Government of the People's Republic of Bangladesh
Ministry of
Housing and Public Works Urban Development Directorate

FLORA AND FAUNA SURVEY UNDER "PREPARATION OF DEVELOPMENT PLAN FOR MEHERPUR DISTRICT

Report on
Spatial Distribution of Habit

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Contents

Content of Table

Contant of Figure

Chapter-1: Introduction

1.1. Project Background

Bangladesh is not only the world's fastest-growing populous country, but also a country with immense potential in the near future. As the world's population grows, so does urbanization. Without suitable standards, it is difficult to manage the developing urban areas as a result of urbanization. Urbanization includes the expansion of houses and other infrastructure. Nobody can deny that the housing and infrastructure situation in metropolitan areas is deteriorating day by day. It must be arranged in order to be properly guided. Meanwhile, the honorable Prime Minister issued significant instructions for the country's spatial and sectoral planning at different levels. Bangladesh is one of the world's most densely populated countries, and it has had tremendous population increase over the last century, however the rate of growth has recently slowed to a reasonable level. Over the next decade, the country will see a rapid development of urbanization. According to an estimate, by 2020, nearly every other man, woman and child will live in an urban area (World Bank ed., Bangladesh 2020). Bangladesh's urban population has been growing at a yearly average rate of 6 percent since independence, at a time when the national population growth was 2.2 percent. As a result, urban population has grown six-fold, compared with a 70 percent increase in rural population (World Bank, 2007). As per recent UN data, approximately 25 percent of Bangladesh's current population currently lives in urban areas. Of this urban population, more than half lives in the four largest cities: Dhaka, Chittagong, Khulna and Rajshahi.

Urbanization refers to the increase in the number of people living in urban areas such as towns and cities. In the course of urbanization, urban expansion is unavoidable. People in Bangladesh are increasingly preferring to reside in and around cities and towns in recent years. People in our country primarily migrate from rural to cities in pursuit of a variety of opportunities. Urbanization, on the other hand, is frequently used as an indicator of development. Unplanned urbanization, on the other hand, poses a hazard to developing countries like Bangladesh. Bangladesh's urbanization has recently been complicated by a number of new issues. Such growing difficulties, as well as their impact, can be mitigated with proper planning and actions. Bangladesh would undoubtedly attain its targeted sustainable urban growth goal through planned urbanization. In 2008, humankind has crossed a socio-demographic milestone for the first time in history by having half of its population living within the urban areas (UNFPA, 2007).

In developing countries, urbanization has now become a powerful force. Cities are important drivers of growth and development, providing jobs, infrastructure, and services. With the unplanned expansion, the growing number of people, assets, and economic activities increase the exposure of cities to the impacts of disasters and climate change. However, in low and lower-middle income countries, new urban development is increasingly more likely to occur on hazard-prone land, namely in floodplains and other low-lying areas, along fault lines, and on steep slopes. In addition to settling in hazard-prone areas, much of the building construction that occurs is unregulated and unplanned, placing vulnerable populations, who settle on hazard-prone land, at increased risk. Besides, poor urban governance, declining ecosystems, and vulnerable rural livelihoods are among the main underlying risk drivers, which need to be addressed to build safer cities. Bangladesh has been experiencing a rapid increase in its urban population ever since its independence in 1971.Urban population as a percentage of total population increased from around 8.8% to nearly 23% during the 1974-2011 periods. It is estimated

that by the year 2021 nearly one-third or 33% of the population of Bangladesh will be living in urban areas. More than 60% of the national GDP is derived from non-agricultural sectors that are mainly based in urban areas. This phenomenon indicates the increasing role of urban areas being played in the national economy.

Upazila Parishad is the lowest administrative level of local government in Bangladesh. The majority of Upazila Parishads are still unable to achieve planned rural-urban development, which involves physically and socioeconomically integrating rural and urban areas. Most of the time, land is used haphazardly, resulting in a low level of living for the population. In the present government's policy for administrative reorganization, the upazila is the most important tier of administration. In light of the foregoing, a comprehensive development plan is required to handle the mandatory land use transition in both urban and rural areas, while avoiding unauthorized and unplanned development. A comprehensive development strategy at the Upazila level appears to be necessary.

Urban Development Directorate under the Ministry of Housing and Public Works, has launched a project titled "Preparation of Development Plan for Meherpur Zilla Project". This initiative aims to formulate a development plan for the next 20 years, divided into essential sectors to create a risk-sensitive and sustainable strategy. To understand the socio-economic and demographic profile of the study area is pivotal step for understanding the immediate needs and forecast the future needs for the next 20 years. Existing data and features are instrumental in providing a clear spatial understanding of the project area, accurately reflecting the potentials and problems of the existing scoria economic related conditions, and facilitating the representation within the development plan. Overall, the scope of socio-economic project signifies a comprehensive and forward-looking approach to urban development, emphasizing sustainability and thoughtful planning over the next two decades.

Existing Flora and Fauna survey is one of the important development modules of this project. In this development plan, existing Floral and Faunal information is considered as an important tool for a durable and sustainable urbanization. Land use planning is an important component for a modern urban development. But practicing urban development using a proper land use plan is not developed in Bangladesh. Prior to land use planning it is very essential to access existing Flora and Fauna conditions and the relevant information in and around the site of future urban development. Therefore, a rigorous Flora and Fauna study is needed to carry out for a resilient urban development.

1.2. Description of the Study Area

Meherpur Zilla, located in the southwestern part of Bangladesh, holds a significant place in the country's history and culture. Known for its rich heritage and pivotal role in the liberation war, Meherpur continues to thrive with its diverse economy, agricultural abundance, and growing infrastructure. This proposal aims to highlight the key aspects of Meherpur Zilla, focusing on its socio-economic landscape, cultural heritage, and potential for future development. The district comprises three Upazilas: Meherpur Sadar, Mujibnagar, and Gangni. Meherpur Sadar serves as the administrative and economic hub, with a diverse economy primarily based on agriculture and trade. Mujibnagar, formerly Bhoborpara, is renowned for its historical importance in the Liberation War, attracting many tourists to its memorial complex. Gangni Upazila is notable for its vibrant agricultural activities and emerging industrial potential. Collectively, these Upazilas contribute to the district's cultural richness, economic

diversity, and historical legacy, positioning Meherpur Zilla as a region of significant importance and development potential in Bangladesh.

Meherpur Zilla is bordered by Kushtia to the east, Chuadanga to the south, and the Indian state of West Bengal to the west and north, situated in the Khulna Division. The district's strategic location offers significant advantages for cross-border trade and cultural exchange. The district is predominantly rural, with a diverse population comprising various ethnic and religious communities. The literacy rate is gradually improving, with ongoing efforts to enhance educational facilities and opportunities.

a) Gangni Upazila

Gangni Upazila (Meherpur district) area 363.95 sq km, located in between 23°44' and 23°52' North latitudes and in between 88°34' and 88°47' East longitudes. It is bounded by Daulatpur (Kushtia) upazila on the North, Alamdanga and Meherpur Sadar upazilas on the South, Daulatpur (Kushtia), Mirpur (Kushtia) and' Alamdanga upazilas on the East, Meherpur Sadar upazila and West Bengal state of India on the West.

Population Total 299607; male 148250, female 151357; Muslim 295458, Hindu 2726, Christian 1313 and others 110. Water bodies Main rivers: Bhairab, Ichamati, Mathabhanga and Kazla; Elangi Beel, Nuner Beel and Elalgari Damash Beel are notable. Administration Gangni Thana was formed in 1923 and it was turned into an upazila on 24 February 1984.' Gangni Upazila consist of one Municipality, 9 Unions, 90 Mouzas and 137 Villages.


