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Reconnaissance field visit to the proposed Khaliajuri Bridge over the Dhanu River, Khaliajuri, Netrokona

Upcoming

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- Spatial and Temporal Changes in Dhaka City's Urban Ecosystem, Landscape and Biodiversity over the past 100 Years
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the CEGIS NEWSLETTER

Safeguarding Environment for Future

Char Ages of the Padma River

Sudipta Kumar Hore, River, Delta and Coastal Morphology Division

An aerial photograph of a River Island (Char)

The evolution of the Padma River Chars has been studied using satellite imagery from the dry season between 1973 and 2024 to create a comprehensive map. Advanced Remote Sensing and GIS tools were used to classify into water and land and then assess the age of the chars using classified images. The resulting map provides insights into the age distribution of the char along the river and accurately outlines the locations of the river channels.

Downstream of Paturia, the Padma River is divided into two channels, separated by a large char approximately 20 km long. This char is a permanent part of the landscape and is just one of the many ever-changing features of the river. The main channel passes through the Harirampur area along the left bank. In contrast, another smaller channel flows through Faridpur along the right bank. These two channels come together in the Dohar Area, adding to the river's dynamic nature. At Dohar, the main channel of the Padma River splits into two channels, forming a char that spans roughly 8 km. The ages of these chars range from 5 to 15 years, indicating the constant evolution of the river. After converging at the Padma Multipurpose Bridge, these channels join the main channel,

Cont'd on page 3

Environmental and Social Impact Assessment for Feasibility Study of Sustainable River Management in Panchagarh and Thakurgaon District

Sanjib Sarker Shawon, Water Resources Management Division

Panchagarh is the northern most district of Bangladesh and adjacent to the Bangladesh-India border. About 28 rivers flow through Panchagarh District, 08 rivers flow through Thakurgaon District, 04 rivers (Nagar, Pathraj, Tangon, Bhulli) flow through both Panchagarh & Thakurgaon District, 01 river (Karatoya) flows through both Panchagarh & Dinajpur District and 01 river (Choto Dhepa) flows through both Thakurgaon & Dinajpur District among which Karatoya river is the major one. Originating from the Jalpaiguri District of India, the river enters Bangladesh at the Vodreswar area of Vojonpur Union under Tetulia Upazila of Panchagarh District. Later, the river falls into the Atrai River at Birganj Upazila of Dinajpur District. Most of the rivers in Panchagarh District are connected to the Karatoya River. Among the rivers of the District, Talma, Chawai, and Ghoramara are three transboundary rivers originating in India and later falling into the Karatoya river in Bangladesh. Another transboundary river in the District is the Dahuk River, which originates in India and, after flowing for approximately 14 km, again enters India. Other mentionable rivers of the district are Tirnoi (Panchagarh), Ranachandi, Berong, Petki, Kurum, Paam, Chatnai, and Bhulli. These rivers are experiencing flood and severe bank erosion during the monsoon season due to reduced conveyance capacity and progressive sedimentation. On the other hand, these rivers contribute to different irrigation projects in the area, namely Ahmednagar Irrigation Project (Block 2 & 3) and the Telipara Irrigation Project. Therefore, sustainable development and management of these rivers are key to the overall development of the area.

Thakurgaon District is located along the Bangladesh-India border in the northern region of Bangladesh. A total of 08 rivers flow through this district, namely the Kulik, Shuk, Tirnoi (Thakurgaon), Senua, Chhoto Senua, Aman Dhaman, Nona, and Lacchi Rivers.

The characteristics of the rivers of Thakurgaon District are that possess relatively lower average depth and steeper bed slopes. Tangon, Shuk, Lacchi, Nona, Nagar, Kulik, Pathraj, and Bhulli Rivers are experiencing sedimentation problems that are triggering bank erosion. The water storage capacity of these rivers is decreasing due to sedimentation, which negatively impacts the irrigation facilities of the area, especially in the dry season. The Tangon Barrage Irrigation Project, Buribadh Irrigation Project, Bhulli Irrigation Project, and Rahmatpur FCDI Project depend on these rivers.

