

**ANNUAL REPORT**

**July 2023-June 2024**

**SPARRSO**



**Bangladesh Space Research and Remote Sensing Organization (SPARRSO)**

**Agargaon, Sher-e-Bangla Nagar**

**Dhaka 1207, Bangladesh**



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**SPARRSO**

**(Published in September 2024)**

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**(Additional Secretary)**

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**Published by:**

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Chairman  
SPARRSO  
(Additional Secretary)  
&  
Advisor of Editorial Committee

## **Foreword**

It is my pleasure to present the Annual Report on the development activities, research work and achievements of Bangladesh Space Research and Remote Sensing Organization (SPARRSO) carried out by the authority and thematic research divisions for the financial year of 2023-2024.

After the independence of Bangladesh, Earth Resources Technology Satellite (ERTS) Programme and Space and Atmospheric Research Centre (SARC) were established in 1972. Later SPARRSO was formed merging those two entities. With the passage of time, SPARRSO is now turned into the national space agency of Bangladesh.

We are committed to fulfill the requirement of space research and remote sensing technology through attaining Sustainable Development Goals (SDG) related research. Over the years, all research projects had been outlined in terms of SDGs. The efforts would go in the upcoming year considering the country's need to be developed. SPARRSO has been substantially contributing to environmental, climate change & global warming issues, national disaster preparedness programs and predominantly contributing to diversified earth-resources, management and monitoring functions over the years. It provides accurate, valid and reliable information to the government and relevant organizations to facilitate their decision making process.

In accordance with its national research mandates, SPARRSO continues to develop a greater scale of collaboration and connections with partners and research organizations in Bangladesh and abroad. Besides, SPARRSO has also set up short, medium and long term plan in this financial year, that will guide this organization to move forward to next decades.

In this opportunity, I would particularly like to acknowledge the continued support of the Ministry of Defence and we are also looking forward enthusiastically, the same to the years to come. The Board of Directors and I continue to be inspired by the scientists, engineers and support-staff of SPARRSO, who work tirelessly for the progressively development of this organization maintaining a high global standard for space science and technology.

I thank the Editorial Committee and my colleagues for their effort in preparing and publishing this report.

Md. Rashedul Islam





Member  
SPARRSO  
(Joint Secretary)  
&  
Convener, Editorial Committee

### **Editorial Note**

On behalf of the Editorial Committee, I am glad to introduce the Annual Report of Bangladesh Space Research and Remote Sensing Organization (SPARRSO) that briefly accounts the activities of the organization performed during the fiscal year, July 2023 to June 2024. The report is going to be published in fulfillment of Section 14(1) of the SPARRSO Act 1991. The report gives a consecutive overview about the applications and usefulness of space science and technology including Remote Sensing (RS), Geographic Information System (GIS) and Global Navigation Satellite System (GNSS) for surveying and mapping of natural resources and monitoring of natural hazards in the country. Notably, we have tried to focus on the annual research activities. This report also brings to light the various achievements of SPARRSO and its participation at national, regional and international events. These are highlighted to promote the use of the earth observation techniques for the greater benefits and welfare of the people of Bangladesh and access to the knowledge of country's resources on a national, regional and global comparative scale.

It is a great pleasure for the Editorial Committee to express the heartiest gratitude to the Senior Secretary of Ministry of Defence (MoD) and Chairman of SPARRSO for their kind advice and cordial cooperation. I would like to acknowledge the contribution of SPARRSO Scientists, Engineers, Officers and Staff for their passion, support and contribution in preparing their respective divisional activities, which are the main contents of this report.

The editorial committee apologizes for any inconsistency in the document and being late in bringing this publication to light. Constructive criticism, suggestion, advice and personal recommendation from anyone for further improvement in preparing our future reports will be highly appreciated and sincerely considered. We pray to Almighty Allah for His blessings to overcome the continuing global crisis having courage and strength to work hard for the betterment of the people in Bangladesh and across the globe.

Md. Abdur Rab



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# **Chapter 1**

## **INTRODUCTION**

## INTRODUCTION

Bangladesh Space Research and Remote Sensing Organization (SPARRSO) is a multi-disciplinary research organization established in 1980. It began its journey as a statutory body in 1992 under the Act 29 of 1991. SPARRSO has been applying space technology in peaceful purposes for the benefit of the nation. It carries out research works in various geo-disciplines that includes atmospheric science, agriculture, forestry, fishery, water resources, environmental sciences, geological science, oceanography etc.

The organization is functioning under the supervision of the Ministry of Defence and is governed by the direct instructions and guidelines of the SPARRSO Board. In Bangladesh, SPARRSO is the focal organization of Asia Pacific Space Cooperation Organization (APSCO). Within the framework of APSCO, SPARRSO is implementing various programs on space science research, space technology development and space technology application domains.

As its regular course of duties, SPARRSO produces required databases, information and maps which are supplied to different Ministries, i.e., Agriculture, Food & Disasters Management, Environment & Forest, Land, Fisheries & Livestock, Defence and others. It also provides information to different departments and organizations, such as Bangladesh Meteorological Department, Bangladesh Bureau of Statistics (BBS), Forest Department, Department of Disaster Management (DDM) etc. Upon any specific request that requires space application from the government organizations, it generates and supply the information for ensuring human safety and security and finally contributing towards national development.

This annual report for the fiscal year of 2023-2024 briefly describes the research, study and operational activities implemented during the reporting period. In addition, it also includes the participation of the officials in training, conferences and meetings organized by different national and international organization.

## 1.1 Functions of SPARRSO

1. Peaceful application of space science and remote sensing technology in different disciplines of science including Agriculture, Forestry, Fisheries, Geology, Cartography, Water Resources, Land use, Weather, Environment, Geography, Oceanography, Education etc. and conducting research for the development and application of this technology.
2. Provide research results and disseminate relevant information to the Government and different agencies as mentioned in section 1.
3. Inform the government about the space and relevant policies of different countries and advise government in this issue on policy decisions.
4. Conduct surveys, training, and research using space science and remote sensing technology and collaborating with different national, foreign or international agencies.
5. Formulation of development project for conducting research on space and remote sensing technology and its implementation taking prior approval from the Government
6. Take necessary steps to perform the above activities.