Mathavanga river, Bamundi Union, Gangni Upazila

b) Meherpur Sadar Upazila

Meherpur Sadar Upazila (Meherpur district) area 276.15 sq km, located in between 23°40' and 23°52' North latitudes and in between 88°34' and 88°47' East longitudes. It is bounded by Gangni upazila and West Bengal state of India on the North, Damurhuda and Mujibnagar upazilas on the South, Gangni and Alamdanga upazilas on the East, West Bengal state of India on the West.

Population Total 256642; male 127300, female 129342; Muslim 252323, Hindu 4199, Buddhist 1, Christian 114 and others 5. Water bodies Main rivers: Bhairab, Kazla; Bhatgari and Chand Beels are

notable. Administration Meherpur Thana was turned into an upazila in 1984. Meherpur Municipality was formed in 1960. Meherpur Sadar consist of one Municipality, 5 Unions, 61 Mouzas and 104 Villages.


Kutubpur beel, Kutubpur Union, Maherpur Sadar Upazila

c) Mujibnagar Upazila

Mujibnagar Upazila (Meherpur district) area 111.51 sq km, located in between 23°36' and 23°45' North latitudes and in between 88°34' and 88°43' East longitudes. It is bounded by Meherpur Sadar upazila on the North, Damurhuda and Meherpur Sadar upazilas on the East, West Bengal of India on the South and on the West.

Population Total 99143; male 49084, female 50059; Muslim 92970, Hindu 945, Buddhist 13, Christian 5200 and others 15. Water bodies Bhairab River, Sarashati Canal and Datpur Beel are notable. Administration Mujibnagar upazila was formed on 24 February 2000. Mujibnagar Upazila consist of 4 Unions, 29 Mouza and 33 Villages.

Dariapur beel, Dariapur Union, Mujibnagar Upazila

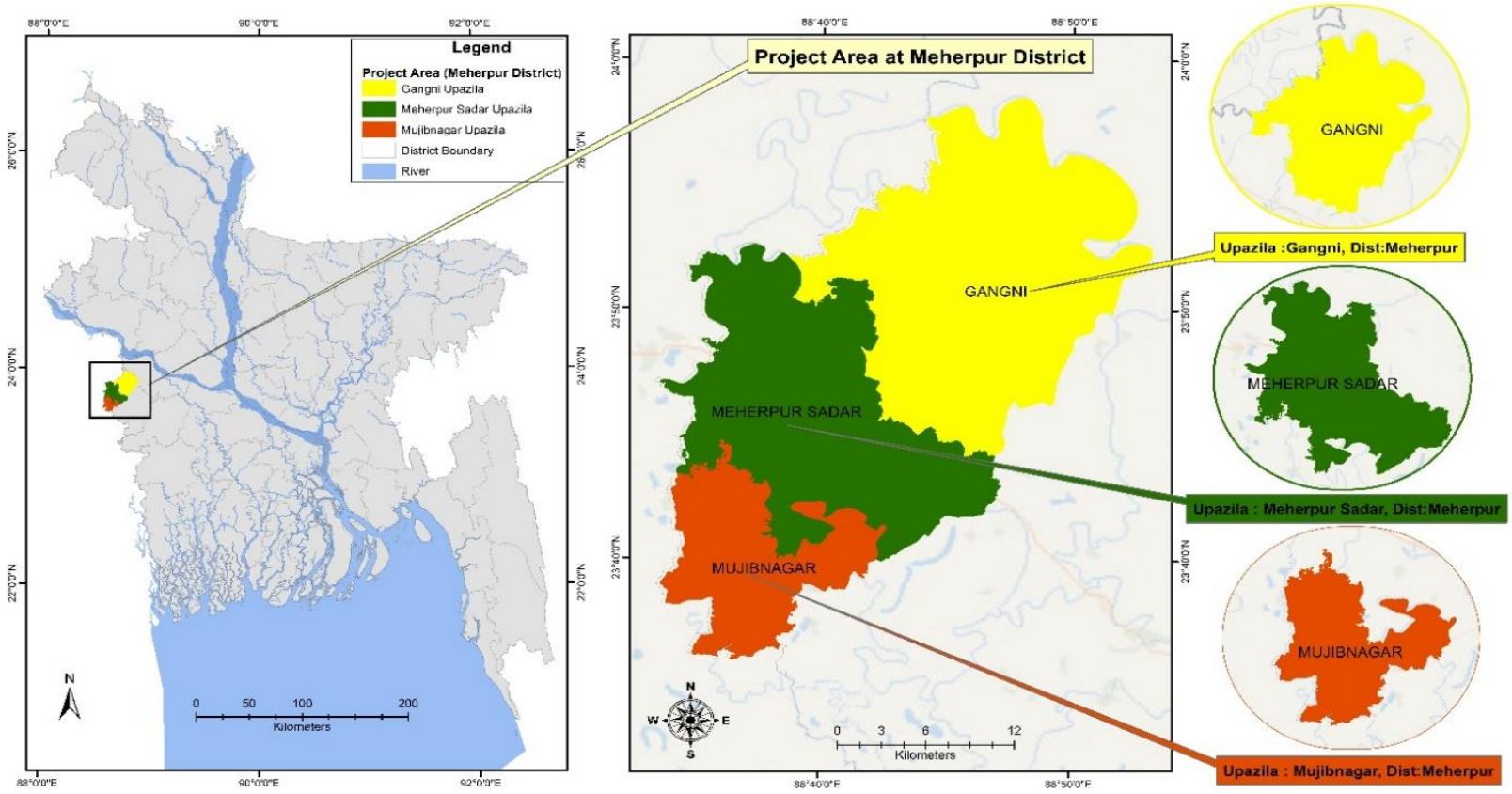


Fig 1: *Location map of project area of Meherpur District.*

1.3. Aims and Objectives

The baseline survey of existing flora and fauna will be conducted in project area of 3 upazilas of Meharpure district; i) Meherpur Sadar upazila, ii) Mujibnagar Upazila, and iii) Gangni Upazila.

Objectives:

Main objectives of the project:

The objective of the project is to optimize resources and activities for sustenance of marginal people. The urban and rural activities and resources are very important to the economy and life of the people of Bangladesh whose living conditions are inextricably linked to the productivity and sustainability of land use. There is no long-term Holistic Development Plan for the rural and urban area but it needs to be integrated with the mainstream of development process of the country. So, an interdisciplinary development planning approach is urgent to optimize livelihood of the project area.

Specific objectives of present study as per scope of work:

Baseline survey of existing flora and fauna in different place of the study area will be conducted to attain the following objectives:

- To develop an understanding of the existing flora and fauna based on available information, data gathering, literature searches, site visits and any baseline studies already carried out;
- To make an inventory of the species that are present on the spatial level of the survey and also the species that are frequent and also which are rare
- To identify the autecological characteristics, they possess and the communities they form
- To identify the characteristics and physical conditions of the sites that form their habitats
- To explore Historical aspects of habitats and biodiversity in the area
- To determine Underlying process of habitats dynamism — char formation, afforestation, forest clearing, settlements, growth centers, dykes, land reclamation, drainage system improvement, etc.
- To determine a threshold for selecting existing flora and fauna, based on their value, using measures;
- To identify those flora and fauna reaching the threshold value which could be affected by the project;
- To identify the spatial arrangements of habitats and the key processes that lead to the decline of endangered species (e.g. Fallowing, eutrophication, disturbance, intensification etc.)
- To determine the species including their habitat that might be threatened due to future development
- To identify the factors affecting the integrity of the existing flora and fauna in the ecosystems and the conservation status of relevant habitats and species;
- To set forth recommendations on preserving the species of the project area and ecology sensitive land use planning to keep the ecological system sustainable.
- To develop an interactive digital model for the ecological system for the project area

Chapter-2: Methodology

2.1. An Inventory of the Flora and Fauna

Literature review was conducted to know the historical aspects of spatial distribution of habitats or species and compile habitat or species inventories on various scales, and also recognize the pattern of rarity. Status of habitats will also be known. Information of the underlying process of decline or increase can be achieved by an historical landscape analysis. Maps with the historical distribution of habitats from these sources should be drawn in the same resolution as the actual distribution. In addition to the secondary sources, primary data on existing flora and fauna will be collected using appropriate methods.