The main objective of the study is to identify all existing problems related to water resources management and check no-regret solutions for sustainable development and management of the rivers in Panchagarh and Thakurgaon Districts. In this regard, the technical study team proposed three major interventions: river bank protection works, re-excavation of the rivers, and construction of the combined water control structure at Kaliaganj on the Karatoya River. The river bank protection works along different rivers are expected to protect a total of 149.80 ha of land in Panchagarh District, including 64.82 ha of rural settlement, and 50.21 ha of land in Thakurgaon District, including 16.1 ha of rural settlement. The re-excavation of 07 selected rivers would increase the conveyance capacity of the rivers. On the other hand, the construction of the combined water control structure on the Karatoya River at Kaliagonj would help retain water for increasing the available water depth near the non-functional LLP pump house at Boalmari Bazar, for which 3,644 ha area will be brought under surface water irrigation resulting increase in 55,648 MT crops per year. Net fish production would also increase to about 38.3 MT/year. The communication system would be developed due to the construction of the combined water control structure at Kaliagonj over the Karatoya River. Besides, common property resources such as educational institutions, roads, bridges, culverts, mosques, graveyards, playgrounds, temples, crematoriums, etc. would be saved from erosion after river bank protection works.

River bank erosion-accretion along the Karatoya River at Panchagarh Sadar Upazila

However, there might be some negligible negative impacts at the pre-construction phase of the project,

Cont'd on page 4

Contract Signing for Different Studies

During the 3rd quarter of the year 2024 (July to September), CEGIS has signed 07 (Seven) contracts with different organizations and clients. The contract titles with clients and dates of signing are given below:

1) Generation of the Land Cover and Natural Capital Map and Developing Integrated Collaborative Forest Management Plans with Bangladesh Forest Department (BFD) on 01 July 2024;

2) Conducting Environmental and Social Impact Assessment Study for Offshore LNG Receiving, Storage, and Regasification Terminal located at Offshore of Kaladiarchar, Maheshkhali, Cox's Bazar with Summit LNG Terminal II Co. Ltd on 08 July 2024;

3) GIS Portal Support Service for ADB with Asian Development Bank (ADB) on 23 September 2024 ;

4) Preparing the Chapter on Information Related to Climate Change Impacts and Adaptation with Department of Environment (DoE) on 25 September 2024;

5) Preparing chapter on information on financial, technology development & transfer & capacity building support needed & received, including gender & climate change with Department of Environment (DoE) on 25 September 2024;

(6) To support and accelerate Bangladesh's transition to net zero and climate resilient pathways with Winrock International on 25 September 2024;

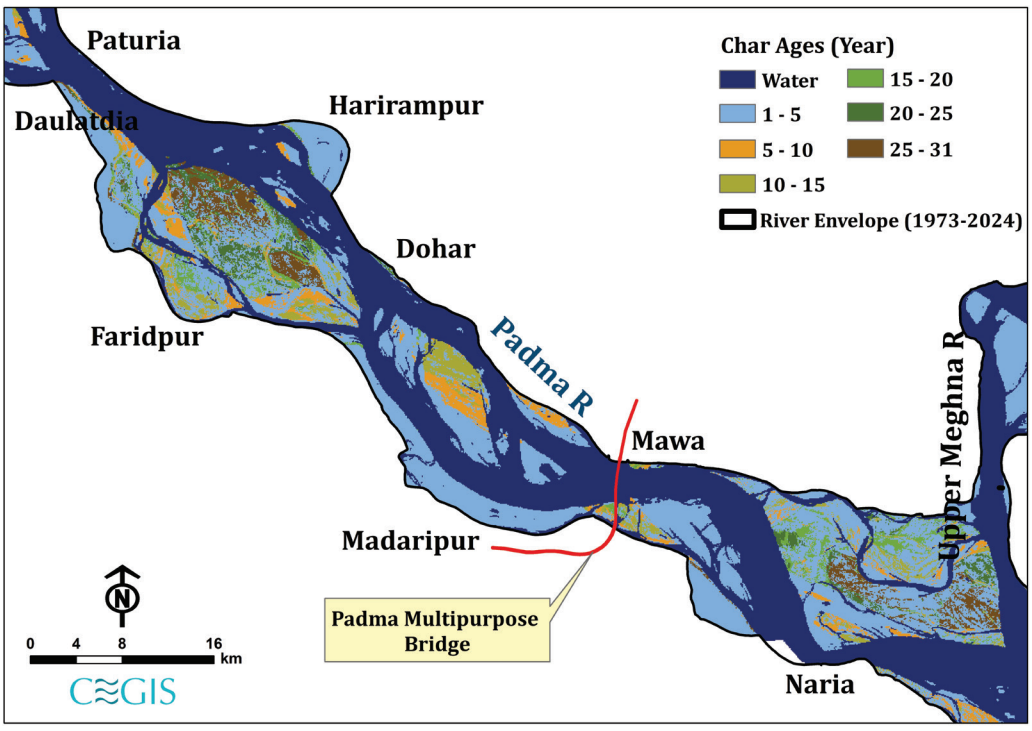
7) Development of the Hydro-Agro Informatics (HAI) Phase I – Design Phase with Planning and Development Department, Government of Sindh, Pakistan on 25 September 2024.