## 1.2 SPARRSO Board

SPARRSO is governed by a Board consisting of Chairman and four Members. As of 30 June, 2024, the members of SPARRSO Board were as follows:

<b>Name</b>	<b>Position in Board</b>
Mr. Md. Rashedul Islam	Chairman (Additional Secretary)
Mr. M. Mahmud Ali	Member (Research) (Additional Secretary)
Mr. M. Mahmud Ali	Member (Technology-1) (Additional Charge)
Mr. Md. Abdur Rab	Member (Application) (Joint Secretary)
Dr. Md. Mahmudur Rahman	Member (Technology-2)

### 1.3 Manpower

The list of existing officers of SPARRSO is enumerated below: (As of 30 June 2024)

Sl	Name	Designation	Phone (Office)	Email
1	Md. Rashedul Islam	Chairman (Additional Secretary)	+88-02- 41025814	chairman@sparrso.gov.bd
2	M. Mahmud Ali	Member (Research) (Additional Secretary)	+88-02- 41025690	membertech1@sparrso.gov.bd
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4	Md. Abdur Rab	Member (Application) (Joint Secretary)	+88-02-48113401	memberapp@sparrso.gov.bd
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9	Mohammad Masudur Rahman Mollah	Financial Adviser (Additional Charge)	+88-02-48118581	admin@sparrso.gov.bd
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11	Dr. Mohammad Shohidul Islam	Principal Scientific Officer		shohidul@sparrso.gov.bd
12	Abdullah Yousuf Imam	Senior Scientific Officer (on higher study abroad)		imam@sparrso.gov.bd
13	Md. Abdul Kader	Senior Scientific	+88-02-48113700	imrankadir@sparrso.gov.bd

Sl	Name	Designation	Phone (Office)	Email
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14	Dr. B.M. Refat Faisal	Senior Scientific Officer		refatfaisal@sparrso.gov.bd
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16	Mohammad Imrul Islam	Senior Scientific Officer		imrul_islam@sparrso.gov.bd
17	Farhana Tazneen	Senior Scientific Officer		farhana@sparrso.gov.bd
18	S.A.M. Arif-Ul-Haque	Senior Scientific Officer		sam_arif@sparrso.gov.bd
19	S M Ahsan Habib	Senior Scientific Officer		ahsan@sparrso.gov.bd
20	Md. Mahmudul Haque	Chief Administrative Officer (Acting)	+88-02-48110814	mahmudulhaque@sparrso.gov.bd
21	Md Monirul Islam Khondoker	Finance Officer (Acting)	+88-02-9134006	kmanirul@sparrso.gov.bd
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24	Md. Mahmudul Haque	Administrative Officer	+88-02-48117503	mahmudulhaque@sparrso.gov.bd
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26	Mohammad Mahdi Hasan	Scientific Officer		mahdi@sparrso.gov.bd
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28	Muhammad Sharif	Assistant Engineer		sharif@sparrso.gov.bd
29	Md. Abdur Rahman-Al-Mamun	Scientific Officer		rahman.almamun@sparrso.gov.bd

<b>Sl</b>	<b>Name</b>	<b>Designation</b>	<b>Phone (Office)</b>	<b>Email</b>
30	Md. Farid Uddin	Scientific Officer		farid.uddin@sparrso.gov.bd
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32	Mehedi Hasan Peas	Scientific Officer		mehedi.inc@gmail.com
33	Md. Jahidul Ashik	Scientific Officer		ashikurp@gmail.com
34	Md. Rassal Mollik	Librarian		rassalm.duis@gmail.com

# **Chapter 2**

## **Research and Application Activities**

## RESEARCH AND APPLICATION ACTIVITIES

### Executive Summary

The Bangladesh Space Research and Remote Sensing Organization (SPARRSO) has significantly contributed to fostering sustainable development goals (SDGs) in Bangladesh through space research and its multidimensional applications over the years. In continuation, during the fiscal year (2022-2023), SPARRSO took ten (10) research works that covered a wide range of topics, including the earth's surface processes and natural resource monitoring (agricultural drought monitoring, water resource management, crop information, forest cover monitoring, air pollutants measurements, etc.) to the development of space technology (CubeSat and UAS development, telescope observatory installation, etc.). The SPARRSO completed these research works within the stipulated time frame with significant outputs that are discussed in the following relevant section.

The research relevant to the agricultural sector was implemented to develop a remote-sensing-based drought monitoring system in Bangladesh, particularly in Dhaka and Khulna divisions, where cropland layers have been generated. This research is expected to contribute significantly to Bangladesh's crop information science and food security issues. The research work of the forestry sector aims to prepare national-scale tree cover maps and monitoring of forest resources, where tree cover maps have been prepared in this pilot study covering mostly the western part of Bangladesh using Landsat satellite images. Furthermore, three research works have been completed this fiscal year related to water and fisheries resource management, particularly remote sensing-based flash flood monitoring, bank-line shifting, and water bodies identification. The findings of these studies play a crucial role in developing a remote-sensing-based flash flood monitoring (e.g., Tanguar Haor) algorithm integrating the Synthetic Aperture Radar (SAR), various hydro-meteorological data in Google Earth Engine (GEE). Besides, geomorphological features (bank line shifting, sand bar, multithreaded channels, etc.) have been investigated to study the Teesta River (Brahmaputra's tributary) dynamics for integrated river basin management. Furthermore, the research of the atmospheric division focuses on measuring the concentration of air pollutants (CO, PM<sub>2.5</sub>, and PM<sub>10</sub>) in major cities (Dhaka) of Bangladesh utilizing the Landsat 8, Sentinel-5P data, and ground-based data, which can be helpful to identify the pollution hotspots and therefore the pollution control strategies.