2.2. The comparative assessment of plant and animal communities

The comparative assessment of animals and plants has been conducting. Dependency of animals on particular plant species will be determined. Seasonal assemblage of animals in a particular habitat based on the phenology of the plant will be determined. Survey will be conducted in different seasons; thus, seasonal assemblage of flora and fauna will also be determined. All the information will be plotted on habitat map.

2.3. Sampling Technique for Inventory

To achieve the objectives of the project various methods will be used (Table 1).

Table 1. Survey methods in brief

Name of the Methods	Objectives to be fulfilled
Survey Methods for Flora	
1. Literature Review 2. Transect survey 3. Quadrat survey 4. Point Quarter Method 5. Collection of plant parts	To understand the existing floral distribution scenario and their significances in the ecosystem of the project area based on available secondary information from any baseline studies which already been carried out previously. To prepare an inventory list of the species of the existing flora, their spatial distribution, the species that are frequent and also which are rare. To identify the ecological characteristics of every ecological unit and the communities they form. To identify the characteristics and physical conditions of the habitats. To determine underlying process of habitats dynamism-char formation, afforestation, forest clearing, settlements, growth centers, dykes, land reclamation, drainage system improvement, etc.
6. Questionnaire Survey	To explore historical aspects of habitats and biodiversity in the area.
Survey Methods for Fauna	
1. Direct Survey Methods 2. Line Transect Sampling 3. Quadrat Sampling 4. Use of different types of traps 5. Counting at colonies and bat roosts	To understand the existing faunal distribution scenario and their significances in the ecosystem of the project area based on available secondary information from any baseline studies which already been carried out previously. To prepare an inventory list of the species of the existing fauna, their spatial distribution, the species that are frequent and also which are rare.

Name of the Methods	Objectives to be fulfilled
6. Night survey 7. Camera trap survey 8. Questionnaire survey 9. FGD 10. Boat Survey through river system or lake for aquatic animals 11. Survey on fish 12. Indirect Survey Methods 13. Pellet / scat / feces count 14. Footprint / Pugmark count 15. Other indices of presence	To identify the ecological characteristics of every ecological unit and the communities they form. To identify the characteristics and physical conditions of their habitats. To determine underlying process of habitats dynamism-char formation, afforestation, forest clearing, settlements, growth centers, dykes, land reclamation, drainage system improvement, etc. To identify the flora and fauna reaching the threshold value which could be affected by the project. To identify the threats to the endangered species (e.g., Fallowing, eutrophication, disturbance, intensification). To determine the species including their habitat that might be threatened due to future development. To set forth recommendations on preserving the species of the project area and ecology sensitive land use planning to keep the ecological system sustainable. To develop an interactive digital model for the ecological system for the project area.

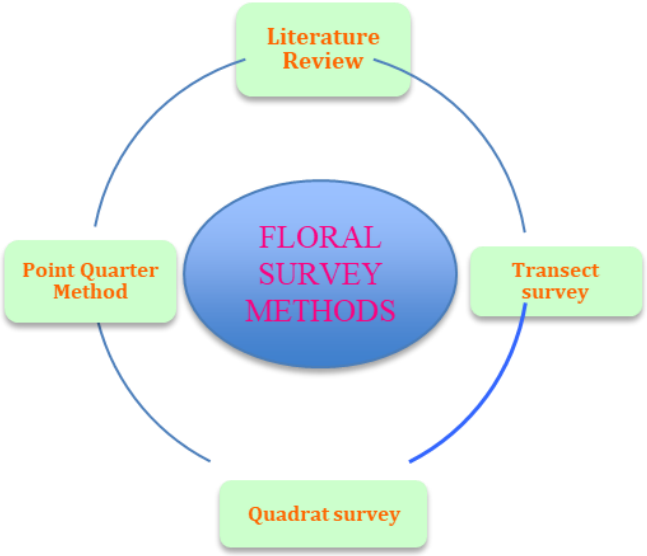
2.3.1. Detailed Survey Methods

i.Survey methods for flora

Plant community will be studied by following different methods. Parameters like frequency, density, abundance, presence, absence and dominance, diversity index will be quantified.

a. Transect survey

Transect survey will be used to explore the existing floristic composition. Sample of the plant species will be collected to prepare herbarium in order to identify the plant species wherever necessary. The floristic composition includes the occurred species of under trees, shrubs, herbs, climbers, epiphytes, parasites and ferns.



b. Quadrat survey

The quadrat survey will be used for assessing plant community structure, tree species diversity and their regeneration status. The estimate of species contents of a habitat shall be determined by observing the plant species at different sample areas.

In the quadrats, trees of ≥5cm diameter will be counted. Moreover, total height and diameter of the trees individuals of different species will also be recorded. The parameters that are commonly used to characterize the structure of the plant communities are: Density, Frequency, Abundance, Vegetation Coverage, Basal area, Dominance, Species richness index, Similarity index, Shannon-Wiener diversity index, Index of similarity etc.

ii.Survey methods for fauna

A combination of different methods will be applied for the project work. Some of the methods are as follows.

2.3.2. Direct Survey Methods

i.Line Transect Sampling

Both temporary and permanent transect lines were set randomly covering all types of habitats. Visual encounter survey was conducted on foot both in day and night. All the wild animals were recorded from the both side of transect. GPS coordinates were used to calculate the total transect area covered for survey. During river habitat survey, the river was considered as a transect line. A total of 14 transect lines including 6 transects in Meherpur Sadar, 6 transects in Gangni and Mujibnagar each were selected for the study (Table 2).

Table 2 List of transects used for data collection

Upazila	Transect	Habitat	Length (Km)
Meherpur Sadar	Transect 1	Riverside/Riverine	8.92
	Transect 2	Homestead	3,41
	Transect 3	Homestead	5.6
	Transect 4	Agricultural	10.4
	Transect 5	Riverside/Riverine	3.5
	Transect 6	Riverside/Riverine	8.7
Gangni	Transect 1	Riverside/Riverine	2.8
	Transect 2	Homestead	2
	Transect 3	Homestead	1.3
	Transect 4	Agricultural	2.5
Mujibnagar	Transect 1	Homestead	3.4
	Transect 2	Homestead	4.6
	Transect 3	Riverside/Riverine	5.3
	Transect 4	Agricultural	7.3

ii. Use of different types of traps

Pit fall trap, tube trap and box trap will be used to capture cryptic species. All these traps are designed to capture live animals. Appropriate baits were used wherever necessary.

iii. Camera trap

Automatic digital camera traps were used to survey nocturnal and crepuscular animals. These camera traps are operated by motion sensor. The camera was automatically activated and captured photos if anything moves in front of it.

iv. Counting at colonies and bat roosts

Bats and some of the birds are colonial and some also build nests in colonies. Bird colony and bat roosts were surveyed.

v. Night survey

Night survey was conducted with the aid of high-power flashlight. Nocturnal wild animals were encountered during night survey.

vi. Questionnaire survey

A pre-designed questionnaire was used to know the status of wild animals and plants in the survey area based on the experience of the local people. A total of 60 questionnaire was surveyed among the local people of Meherpur district.

vii. River Habitat Surveys (RHS) & River Corridor Surveys (RCS) through Boat Survey for aquatic animals

Boat survey was conducted in suitable sites to encounter aquatic animals like dolphins. Images of dolphins were also be used as a questionnaire among the local fishermen to know the past status of these aquatic mammals.

viii.Survey on fishes

Local fishermen were visited to see their catch and types of available fishes. Local market was also be surveyed to know the status of local fish. Both marine and freshwater fisheries will be surveyed. The team members visited fish landing areas, fisher's village and local markets to learn about beneficiary's customs and attitudes. Direct observations and participation with the fishers for gear use, on-field surveillance, homestead drying of fishes, and selling at retail market of city, were the most useful and meaningful way to confirm the abundance and marketing of fishes, and to know about beneficiary's livelihood dynamics, work practices, vulnerabilities, and their indigenous knowledge in a social setting (Hossain *et al.* 2014; Deb and Haque 2011).