Mr. Gobinda Roy, Project Director, Sustainable Forests & Livelihoods (SUFAL) Project of Bangladesh Forest Department (BFD) & Mr. Md. Jahid Hossain Jahangir, Director of Business Development Division along with the Executive Director Malik Fida A. Khan and Mr. Motaleb Hossain Sarker, Deputy Executive Director of CEGIS with other professionals from both organisations were present in the contract signing ceremony

Char Ages of the Padma River ... (Cont'd from page 1)

passing through the Mawa area along the left bank. Char formation has been observed along the right bank opposite Mawa. This char is relatively small (4 km) and young (age varies from 1 to 10 years) compared to the upstream chars, indicating that this area is still in development phase.

Furthermore, there is a large char downstream of Mawa. This char divides into two channels. The main channel runs through the Naria area along the right bank, while a smaller channel runs from Mawa along the left bank and meets the Upper Meghna River. The char is approximately 20 km long, and its age at different locations varies from 1 to 25 years.



Chars and their ages along the Padma River

Overall, the map of the sandbar ages of the Padma River helps to assess the potential location of permanent chars where small-scale economic activities might be carried out. It also provides insight into the dynamics and vulnerability of the river in a particular location.

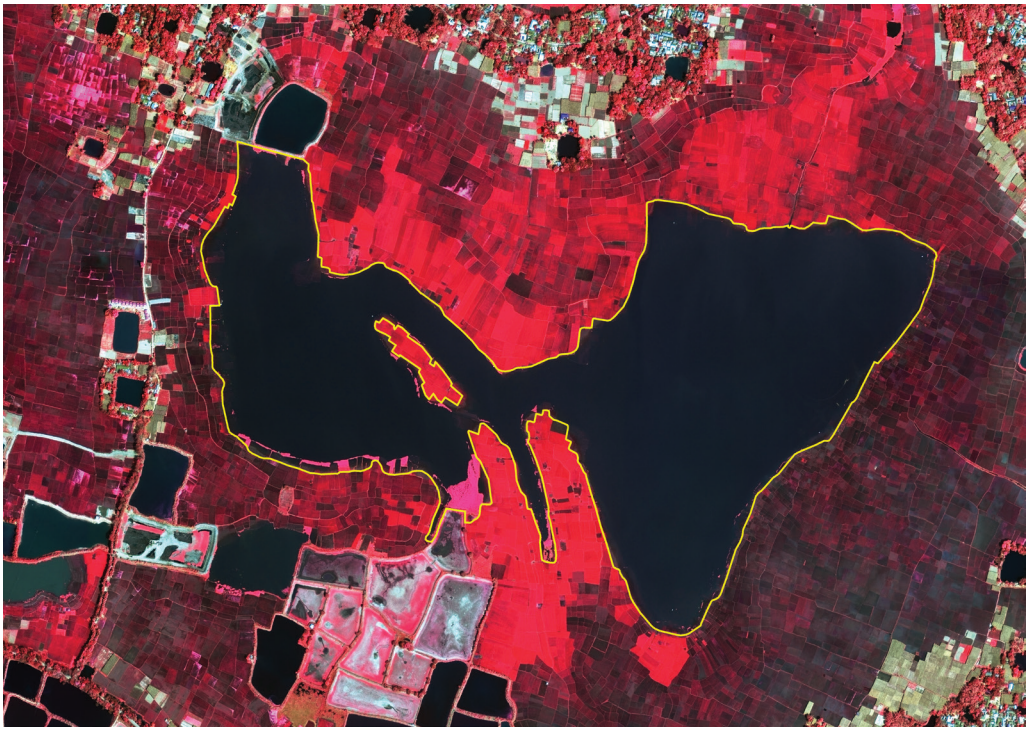
Natural Capital Mapping in Bangladesh

Rathindra Nath Biswas & Sazu Miah, Remote Sensing Division

The Bangladesh Forest Department, under the Ministry of Environment, Forest and Climate Change, has undertaken a development initiative as part of the Sustainable Forests and Livelihoods (SUFAL) Project for generating a Land Cover, Natural Capital Map and developing Integrated Collaborative Forest Management Plans, conducted by the Remote Sensing Division of CEGIS.