Apart from the above-mentioned remote sensing application-based research, SPARRSO also worked on developing space technology, particularly the CubeSat and telescope-based space observatory during this fiscal year. The first phase of research in the space physics and rocket dynamics division focuses on installing a 16-inch diameter optical telescope for space observation, which would play a crucial role in space monitoring with the completion of this research soon. On the other hand, the ground station division is developing an IU CubeSat, designed with a weather analysis module and camera, which successfully transmits the data. This technological advancement represents a strong foundation in Bangladesh's space research

capability. Besides, the SPARRSO is also interested in formulating a national policy related to the space for Bangladesh, and a draft has been prepared for further improvement.

Hence, the successful completion of the satellite remote sensing and space science-based research works from the respective divisions of SPARRSO would play a crucial role in different sectoral policies, strategic planning, and decision-making in Bangladesh.

## **2.1 Atmospheric Research Division**

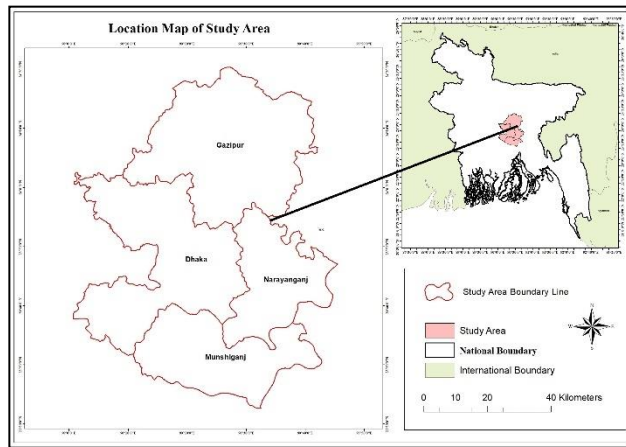
### **Research title: Air Quality Monitoring Using Remote Sensing and GIS Technologies in major cities of Bangladesh**

#### **Introduction**

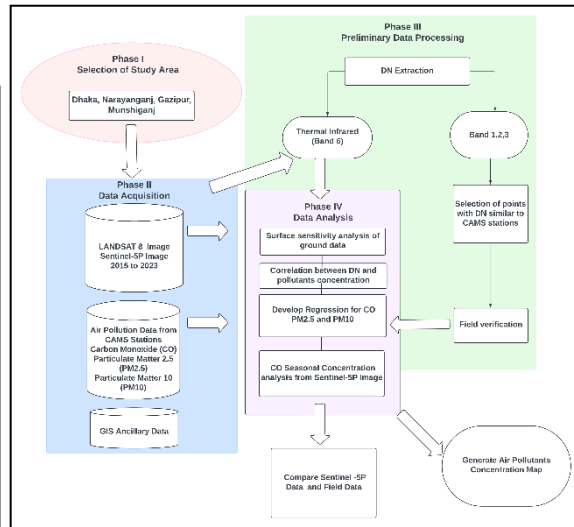
Rapid industrialization and urbanization have made air quality monitoring increasingly critical in urban areas. This study focuses on assessing air quality in major cities of Bangladesh using remote sensing (RS) and Geographic Information Systems (GIS). Air quality monitoring using RS & GIS technologies has emerged as a powerful approach to assess and manage air pollution in urban environments. Remote sensing enables the acquisition of high-resolution, real-time data on various air pollutants, such as carbon monoxide (CO), particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), and other harmful substances, by capturing reflected or emitted electromagnetic radiation from the Earth's surface and atmosphere. These data are obtained through satellites or airborne sensors, which provide extensive spatial coverage that ground-based monitoring systems alone cannot achieve. GIS offers robust tools to store, analyze, and visualize these pollutants' spatial and temporal distribution. Researchers can generate detailed pollutant distribution maps by integrating RS data into GIS, identify pollution hotspots, and monitor changes over time. Landsat-8, Sentinel-5P, ground networks, and continuous atmospheric monitoring station (CAMS) data are used to measure the concentration of air pollutants such as CO, PM<sub>2.5</sub>, and PM<sub>10</sub> in the regions of Dhaka, Narayanganj, Munshiganj, and Gazipur in Bangladesh.

#### **Methodology**

The methodology of this research is divided into four key phases. Phase-1: selection of the study areas; phase-2: data acquisition; phase-3: preliminary data processing and phase-4: concentration maps generation, the research process is shown with a block diagram in Fig 2.1 (a) Phase-1 involves the careful selection of study areas, focusing on Dhaka, Narayanganj, Munshiganj, and Gazipur in Fig 2.1(b). This region has been chosen due to its notably high levels of air pollution, a critical environmental concern. Phase-2 focuses on data acquisition utilizing advanced satellite technology and ground-based monitoring systems. Phase-3 involves preliminary data processing, beginning with surface sensitivity analysis of the ground data to understand the variability and impact of different surfaces. Phase-4 focuses on the generation of concentration maps, which visually represent the spatial distribution of pollutants across the study areas.



