রকল্পগুলো জিওবি অর্থায়নে বাস্তবায়ন করা যেতে পারে।

২৭.৬.১৬
(ফারজানা জাহান)
সহকারী প্রধান
ফোনঃ ৯৫৪০২৫৯

প্রধান বন সংরক্ষক
বন অধিদপ্তর, বন ভবন
আগারগাঁও, ঢাকা।

সদয় অবগতির জন্য অনুলিপি ঃ

১। সচিব মহোদয়ের একান্ত সচিব, পরিবেশ ও বন মন্ত্রণালয়, ঢাকা।
২। প্রকল্প পরিচালক, "স্ট্রেংদেনিং রিজিওনাল কো-অপারেশন ফর ওয়াইল্ড লাইফ প্রটেকশন" শীর্ষক প্রকল্প পুরাতন বন ভবন, মহাখালী, ঢাকা।
৩। অতিরিক্ত সচিব (উন্নয়ন) মহোদয়ের ব্যক্তিগত কর্মকর্তা, পরিবেশ ও বন মন্ত্রণালয়।
৪। উপ-প্রধান মহোদয়ের ব্যক্তিগত কর্মকর্তা, পরিবেশ ও বন মন্ত্রণালয়।

The **Strengthening Regional Co-operation for Wildlife Protection (SRCWP)** project, the first World Bank supported regional project in South Asia, aims to build country capacity and incentives for tackling the illegal wildlife trade and other selected regional conservation threats to habitats in border areas. The project was launched in 2011 in Bangladesh and Nepal in the first phase and Bhutan joined in the second phase to bring regional collaboration in combating wildlife crime through strengthened legislative and regulatory frameworks and well-equipped specialized agencies and systems, as well as relevant training and awareness programmes for staff responsible for enforcement of wildlife laws and regulations. The project is also supporting the institutional strengthening of the South Asia Wildlife Enforcement Network (SAWEN) which was established by SAARC countries in 2011 to combat wildlife crime in the South Asia Region.

The Bangladesh Forest Department (BFD) is implementing the project through a partnership with research institutes, universities and environmental NGOs. A total of 36 sub-projects have been supported to improve the management of protected areas and conservation of flagship species through a landscape approach. Some of the sub-projects are addressing human-wildlife conflict through engagement with the local communities and civil society to foster and enduring culture of wildlife stewardship and protection. The regional wildlife project has supported the establishment of a Wildlife Crime Control Unit (WCCU) within the wildlife circle, three wildlife Divisions in the Forest Department, and a Wildlife Centre to undertake training, research, education and awareness on the issues of wildlife conservation and protection.

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