The natural wetlands such as lakes, haors, baors, beels, and lakes were identified using high-resolution multispectral satellite images from WorldView 3 with a spatial resolution of 30cm. Additionally, the water extent of natural features like Haor, Baor, Beel, and Lake was determined using InSAR (Interferometric Synthetic Aperture Radar) microwave imagery with a spatial resolution of 10m during the monsoon season. The imagery from the vendor archive underwent geometric correction, orthorectification, and georeferencing using Ground Control Points (GCPs) obtained during field surveys with Real-Time Kinematic (RTK), a high-accuracy GPS system. The delineated natural features from satellite imagery were validated using historical toposheets, field checks, and cross-referenced with the wetlands list from the Bangladesh Haor and Wetland Development Department.

The project's results consist of digitized natural wetlands, their names, geospatial area statistics, locational information, ecosystem services, water quality information, environmental issues, and a Web-based Management Information System (MIS).



High-resolution multispectral satellite images from WorldView 3: Mograr Beel, Mohanpur, Rajshahi

The high-resolution natural capital mapping for the SUFAL project will improve monitoring, support integrated management strategies, and enhance development initiatives concerning the natural environment, benefiting the involved stakeholders.

Environmental and Social Impact ... (Cont'd from page 2)

while the significance of the negative impacts at the pre-construction and construction phase can be brought down to an acceptable level through the implementation of the environmental management plan. The recommendation from this study is summarized as follows: (i) Development works in any river by any organization should be undertaken after conducting a detailed feasibility study. The output of the study should be discussed in the District Water Management Committee, so that other organizations may be informed of the development plan to avoid duplication of works as well as for better management of the river's potentials and optimization of resources; (ii) re-excavation of rivers should be 60m away from both upstream and downstream of the bridge for the safety of the bridge; (iii) unplanned sand and stone extraction should be stopped and an area in the river bed may be demarcated by the concerned organization for this purpose, which will not cause bank erosion; (iv) encroachment of the river should be removed by the concerned authority to bring back the life and natural function of the river; (v) re-excavated/dredged material should be disposed of as per the dredged material management plan (prepared by the technical study) so that it does not return to the river; (vi) environmental flows in the rivers should be ensured particularly for the sustenance of aquatic biodiversity including fish besides the abstraction for irrigation; (vii) a smart monitoring system through developing tools & techniques needs to be introduced to implement the project within the stipulated time effectively.

Hydro-Morphological Study of Five Bridges

Shajal Mehedi & Arifur Rahman, Climate Change and Disaster Management Division

CEGIS has been assigned by the Roads and Highway Department to conduct a hydro-morphological study at specific locations of several rivers in Bangladesh. These locations include the Shitalakshya River near Dangabazar, the Mongla River near Mongla Port, the Dhounu River around Khaliajuri, the Atrai River near Bushirbandar, and the Karatoya River around Khansama. The study involves detailed hydrological, morphological, and hydraulic analyses using mathematical modeling to determine the bridge opening width, slope protection for the approach roads, riverbank protection, and flood discharge and flood levels computations.

Key parameters obtained from the study include flood discharge, highest flood levels, velocity, depth, flow area, flood frequency, sediment characteristics, and erosion data. The CEGIS team has used historical maps and satellite imagery to estimate erosion and accretion, helping to predict future changes, assess erosion risks and to identify possible interventions.

The project involves the development of two hydrodynamic models: a one-dimensional (1D) model and a bridge model. The 1D model, created using SOBEK, covers a longer river stretch to establish boundary conditions for the bridge model. The bridge model, developed in HEC-RAS, focuses on a shorter river segment and utilizes discharge and water levels from the 1D model. CEGIS has also factored in the impact of climate change by simulating the bridge model for different return periods (25, 50, and 100 years) based on downscaled data from a Global Climate Model (GCM). Scour levels were estimated using the HEC-RAS model, and a multi-criteria analysis will be used to determine the optimal bridge alignment.