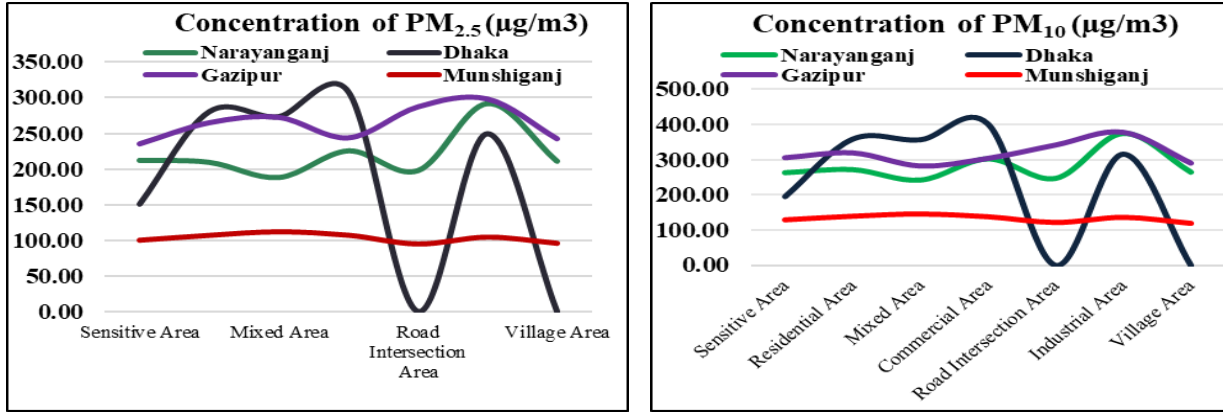
**Fig. 2.1(a)** Map of the study area



**Fig. 2.1(b)** Block diagram of methodology

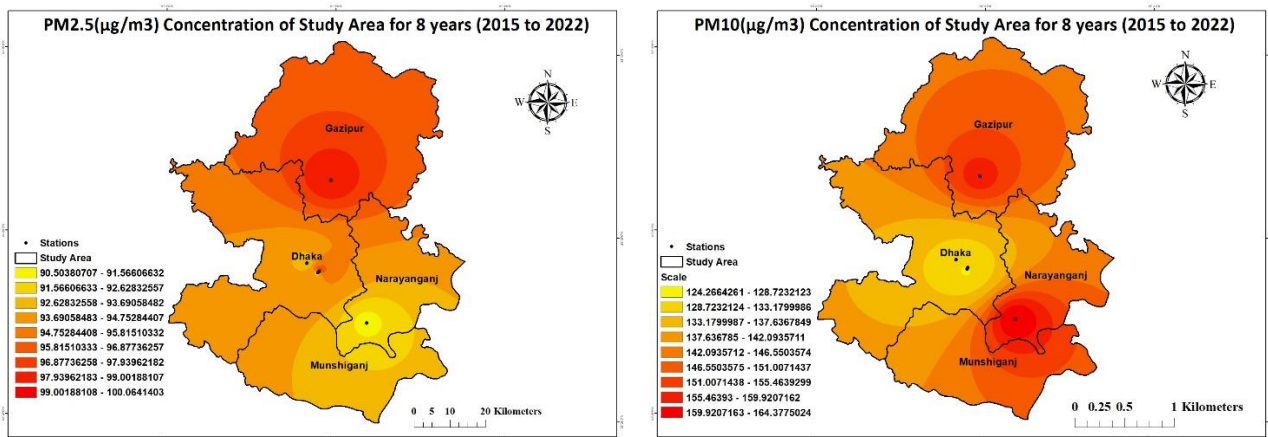
## Results and Discussion

The results of the sensitivity analysis reveal distinct categories based on the pollutant concentrations across different areas. Sensitive areas, such as hospitals and schools, show high vulnerability to pollution, requiring immediate attention. The concentrations of PM<sub>2.5</sub> and PM<sub>10</sub> across different surfaces are shown in Fig 2.2 (a) and Fig 2.2 (b), respectively. The surfaces are classified into seven categories: sensitive area, residential area, mixed area, commercial area, road intersection area, industrial area, and village area. Figure 2(a) depicts the PM<sub>2.5</sub> concentrations in Dhaka, with the commercial area having the highest concentration at 309 µg/m<sup>3</sup>, followed by the residential area at 281 µg/m<sup>3</sup>. In Narayanganj, which is predominantly industrial, the highest PM<sub>2.5</sub> concentration is 292µg/m<sup>3</sup>, while the lowest concentration is 188 µg/m<sup>3</sup>. Figure 2(b) is about the Dhaka area's PM<sub>10</sub> concentration according to different surfaces. The commercial area has the highest concentration 403 µg/m<sup>3</sup> and then residential area has the second highest concentration 360µg/m<sup>3</sup> in Dhaka. As the maximum area of the Narayanganj is Industrial areas, the highest PM<sub>10</sub> concentration is 374 µg/m<sup>3</sup>. Dhaka, Narayanganj, and Gazipur have the strongest concentration value of PM<sub>10</sub>, and the Munshiganj area has a comparatively lower value than other areas. The study correlated satellite reflectance with ground-based measurements of air pollutants, yielding correlation values of 0.59 for CO, 0.60 for PM<sub>2.5</sub>, and 0.54 for PM<sub>10</sub>. The correlation values indicate a moderate relationship, suggesting that remote sensing can be a viable tool for monitoring air quality.



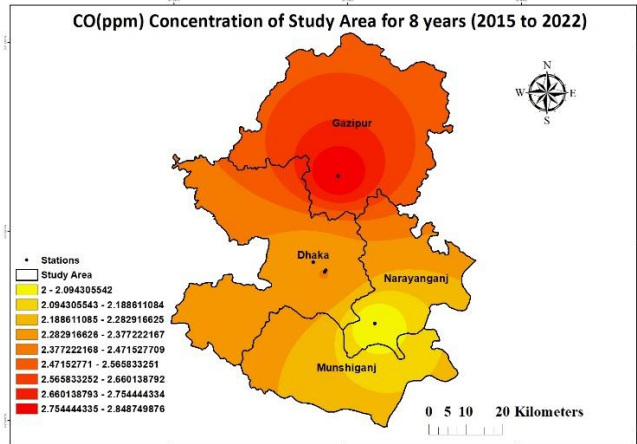
**Fig. 2.2** (a) Concentration of PM<sub>2.5</sub> (µg/m<sup>3</sup>) and (b) PM<sub>10</sub> (µg/m<sup>3</sup>) for different land surfaces

The generation of pollutant concentration maps involves creating detailed visual representations of PM<sub>2.5</sub> and PM<sub>10</sub> levels. PM<sub>2.5</sub> concentration maps are generated and analyzed using ground network data from 2015 to 2022, for the study areas of Dhaka, Narayanganj, Munshiganj, and Gazipur. Fig 2.3 (a) presents PM<sub>2.5</sub> concentration map that is a comprehensive analysis of an average PM<sub>2.5</sub> concentration, illustrating the trends and changes in PM<sub>2.5</sub> levels across the study area. Similarly, average concentration maps of PM<sub>10</sub> and CO are presented in Fig. 2.3(b) and 2.3(c), respectively. Overall, the research demonstrates that integrating remote sensing technology with GIS techniques, specifically the kriging interpolation method, can effectively monitor PM<sub>2.5</sub> and PM<sub>10</sub> concentrations. Satellite-based imagery offers a cost-effective approach to producing air quality maps, particularly at a micro-scale level. The strong correlation between DN and pollutants suggests that the thermal infrared band of Landsat 8 can be used to determine the relationship.