2.3.3. Indirect Survey Methods

i.Presence of Scat, feces and pellet

Presence of scat, feces and pellet indicate the presence of certain species in the area.

ii.Footprint / Pugmark count

This method is used for identifying and counting wild animals. In addition, the data allow one to determine sex ratio and age structure of the population.

2.4. Identification of critical Species

During the survey any critical habitat (also why it is critical) and its significance needs to be identified, and protection status recorded in practice, a check of each individual species against the following were required in order to be to determine its protection status:

- IUCN's threatened category (Red Data Book-both National and global threatened category);
- Species protected under Wildlife (Protection and Security) Act 2012;
- Species protected under any protocol, conventions and any other agreement;
- Species considered as flagship species, keystone species or other significant species; and
- Endemicity of the species.

2.5. Identification of critical ecosystem and wildlife habitats

Habitats with high species diversity, population density of rare or threatened species were determined from the field survey. Ecosystem services were also be determined from field observation and also by questionnaire survey and FGD. Critical ecosystem or habitats were plotted on the maps using GPS coordinates.

2.6. Mapping of the Site

As per survey findings, we prepared ecosystem based thematic map for every task of the site of the flora and fauna in ARC GIS and prepare data base which can be provided as shape file or map format in desire scale by consultation with PD.

2.7. Development of an Interactive Digital Model

From GIS based data base of the survey findings and their interpretation were integrated in a GIS module and to develop an interactive digital model of existing habitat, decline of habitat and possible areas of conservation. Historical changes of vegetation cover were evaluated from the previous 30 years image. Land use map were prepared accommodating wildlife habitat, vegetation cover, waterbodies, forests and other landmarks.

2.8. Submission of Report

The final report includes clearly, information on existing flora and fauna necessary for decision making Key aspects which include:

- Description of baseline and trends of existing flora and fauna, if the project were not to go ahead;
- Explanation of the criteria used to evaluate existing flora and fauna, and assess the' significance of impacts of the project;
- Statement of methodology used:
- Presentation of analytical techniques used and the analysis itself; and interpretation from the analyses
- Identification of likely impacts on existing flora and fauna; and an explanation of their significance and the level of certainty with which this can. be stated; and
- Description of legal and policy consequences.

Chapter-3: FINDINGS of Flora and Fauna

3.1. Flora of Meherpur District

A total of 415 species of plants were recorded from three selected upazilas of Meherpur. Herb constitutes the highest species diversity (48.67%) followed by trees (20.72%), shrubs (16.39%), climbers (6%), other plants including climbers, ferns and orchids 9.64% and aquatic plants (4.58%).

Trees: A total of 86 tree species were recorded from different habitats of the selected study area. About 43% tree were rare, followed by 38% common, and 19% very common trees.

Herb: A total of 202 species of herbs were recorded, of which 96 (47%) species were common, 92 species (46%) were very common, and 14 species (7%) were rare in different habitats of the study area.

Shrub: A total of 68 shrubs were recorded, of which 51 % (n=35) were very common, 34% (n=23) were common, and 15% (n=10) were rare.

Aquatic plants: 19 species of aquatic plants were recorded from the study sites, of which 14 species were common, four species were very common, and one species was rare to find.

Others plants: Fern, Epiphyte, Orchid, Climber, Vine: A total of 40 other floral species, including 23 climbers, 8 ferns, 5 palms, 2 orchids, and one species each of parasite and woody climber were found. One terrestrial ground orchid Zeuxine strateumatica was recorded from Mujibnagar complex area.

3.1.1. Floral Diversity in Meherpur Sadar Upazila

Meherpur Sadar Upazila is also rich in floral diversity. A total of 68 species of trees, 202 species of herbs, 68 species of shrubs, 19 aquatic plants, and 39 other plant species, including liana, vine, and orchids, were recorded. Among these recorded plants, 13% tree species were very common, 35% common and 52% rare while 60% herbs were common, 28% very common and 12% were rare in Meherpur Sadar Upazila. About 45% shrubs were common, 37% very common and 18% rare while 68% aquatic plants were common, 21% very common and only 11% rare in Meherpur Sadar Upazila.

3.1.2. Floral Diversity in Gangni Upazila

Gangni Upazila supports similar floral diversity as Meherpur Sadar Upazila. A total of 68 species of trees, 202 species of herbs, 68 species of shrubs, 19 aquatic plants, and 39 other plant species, including liana, vine, and orchids, were recorded. Among these recorded plants, 40% tree species were common, 15% very common and 45% rare while 58% herbs were common, 29% very common and 13% were rare in Gangni Upazila. About 44% shrubs were common, 38% very common and 18% rare while 79% aquatic plants were common, 10% very common and about 11% rare in Gangni Upazila.

3.1.3. Floral Diversity in Mujibnagar Upazila

Mujibnagar Upazila is enriched with floral diversity. A total of 68 species of trees, 202 species of herbs, 68 species of shrubs, 19 aquatic plants, and 40 other plant species, including liana, vine, and orchids, were recorded. Among these recorded plants, 35% tree species were common, 14% very common and 51% rare while 59% herbs were common, 28% very common and 13% were rare in Mujibnagar Upazila. About 40% shrubs were very common, 40% common and 20% rare while 63% aquatic plants were common, 26% very common and about 11% rare in Mujibnagar Upazila.

3.2. Faunal Diversity of Meherpur District

3.2.1. Faunal Diversity of Meherpur Sadar Upazila

3.2.1.1. Fish Diversity in Meherpur Sadar Upazila

A total of 68 fish and 2 prawn species under 14 orders and 24 families were found to be available in the markets of Meherpur district (Appendix 6). All the fish species were found in the markets of three upazilas of Meherpur but their relative abundance was varied. Among these 68 species, 56 species were recorded from the fish markets, fish landing stations and from the field sites and another 12 species of fish were recorded from the questionnaire survey with the fishermen and secondary sources (Tikadar et al. 2021). Cypriniformes order contributed highest (29.5%, 20 species) in which Cyprinidae family along contributed 28% (20 species) out of 24 families.

About 44% (n=40) of the recorded fishes were commonly found in all study areas. The rest were very common (35%) and rare (21%). Though, Meherpur district is a drought prone area and most of the ponds and shallow waterbodies dry up during winter months, but the rivers and large sized waterbodies (beels) hold water throughout the year and many native fish species are being surviving here.

The waterbodies of Meherpur district supports a good number of threatened species of fishes listed in Table 8. A total of 12 species of threatened fishes were recorded from this river of which two species were Critically Endangered (3%), four species (10%) were Endangered and six species Vulnerable.

3.2.1.2. Amphibians of Meherpur Sadar Upazila

During the study period a total of 18 species of amphibians were recorded from three upazilas of Meherpur district. Among the amphibians recorded from Meherpur Sadar Upazila, two species was toad and rest of all were frogs. The family Dicroglossidae comprised of highest number of species (9 species), followed by Microhylidae (3 species), Ranidae and Rhacophoridae 2 species each. Among the recorded species, 38.89% was uncommon, 33.33% common and 27.78% very common. None of the threatened species of amphibians were found in any upazilas of Meherpur district.

3.2.1.3. Reptiles of Meherpur Sadar Upazila

A total of 22 species of reptiles under eight families were recorded from Meherpur district. Among the recorded reptiles in Meherpur Sadar Upazila, one species was agamid, three geckos, four skinks, two monitor lizards and ten species of snakes. Most of the snakes were found very rare in this region. Occurrence of only two species of turtles were recorded during the field visit. Lizards and snakes constituted the highest proportion of reptiles (45.45% each) followed by turtles (9.09%). Most of the recorded reptiles 36.36% were rare while 18.18% was very common, 22.73% each were common and uncommon. Occurrence of turtles were only confirmed with the interview of fishermen.