Khanshama Zia Bridge over Karatoya River, Khanshama, Dinajpur

Feasibility Study from Bhola to Barishal Gas Transmission Pipeline

Abu Sayed Md. Faysal, Power, Energy and Mineral Resources Division

Bangladesh's consumption of natural gas has been significantly increasing, creating a growing gap between supply and demand. In this regard, the Gas Transmission Company Limited (GTCL) has initiated a project to connect the stranded gas reserves of the Shahbazpur and Bhola areas to the national gas grid by constructing a gas transmission pipeline from Bhola to Barishal, covering a mix of plain land and complex terrain with crossings of large and dynamic rivers.

CEGIS and its sub-consultant ILF Consulting Engineers, a German-based consultancy firm, have conducted a feasibility study to assess the technical feasibility, financial viability, environmental sustainability, and social acceptability of the proposed gas pipeline project.

The proposed Bhola to Barishal Gas Transmission Pipeline will follow the Shahbazpur-Ilisha-Mehendiganj-Hizla-Barishal Route. The pipeline will be approximately 96 km long with a 24-inch diameter and 1000 psig pressure rating. It will involve four river crossings with a total bank-to-bank crossing length of about 4.025 km. The proposed route has been chosen through a detailed morphological analysis to identify a narrow corridor suitable for the Intersection HDD Method for the Tentulia River and the Lower Meghna, while the remaining smaller river crossings will use the Conventional HDD Method.

Upon completion of the pipeline project, 290 MMSCFD of gas from the gas fields in the Bhola area are expected to be transmitted to the national grid.

Shahbazpur Gas Field Process Plant

Minor Irrigation Development by Removal of Water Logging and using Modern Irrigation Techniques in Tangail District

Mohammad Abdur Rashid & Md. Ashraful Alam, Agricultural and Fisheries Division

The Tangail District in Bangladesh faces major irrigation and water management issues, particularly during the dry season when over-extraction leads to groundwater depletion. Inadequate irrigation infrastructure, limited canal systems, and outdated practices complicate effective water management. Further, challenges like flooding, waterlogging, and climate change-related irregular rainfall threaten agriculture, leading to lower crop yields, increased food insecurity, and rising regional poverty.

The Bangladesh Agricultural Development Corporation is developing an Irrigation and Water Management Plan for Tangail District. As part of this initiative CEGIS conducted a feasibility study for the "Minor Irrigation Development Project" aimed at addressing waterlogging and implementing modern irrigation techniques.

The Study assessed interventions to enhance irrigation and drainage systems, including re-excavating canals, installing buried pipelines, and improving irrigation water access. Key initiatives involve re-sinking deep tube wells, using low-lift pumps, and utilizing solar power for equipment while minimizing water losses with efficient pipelines. Climate-smart technologies, like drip irrigation and solar wells, will be integrated into multifunctional systems. The project also includes building infrastructure such as water passes, cattle crossings, footbridges, and protective measures for the irrigation networks.

The project aims to increase irrigated land by 27,000 hectares and boost food grain production by 150,000 metric tons, enhancing irrigation water availability and system efficiency while reducing greenhouse gas emissions.

Mainly used irrigation techniques are (from left) Earthen Irrigation Cannel, Dug Well, Deep Tube well, and Solar panel

Hobo Weather Station U30: a recent addition to the Environmental Laboratory of CEGIS

HOBO weather station U30 is a no-remote communication weatherproof data logging sensor-based device that can be easily reconfigured and adapted for outdoor environmental/meteorological monitoring applications by collecting weather data and uploading data to software for analysis. Onset Corporation, USA manufactures this devise. HOBO U30 can record, monitor, and analyze data. Operators can easily configure the logger, check the status, and download data for graph and analysis. The logging interval is 1 sec to 18 hrs. Memory is 512 kB of nonvolatile data storage. The power source is 4V, 10 AHr, rechargeable sealed acid external power required solar panel. HOBO weather can measure wind speed, wind direction, and temperature/RH in the air. Rainfall and gaseous & particulate matter can also be measured when related sensors are provided.