**Fig. 2.3(a)** Average concentration of PM<sub>2.5</sub> of 8 years

**Fig. 2.3(b)** Average PM<sub>10</sub> concentration of 8 years



**Fig. 2.3(c)** Average CO concentration of 8 years

## Conclusions

This study demonstrates how Remote Sensing and Geographic Information System technologies may be used to monitor air quality across major cities in Bangladesh. This research provides vital insights into the spatial distribution of pollutants like CO, PM<sub>2.5</sub>, and PM<sub>10</sub> by utilizing data from satellite platforms such as Landsat 8 and Sentinel-5P with measurements of the ground-based air quality data. The effectiveness of this method for monitoring urban air quality is affirmed by the moderate to significant correlations observed between the satellite-derived digital numbers and pollutant concentrations. The generated concentration maps manifested significant pollution hotspots in industrial and mixed zones, highlighting the necessity of pollution control strategies. Furthermore, the application of the kriging interpolation method in GIS made it possible to create comprehensive pollutant maps. These maps will provide valuable tools for urban planning and environmental management to the policymakers. The following research could focus on expanding the range of geographical and temporal coverage of satellite data to improve air quality monitoring systems in Bangladesh and/or similar situations elsewhere.

## 2.2 Agricultural Division

**Research title: Developing an Agricultural Drought Monitoring Model Based on Multi-Source Remote Sensing Data**

### Introduction

Drought condition in Bangladesh reveals a complex picture. Aridity and drought are common in the country, particularly in the northwestern and western regions. Due to high poverty rates, dependence on agriculture, low adaptive capacity, and high variability of annual and seasonal rainfall, the Barind tract and Teesta floodplain regions of northern and northwestern (North Bengal) Bangladesh are particularly affected by drought. The country is mostly affected by drought during the Kharif seasons among the three (Kharif I, Kharif II, and Rabi) cropping seasons. Recently, researchers addressed the central region of the country as vulnerable to droughts, including northern and north-western regions as identified earlier. In Bangladesh, the

Pre-Kharif season (March to June) is characterized by variable rainfall, a protracted dry spell, high temperatures (over 40 °C from March to June), and increased evapotranspiration.

Drought monitoring in Bangladesh involves the use of various drought indices such as the Standardized Precipitation Index (SPI), Standardized Precipitation Evapotranspiration Index (SPEI), and Vegetation Condition Index (VCI). These indices are used to assess drought characteristics, including intensity, frequency, and duration, at different temporal and spatial scales. As we know, drought is a slow process that begins with a precipitation deficit, then leads to soil moisture deficit and a higher land surface temperature, and at last, the vegetation growth will be influenced by this process. Therefore, to monitor the comprehensive drought we must consider these parameters which are derived from precipitation, soil, and vegetation. Therefore, to monitor the comprehensive drought we must consider these parameters which are derived from precipitation, soil, and vegetation. In this study, we used CHIRPS data as a component from precipitation to calculate PCI, used soil moisture & LST as a component from soil to calculate SMCI & TCI, used NDVI as a component from vegetation to calculate VCI and used EVI & LST as a component from vegetation and soil to calculate VSWI. In this study, an integrated weighted drought index (IWDI), based on remotely sensed data was used to develop and evaluate the drought conditions over the selected study area. The objectives of this research are (a) to identify drought indices and remote sensing products capable of detecting drought events in Bangladesh, (b) to investigate significant meteorological factors triggering drought events in Bangladesh, and (c) to generate an updated cropland layer.

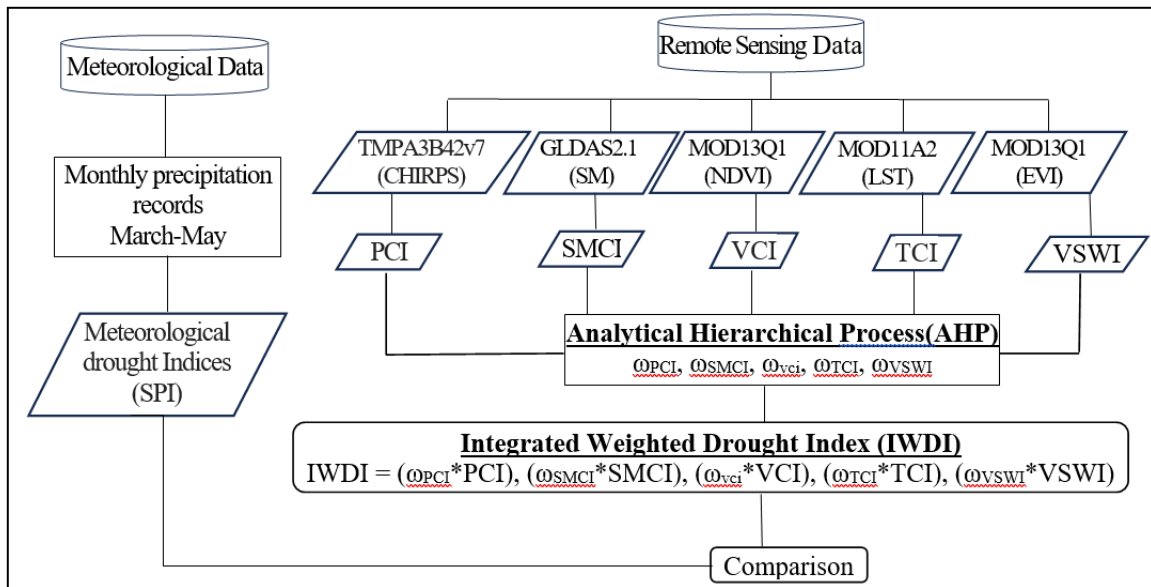
## **Research Methodology**

The Dhaka and Khulna division is the study area for this research. The Dhaka division consists of thirteen districts: Dhaka, Narayanganj, Faridpur, Gazipur, Gopalganj, Kishoreganj, Madaripur, Manikganj, Narsingdi, Rajbari, Shariatpur, and Tangail. Dhaka is the most populated division of Bangladesh, with 44 million people. This division is surrounded by four major rivers: the Buriganga, the Dhaleshwari, the Shitalakshya, and the Turag.