3.2.1.4. Bird Diversity in Meherpur Sadar Upazila

A total of 199 species of birds were found in the study area as an outcome of the direct field survey and based on secondary literature (Published scientific articles, citizen science apps, and newspaper articles). The listed avifauna comprised a total of 58 families, of which Anatidae and Accipitridae had the highest number of species (n=14), followed by Ardeidae (n=10) and Scolopacidae (n=10).

Habitat categorization of birds: Bird habitats were broadly categorized into four habitats: agricultural land, grasslands and open habitats, homestead vegetation, and wetland. Of all habitats, wetland habitats support the highest species of birds (n=76), followed by homestead vegetations (n=49), agricultural land (n=45), and grasslands and open habitats (n=29).

Threatened Status of Birds: About 94% (n=188) of birds fell under the least concern species category, seven species were near threatened, two species were vulnerable (Black headed ibis and Imperial eagle), and Data Deficient (Indochinese Roller, Common quail).

In the case of the global scenario, one globally Endangered bird species (Brown Fish-Owl), three vulnerable species (Common Pochard, River Tern, Imperial Eagle), 4 Near Threatened, and 191 least concern birds were categorized from the study area.

A total of 196 species of birds were recorded from Meherpur Sadar Upazila, of which 55% (n=108) were very common, 23% (n=45) were common, 18% (n=36) were rare, and 7 species of birds were rare in occurrence.
According to the IUCN national Redlist status, 94% (n=185) of birds are of least concern in Meherpur Sadar Upazila, 4% (n=7) are Near Threatened, and two birds each are vulnerable and data deficient.

3.2.1.5. Mammals in Meherpur Sadar Upazila

A total of 27 species of mammals under 11 families were recorded from Meherpur district. Bats constituted the highest number of species (7 species) followed by rats (6 species). Among the recorded mammalian species in Meherpur sadar upazila, 29.63% was very common, 22.22% was common, 14.81% uncommon and 33.33% rare. Mammalian family Muridae constituted the highest number of species (6 species) followed by Vespertilionidae (5 species) and Viverridae (3 species).

3.2.2. Faunal Diversity of Gangni Upazila

3.2.2.1. Fish Diversity in Gangni Upazila

A total of 68 species of fish were recorded from Gangni Upazila. Cultured carps and Cat fishes were the dominant types of species. Most of the fish species in Gangni were rare (36.76%) and uncommon (20.59%) while 23.53% common and 19.12% very common.

3.2.2.2. Amphibian Diversity in Gangni Upazila

Though Gangni upazila is comparatively drier than other two upazilas of Meherpur district, but some of the wetlands and agricultural fields serve as the breeding habitats for many species of frogs. During the survey period a total of 18 species of frogs and toads were recorded from this upazila. Among these recorded amphibians 22.22% were very common, 33.33% common, 38.89% were uncommon and 5.56% were rare in the habitats of Gangni upazila.

3.2.2.3. Reptiles Diversity in Gangni Upazila

All the 22 species of reptiles were also recorded from Gangni Upazila. Most of the reptiles of Gangni upazila was rare (36.36%) while 27.27% was uncommon, 18.18% was very common and common each.

3.2.2.4. Status of Birds in Gangni Upazila

A total of 190 species of birds were found in the different habitats of Gangni Upazila. Among all birds found 50% (n=96) were very common, 25% (n=47) were common, and 22% (n=42) were rare in occurrence

In terms of national threat status, 96% (n=183) of birds are least concerned, 3% (n=5) of birds are near threatened, and one species each is vulnerable and data deficient.

In global scenario, 97% (n=185) birds are Least concern, 2% (n=3) birds are near threatened and one species each of birds are in Endangered and vulnerable.

3.2.2.5. Mammalian Diversity in Gangni Upazila

All the 27 species of mammals were also found in Gangni upazila. About 33.33% mammals in this upazila was rare, 22.22% uncommon, 18.52% common and 29.63% very. Common Langur (*Semnopithecus entellus*) was frequently found to visit Gangni upazila.

3.2.3. Faunal Diversity of Mujibnagar Upazila

3.2.3.1. Fish Diversity in Mujibnagar Upazila

A total of 68 species of fish were found to be available in Mujibnagar Upazila (Appendix 6). Cultured Carps, Tilapia and Catfishes were dominant fish in the markets of Mujibnagar. About 29.41% of the recorded fishes were very rare and 23.53% uncommon, 29.41% common and 17.65% very common in Mujibnagar Upazila.

3.2.3.2. Amphibian Diversity in Mujibnagar Upazila

Mujibnagar upazila also supports the same number of amphibian species (18 species). Among these recorded amphibians 50.00% were uncommon, 22.22% were very common and common each, 5.56% were rare in Mujibnagar upazila.

3.2.3.3. Reptilian Diversity in Mujibnagar Upazila

Same number of reptile species were also found in Mujibnagar upazila (22 species). Most of the reptiles of Mujibnagar upazila was also rare (40.91%) while 22.73% was uncommon, 13.64% was common and 22.73% very common.

3.2.3.4. Bird Diversity in Mujibnagar Upazila

A total of 186 species of birds were recorded from Mujibnagar Upazila, of which 52% (n=96) were very common, 26% (n=49) were rare, and 19% (n=35) were common in occurrence.

3.2.3.5. Mammalian Diversity in Mujibnagar Upazila

Mujibnagar upazila also supports 27 species of mammals. About 22.22% mammals in this upazila was rare, 18.52% uncommon, 28.63% common and 29.63% very common. A group of Northern Grey Langur (*Semnopithecus entellus*) with 32 individuals was recorded from Mujibnagar upazila. The langur group is habituated with the local people and tourists. Tourists are often found to provide food to the langurs.

Chapter-5: Spatial Distribution of Habitat

5.1. Wetlands

There are some wetlands of biodiversity significance have been recorded from Meherpur district. A total of 31 beels were identified those hold water throughout the year and have sensitive ecosystem. These wetlands should be conserved (Table 3) (Fig. 2, 3, 4).

Table 3 List of wetlands of biodiversity significance

Sl	Beel name	Area name		Location	
1	Garagari beel	Buripota	Meherpur sadar	23°46'49.93"N	88°34'0.24"E
2	Horirumpur beel	Buripota	Meherpur sadar	23°46'53.27"N	88°35'6.49"E
3	Jolee beel	Buripota	Meherpur sadar	23°45'29.01"N	88°35'42.56"E
4	Boro jolee beel	Buripota	Meherpur sadar	23°45'7.37"N	88°36'1.79"E
5	Chand beel	Amjhupi	Meherpur sadar	23°44'40.80"N	88°39'56.47"E
6	Katapukur beel	Baradi	Meherpur sadar	23°44'3.29"N	88°45'22.49"E
7	Harder beel	Baradi	Meherpur sadar	23°44'17.96"N	88°46'15.85"E
8	Sholmari beel	Baradi	Meherpur sadar	23°42'22.48"N	88°46'23.82"E
9	Bejon beel/ Terghoria beel	Kutubpur	Meherpur sadar	23°49'59.76"N	88°36'35.16"E
10	Nunar beel	Gangni	Meherpur sadar	23°51'26.54"N	88°48'44.71"E
11	Dubokhola beel	Kutubpur	Meherpur sadar	23°48'52.94"N	88°36'37.88"E
12	Bitkamari beel	Kutubpur	Meherpur sadar	23°48'42.86"N	88°36'27.58"E
13	Kutubpur beel	Kutubpur	Meherpur sadar	23°51'33.46"N	88°38'23.52"E
14	Duntola beel	Kutubpur	Meherpur sadar	23°50'18.12"N	88°35'40.25"E
15	Kakrajoler beel	Kutubpur	Meherpur sadar	23°50'51.01"N	88°37'18.00"E
16	Sholmari beel	Kutubpur	Meherpur sadar	23°51'50.14"N	88°35'20.63"E
17	Isamoti beel	Kathuli	Gangni	23°53'58.97"N	88°43'21.06"E
18	Dholar beel	Kathuli	Gangni	23°53'27.35"N	88°42'24.69"E
19	Shaldah beel	Roypur	Gangni	23°47'51.87"N	88°48'48.59"E
20	Dhomash beel	Kajipur	Gangni	23°56'26.44"N	88°45'43.13"E
21	Moragang river	Motmura	Gangni	23°53'14.49"N	88°49'30.16"E
22	Nougara beel	Dariapur	Mujibnagar	23°43'4.14"N	88°34'22.83"E
23	Chucho khola beel	Dariapur	Mujibnagar	23°42'8.96"N	88°34'4.45"E
24	Poddo beel	Bagoan	Mujibnagar	23°37'29.71"N	88°37'36.78"E
25	Taranagar chulkani beel	Bagoan	Mujibnagar	23°37'40.81"N	88°37'51.06"E
26	Tuplar beel	Bagoan	Mujibnagar	23°38'8.32"N	88°38'13.44"E
27	Nagar beel			23°40'57.58"N	88°34'49.31"E
28	Horirampur beel	Bagoan	Mujibnagar	23°36'49.52"N	88°39'3.24"E
29	Shib nogor bot tola beel	Bagoan	Mujibnagar	23°37'22.60"N	88°39'27.32"E
30	Mirgangi beel		Chuadanga	23°39'52.44"N	88°44'8.21"E
31	Kajla beel/ dolka beel		Chuadanga	23°40'36.95"N	88°45'4.16"E