Hobo Weather Station U30

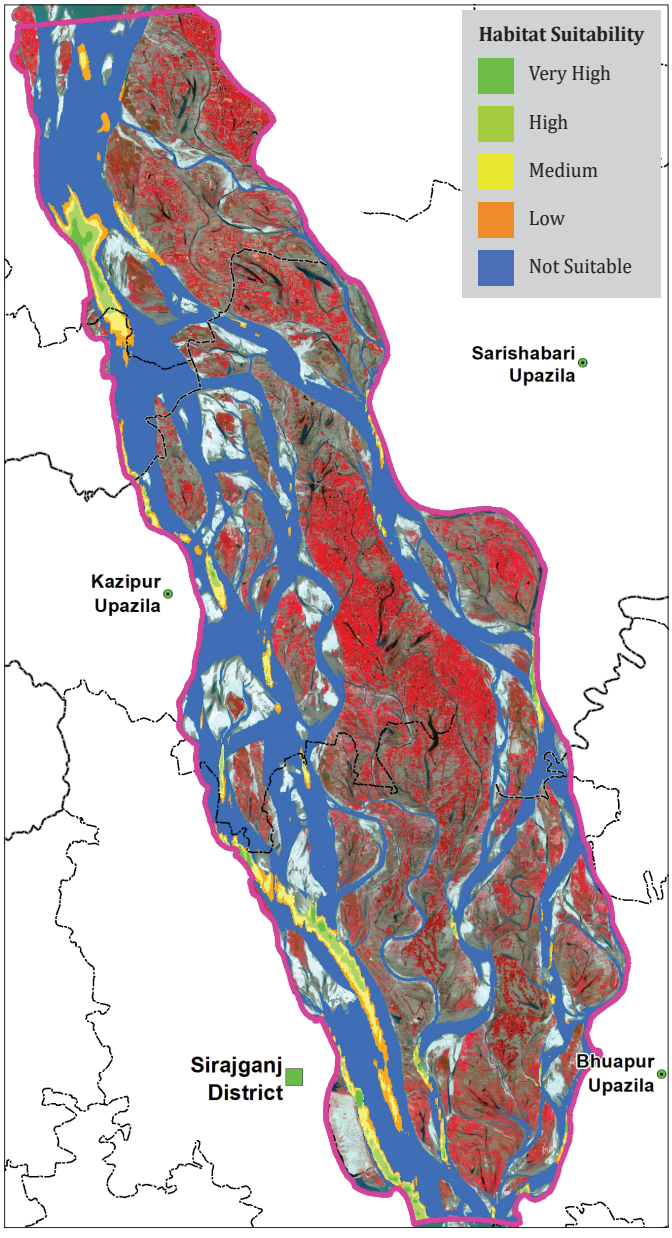
Once the tripod is fixed, HOBO U30 must attach it to the backside of the station. Also, the tripod is used to keep the solar panel in position. The radiation shield and full cross-arm have to be fixed with the same tripod. Wind speed and wind direction smart sensors must be set to cross arm. Then, sensors and solar panels are to be connected to smart sensor ports through cable access openings. After that the U30 could be connected to the computer with a USB cable. Then it is plugged in a built-in battery cable into the battery connector and into the power supply. Device>Lunch should be selected from the main menu to configure the lunch setting. To verify, the U30 and sensors are working properly, from the main menu, Device>Status is to be selected. Before connecting sensors and launching HOBO U30, the battery level should be at least 40%. From the main menu, Device>Read Out is to be selected for Read Out. When HOBO ware Pro prompts to stop the logger before reading out, it must click Stop. When HOBO ware Pro prompts to save the data file, it has to click Save. After saving the file, the plot set-up dialogue will appear. Channels should be selected to plot, and it is necessary to click plot. Then, a graph will appear. U30 is now ready for deployment. For deployment, the lunch window is to be opened in HOBO ware, and the log interval for deploying is to be set.

CEGIS can use this instrument for environmental impact assessment studies or environmental/metrological research purposes.