In situ and remote sensing data were collected from different sources to develop the integrated weighted drought index. In situ meteorological data, i.e., (precipitation) of 11 stations from 2000 to 2022 were obtained from the Bangladesh Meteorological Department (BMD, <http://bmd.gov.bd>). MOD11A2 V6.1 product of Terra Land Surface Temperature (LST), CHIRPS daily rainfall data product at 0.05° resolution, Soil Moisture (SM) data of GLDAS-2.1: Global Land Data Assimilation System and MOD13Q1.006 product of Terra Vegetation Indices (NDVI and EVI) at 16-day global and 250-m resolution were used in this study using Google Earth Engine (GEE) platform.

All the satellite data products were accessed in GEE and then the dataset was filtered for the study area during the periods of 2000-2022 Pre-Kharif (March-May) seasons. Different datasets are available in different spatiotemporal resolutions, which cannot be used directly (Mustafa et al., 2020, 2021). This study's datasets were resampled and projected into homogeneous spatiotemporal resolution using GEE (Kulkarni et al., 2020; Shahzaman et al., 2021). Indices

(i.e., Precipitation Condition Index (PCI), Soil Moisture Condition Index (SMCI), Standardized Precipitation Index (SPI), Vegetation Condition Index (VCI), Temperature Condition Index (TCI), and Vegetation Supply Water Index (VSWI) were executed using JavaScript in Google Earth Engine (GEE) platform. Weight calculation in AHP. Finally, the outputs were analyzed and visualized as figures, graphs, maps, and tables using different tools such as Erdas Imagine (Version), ArcGIS (Version), MS Excel, etc. Fig. 2.2.1 shows the research flowchart.



**Fig. 2.2.1** Agricultural drought determination procedures.  $\omega$  shows the weight of each drought indices, i.e., PCI, SMCI, VCI, TCI, and VSWI

### ***Process of Integrated Weighted Drought Index (IWDI) construction***

The IWDI has been found to have a significant correlation with meteorological and agricultural drought indices, making it a reliable indicator for monitoring agricultural droughts. The integration of different indices, as done in the IWDI, is considered a better option for understanding and monitoring agricultural drought losses. The Integrated Weighted Drought Index (IWDI) is calculated by considering all possible variables relevant to different types of droughts, such as meteorological, agricultural, and soil moisture drought indices. In this study 5 (five) parameters i.e. CHIRPS data as a component from precipitation to calculate PCI, soil moisture & LST as a component from soil to calculate SMCI & TCI, NDVI as a component from vegetation to calculate VCI and EVI & LST as a component from vegetation and soil to calculate VSWI are selected. These inputs are crucial for selecting appropriate drought indicators. Analytical hierarchical process (AHP) is a structured technique, which can be used for establishing and evaluating complicated decisions. By using AHP weights are calculated as follows: PCI (0.14), SMCI (0.25), VCI (0.25), TCI (0.2), and VSWI (0.16).

The IWDI is computed as the weighted average of the

$$IWDI = 0.14PCI + 0.25SMCI + 0.25VCI + 0.2TCI + 0.16VSWI$$

Where: PCI = Precipitation Condition Index

SMCI = Soil Moisture Condition Index

VCI = Vegetation Condition Index

TCI = Temperature Condition Index

VSWI = Vegetation Supply Water Index

## Result and Discussion

### *Drought Trend Based on In-situ SPI*

Precipitation data were derived from monthly rainfall measurements for a period of 22 years (2000–2022). These monthly rainfall data were used to compute the SPI for each station. In situ rainfall data were collected from the Bangladesh Meteorological Department (BMD). In the study area, the number of rainfall stations between 2000 and 2006 was 5, from 2007 to 2017 the number of these stations had increased and reached 11 in 2018. The SPI is an index normally calculated based on selected periods (typically 1, 2, 3, 6, 9, 12, 24, and 48 months of total precipitation) and indicates how the precipitation for a specific period compares with the complete record (possibly 25 or 50 or 100 years) at a given station. SPI at different time scales, e.g. 1- or 3-month SPI of a particular month represents a deviation in precipitation totals for the same month and current plus the previous two months, respectively. Positive values indicate greater than mean precipitation and negative values indicate less than mean precipitation.

The 3-month SPI was calculated for 11 rainfall stations using monthly rainfall data of the pre-kharif season (March-May) from 2000 to 2022. The SPI data shows significant variability in precipitation across the 11 weather stations indicating both dry and wet periods. Notable drought years include 2007 and 2014 when several stations showed extended dry spells. Faridpur recorded the highest number of dry events.