Moragang beel at Gangni Upazila, Meherpur

Moragang beel at Gangni Upazila, Meherpur

Shaldah beel at Gangni Upazila, Meherpur

Dhomash Beel at Kajibur, Gangni, Meherpur.

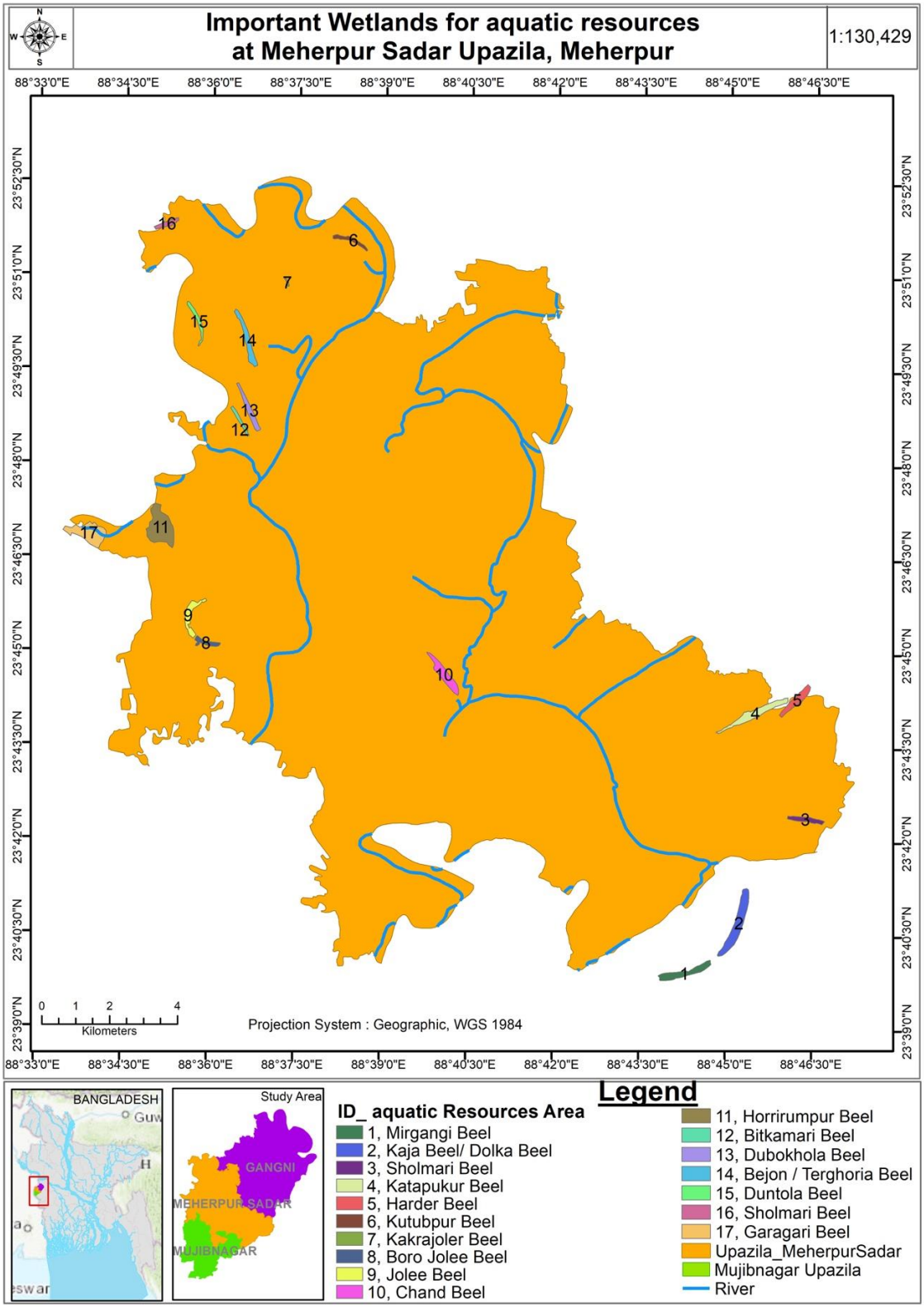


Fig. 2: Map of important wetlands and aquatic resources in Meherpur Sadar upazila.