Ganges River Dolphin Habitat Suitability in the Jamuna River

S M Shamim Ahmed Tuhin, Remote Sensing Division; Mohammed Mukteruzzaman, Power Energy and Mineral Resources Division; Md. Mizanur Rahman; River, Delta and Coastal Morphology Division

The Jamuna River is a highly braided river with multiple channels separated by numerous small sand bars and char lands. The river has two main ecosystems: freshwater and charlands. The Jamuna River supports a high diversity of fish, amphibians, reptiles, birds, and mammals, along with many invertebrates and floral species. The river supports ecologically significant habitats, including critical fish habitats (e.g., Ilish for spawning grounds), movement corridors for migratory birds and habitats for large aquatic mammals (e.g., Ganges River Dolphin). According to Integrated Biodiversity Assessment Tool (IBAT) and International Union for Conservation of Nature (IUCN) Red List (2015), the Ganges River Dolphin in the Jamuna River was considered a globally critically endangered and nationally endangered species whose habitats are under threat.



Ganges River Dolphin habitat suitability and distribution during the monsoon period in the project influenced area of the Jamuna River

Therefore, identifying the important and ecologically critical species' habitat distribution patterns and determining suitable conditions for their habitats are fundamental for biodiversity conservation and sustainable management of the Jamuna River floodplain.

CEGIS has conducted a project work entitled as "Environment and Social Impact Assessment for Char Stabilization and Livelihood Development Project in the Jamuna River" under supervision of Bangladesh Water Development Board which has determined ecologically important wildlife and fish species' habitat distributions and suitability through ecological modelling with remote sensing and GIS technology. Species habitat suitability assessment using remote sensing and GIS-based technology includes relatively low-cost, short time-consuming, less intensive surveys and small or large area coverage compared to traditional assessment.

A remote sensing and GIS-base machine learning model called the "Maximum Entropy Model (MaxEnt)" was applied to assess and determine suitable and non-suitable habitats' distribution of different species, their habitat suitability and significant habitat controlling environmental parameters.

This model results in a species habitat distribution map (both monsoon and dry season), significant environmental parameters that control the habitat distribution through species occurrence GPS locations and simulation of their habitat-related important environmental parameters such as river bathymetry (water depth), bed materials, flow velocity, water quality parameters (temperature, pH, turbidity, TDS, EC), land use and land cover, and climatic parameters etc.

In this project, wildlife (e.g. Ganges River Dolphin and Migratory birds) and fish (e.g. Ilish, Ayre and Catla) species were considered for the assessment. A total of 9,535 ha (8.87%) out of 1,07,576 ha is predicted suitable habitat for the Ganges River Dolphin during monsoon season. In dry season, they explore the pool areas in the Jamuna and its suitable connecting rivers.

The spatial habitat distribution and its suitability of Ganges River Dolphin in the project influenced area along the Jamuna River is represented in the map. From the model result, 3,064 ha (14.45%) has been calculated suitable and 18,140 ha (85.55%) non-suitable during monsoon season. The suitable area also categorized as 247 ha (1.16%) as very high, 724 ha (3.41%) high, 953 ha (4.50%) moderate, and 1,140 ha (5.38%) as low suitable.

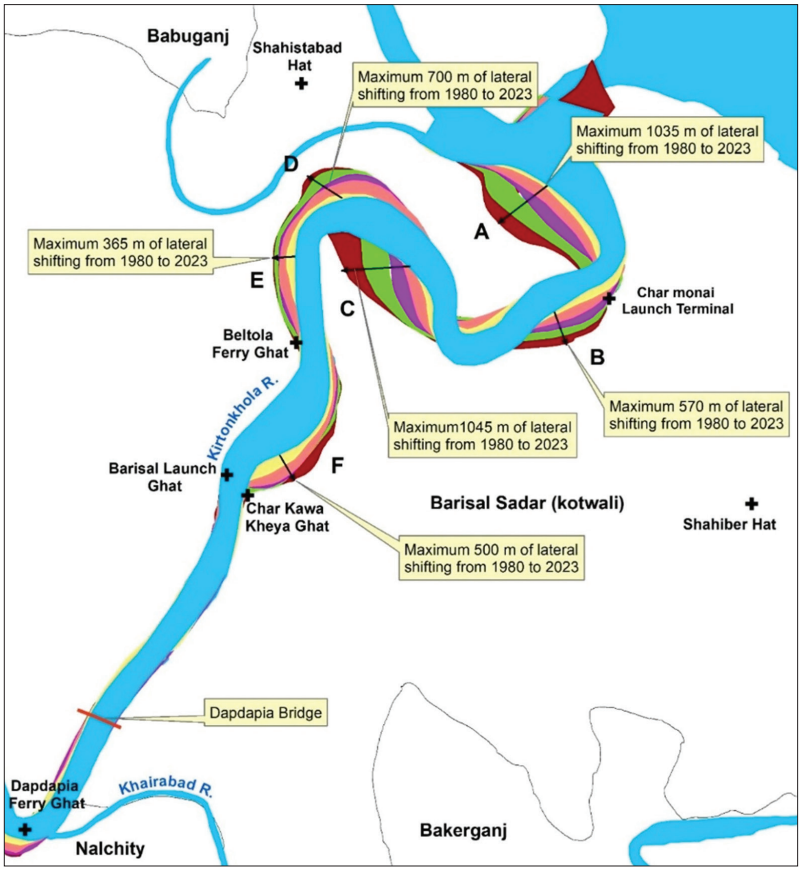
As the Jamuna is a trans-boundary river, the Ganges River Dolphin habitat might be shifted to the upstream if they do not get the suitable environment. However, this technologically advanced work for national and globally significant species may contribute to the national and international biodiversity conservation and management plan.