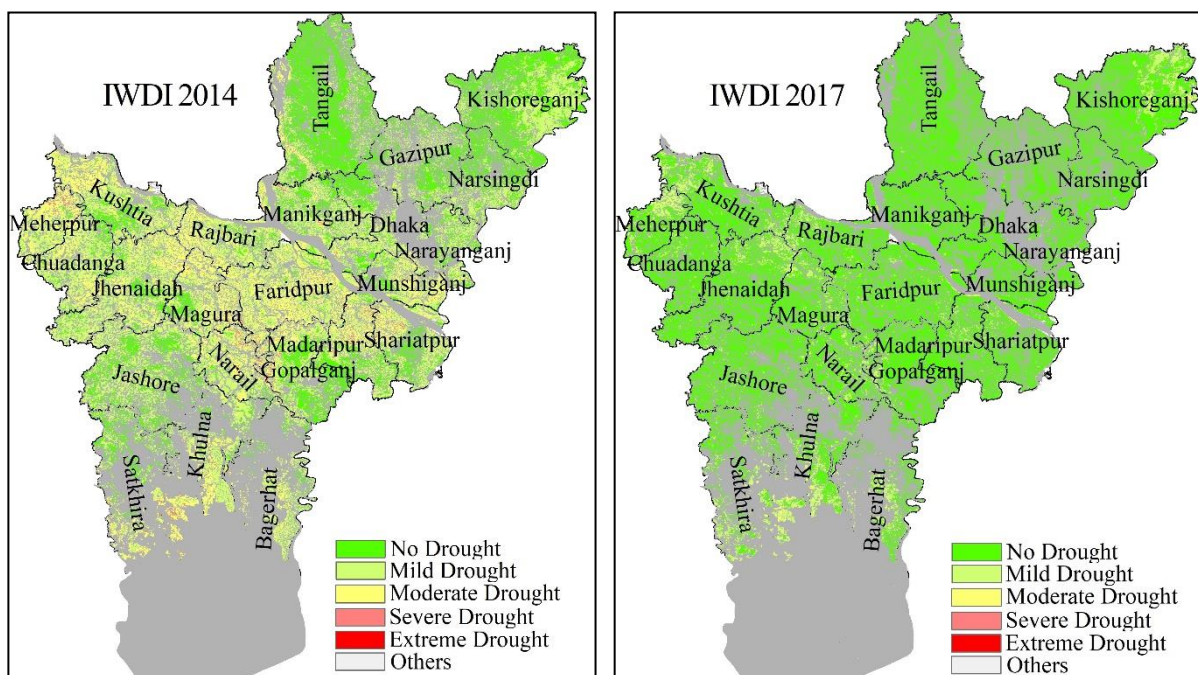
### *Drought Trend Based on IWDI*

To enumerate the drought stages, this study used the following interval to define the range of IWDI classification levels (Table 2.2.1).

Table 2.2.1 Classification of drought categories based on the value of the IWDI

IWDI Value	Drought Severity
>1.0	No drought
1.0–0.8	Mild drought
0.8–0.6	Moderate drought
0.6–0.4	Severe drought
<0.4	Extreme drought

PCI, SMCI, VCI, TCI, and VSWI maps were produced. By using these indices IWDI were produced from 2000 to 2022, providing a comprehensive temporal and spatial analysis of drought conditions (Fig. 2.2.2). The maps focus on the region encompassing Dhaka and Khulna division, using a color-coded scale ranging from red (<0.4, indicating extreme drought), medium coral light (0.6-0.4, indicating severe drought), yellow (0.8-0.6, indicating moderate drought), Lemongrass (1.0-0.8, indicating mild drought) and leaf green (>1.0 no drought). From 2000 to 2022, the drought patterns across different districts, as indicated by IWDI data, reveal significant fluctuations in the severity and extent of droughts. Using the Integrated Weighted Drought Index (IWDI), we found that in a dry year like 2014, about 70 percent of total agricultural land was affected by mild to moderate drought, whereas in wet years, such as 2017, most agricultural land exhibited no drought conditions, with only 10 percent experiencing mild drought.



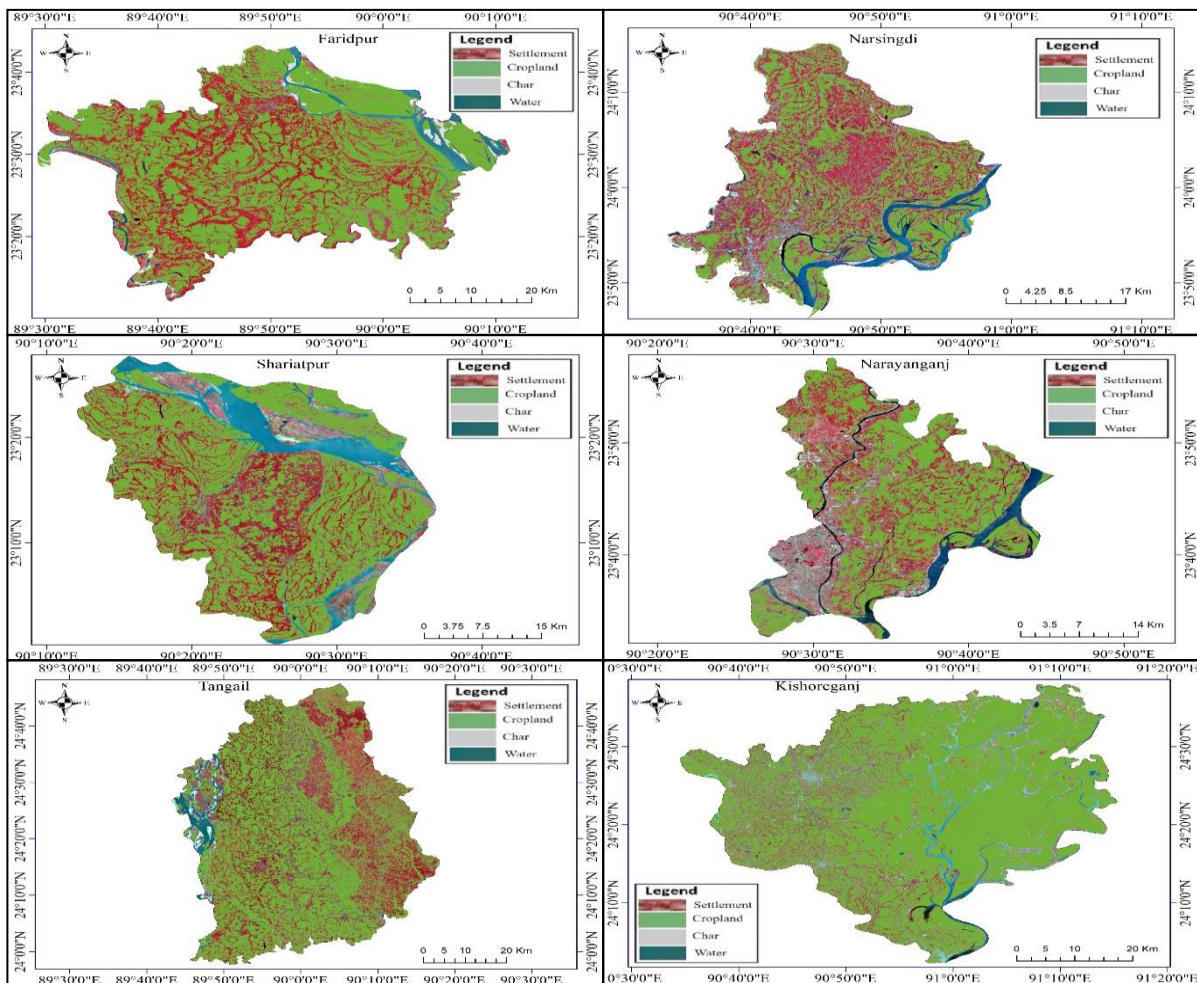
**Fig. 2.2.2** Spatial distribution of pre-kharif Integrated Weighted Drought Index (IWDI) in a dry Year (2014) (left) and a wet year (2017) (right) over the study area