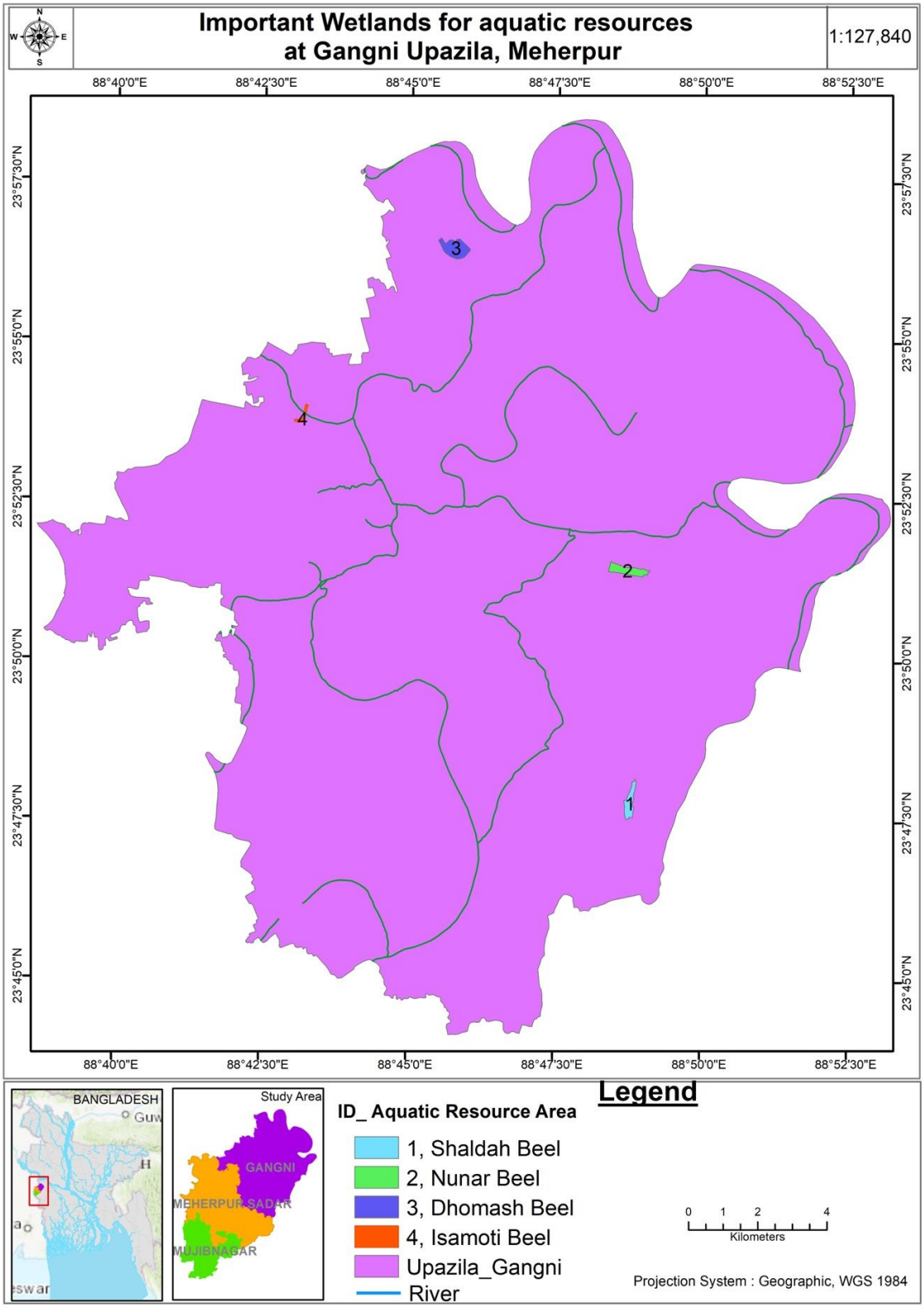


Fig. 3: Map of important wetlands and aquatic resources in Gangni upazila.

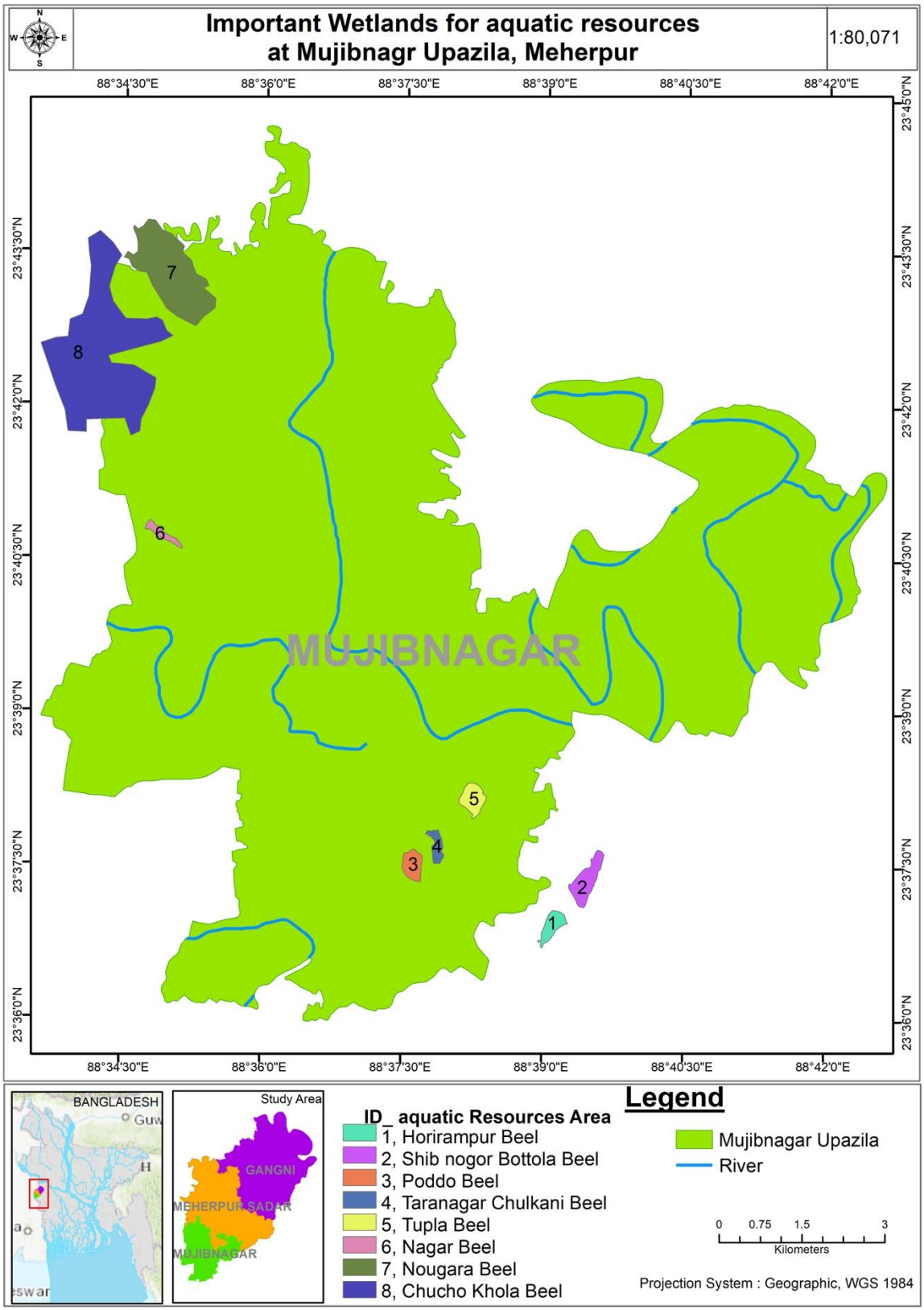


Fig. 4: Map of important wetlands and aquatic resources in Gangni upazila.

5.2. Bird Colony

Five permanent breeding colonies of birds were identified from Meherpur district of which three colonies were situated in Meherpur sadar upazila, one colony each from Gangni and Mujibnagar upazila (Fig. 5, Table 4).