Feasibility Study for Water Resources Management in the Kirtonkhola-Shugandhya-Bishkhali River System

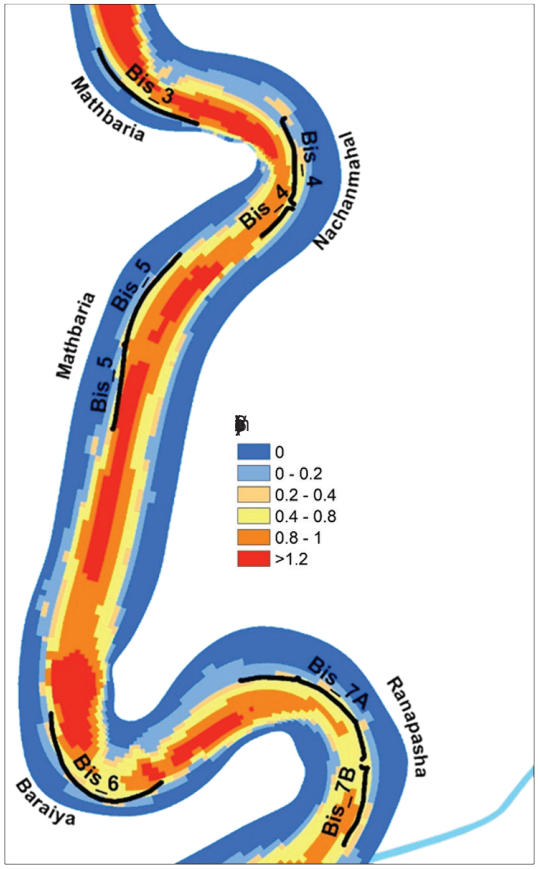
Abhijit Das & Dr. Jakia Akter, River, Delta and Coastal Morphology Division

River erosion is a major natural disaster in the Kirtonkhola-Shugandha-Bishkhali River System areas in southern Bangladesh. The polders on both sides of the Bishkhali River are facing various problems, such as damaged embankments, damaged water management structures (drainage and flushing), sedimentation inside internal canals, etc. These coastal region problems may worsen due to climate change and sea level rise.

climate change impact, on-site verification, and stakeholder input. The plan includes bank protection works, re-sectioning of embankments, and constructing, repairing, or replacing water management structures and canals. The proposed interventions are designed to be economically viable, ensuring sustainable solutions for the long term. A thorough evaluation of the proposed structures' environmental and social impacts was



Shifting of bankline of Kirtonkhola River from satellite image analysis



Velocity profile of Bishkhali River from mathematical modeling

CEGIS has conducted extensive survey work and data collection, including cross-section survey, embankment survey, inventory of structures, sediment analysis, water level measurement, velocity and discharge measurement, etc., to comprehensively understand the study area. The data was used to conduct a hydromorphological analysis and to identify vulnerable areas using mathematical modeling.

A comprehensive plan has been developed to address the issues in this area, taking into account model outputs, conducted, leading to the development of an Environmental Impact Assessment (EIA), Environmental Monitoring Plan, and Management Plan.

It is emphasized that the project will not have any permanent harmful implications. Implementing this plan will safeguard properties from river bank erosion and ensure effective water resource management in the polders. The project will bring socio-economic benefits to the local community by ensuring stable riverbanks and effective water resource management in the polders.