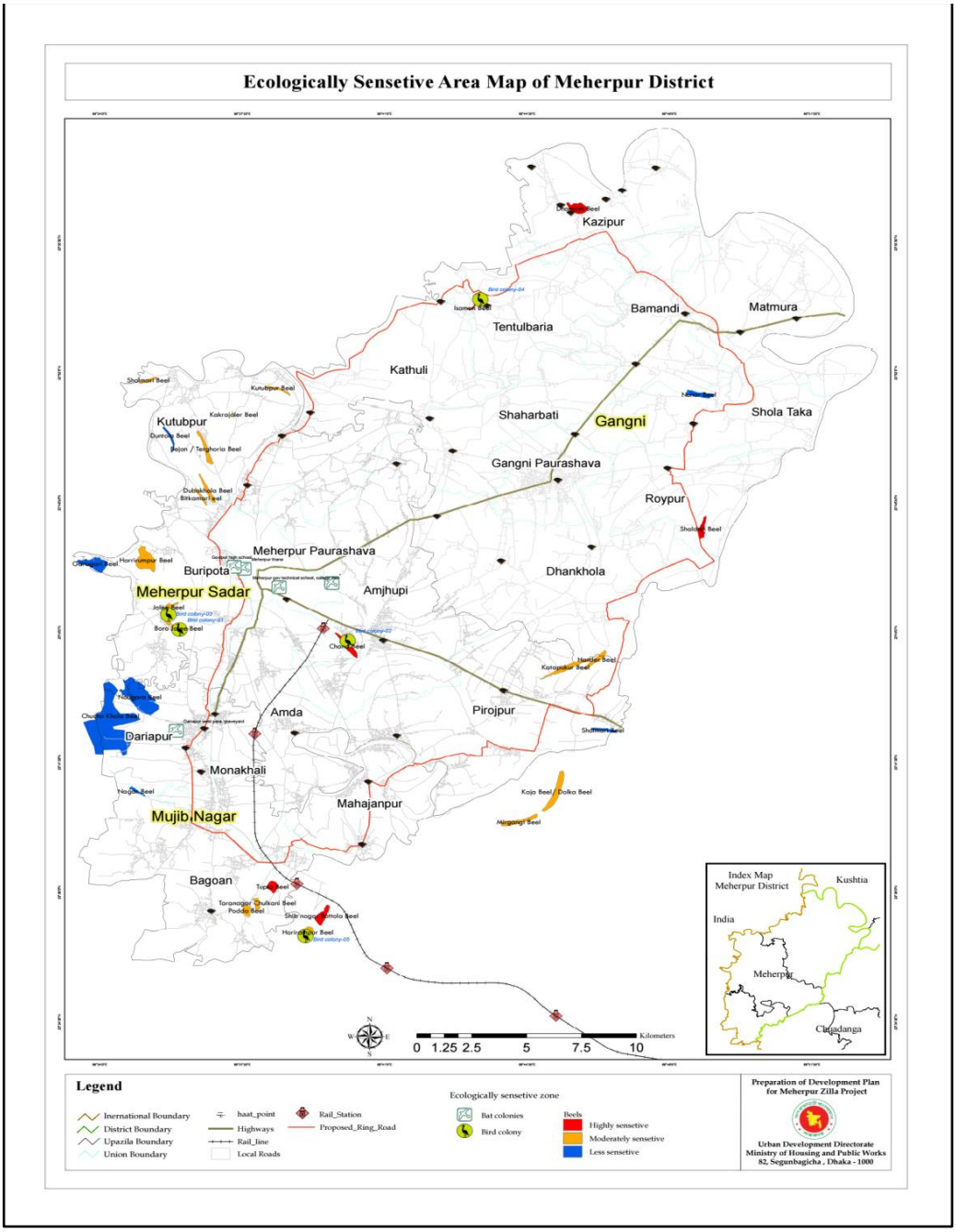


Fig. 5: Map of bird breeding colonies recorded from Meherpur district.

Table 4: Location of bird colonies recorded from Meherpur district

Sl	Bird colony	Species	Location		GPS	
			Place	Upazila	Lat	Long
1	Bird colony-01	Black crowned night heron, Gray heron, Little cormorant, Indian cormorant, Oriental darter	Boro-jolee, Buripota	Meherpur sadar	23.751254°	88.599338°
2	Bird colony-02	Black crowned night heron, Gray heron, Little cormorant, Indian cormorant, Oriental darter,	Chand beel ghat, amjhupi	Meherpur sadar	23.746266°	88.668158°
3	Bird colony-03	Little cormorant, Indian cormorant, Oriental darter, Ducks, Open bills	Buripota	Meherpur sadar	23.758060°	88.594708°
4	Bird colony-04	Indian cormorant, Oriental darter, Ducks, Open bills	Isamoti beel, Kathuli	Gangni	23.899714°	88.722517°
5	Bird colony-05	Little cormorant, Ducks, Open bills	Horirampur beel, Bagoan	Mujibnagar	23.613756°	88.650900°

5.3. Important Bat Colonies

Five roosting colonies of Flying Fox Bat (*Pteropus giganteus*) were recorded from Meherpur district of which four colonies situated in Meherpur sadar upazila and another colony was in Mujibnagar upazila (Fig. 6, Table 5).

Table 5: Location of bat colonies identified from Meherpur district

Sl	Bat colony	Individual	Location		GPS	
			Place	Upazila	Lat	Long
1	Bat colony-01	150+	Meherpur thana	Meherpur sadar	23.778737°	88.625740°
2	Bat colony-02	360+	Govipur high school	Meherpur sadar	23.779586°	88.621684°
3	Bat colony-03	285+	Dariapur west para, graveyard	Mujibnagar	23.705871°	88.597965°
4	Bat colony-04	80+	Meherpur gov technical school, college mor	Meherpur sadar	23.770405°	88.640089°
5	Bat colony-05	110+	-	Meherpur sadar	23.772133°	88.661750°

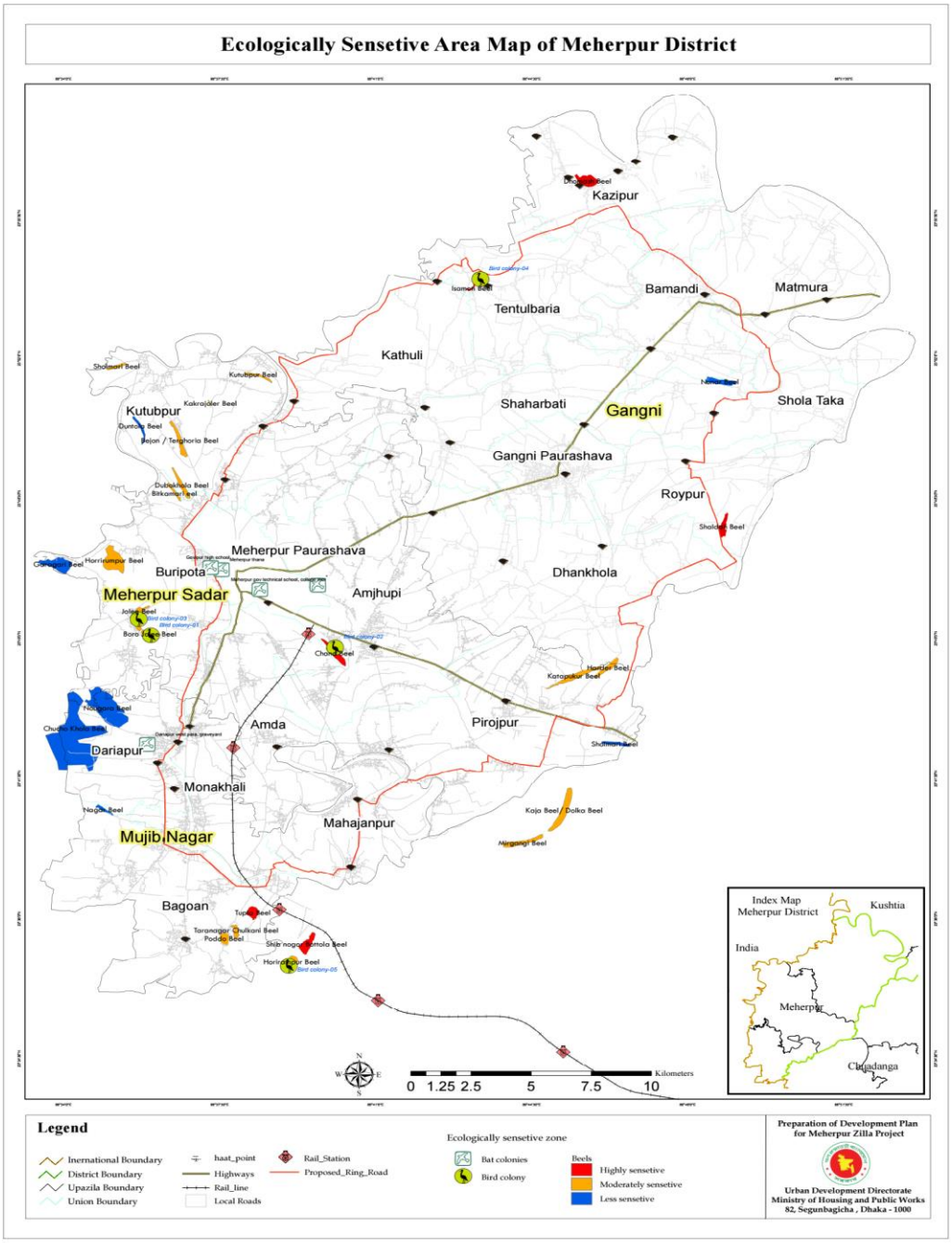


Fig. 6 Bat colonies recorded from Meherpur district.