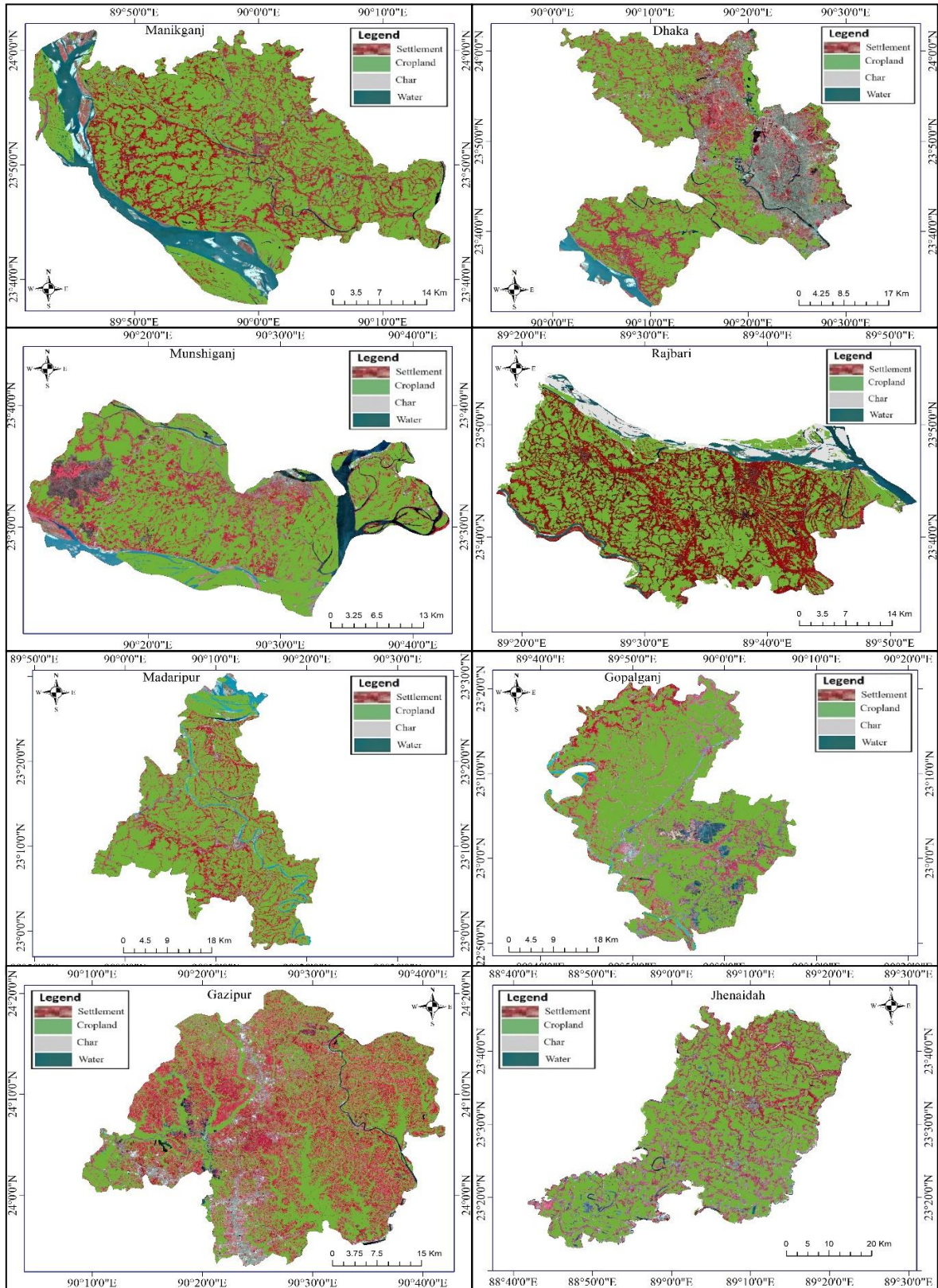
### ***Cropland Layer***

The cropland layer represents a binary map legend of crop/non-crop that highlights the separation between annual cropland and non-cropland areas. Cropland layers have been created for 23 districts of Dhaka and Khulna division. To create cropland layer upazila-wise high resolution (0.5m) georeferenced Google Earth Image was downloaded using Tile+ plugins of QGIS. After that multi-resolution segmentation algorithm of eCognition software was used to develop image objects using Google Earth Image (Fig. 2.2.3 a, b, c). The algorithm uses three parameters: scale, shape weighting, and compactness weighting. Segmentation parameters were determined through a combination of trial and error, and experience. Parameters used in this

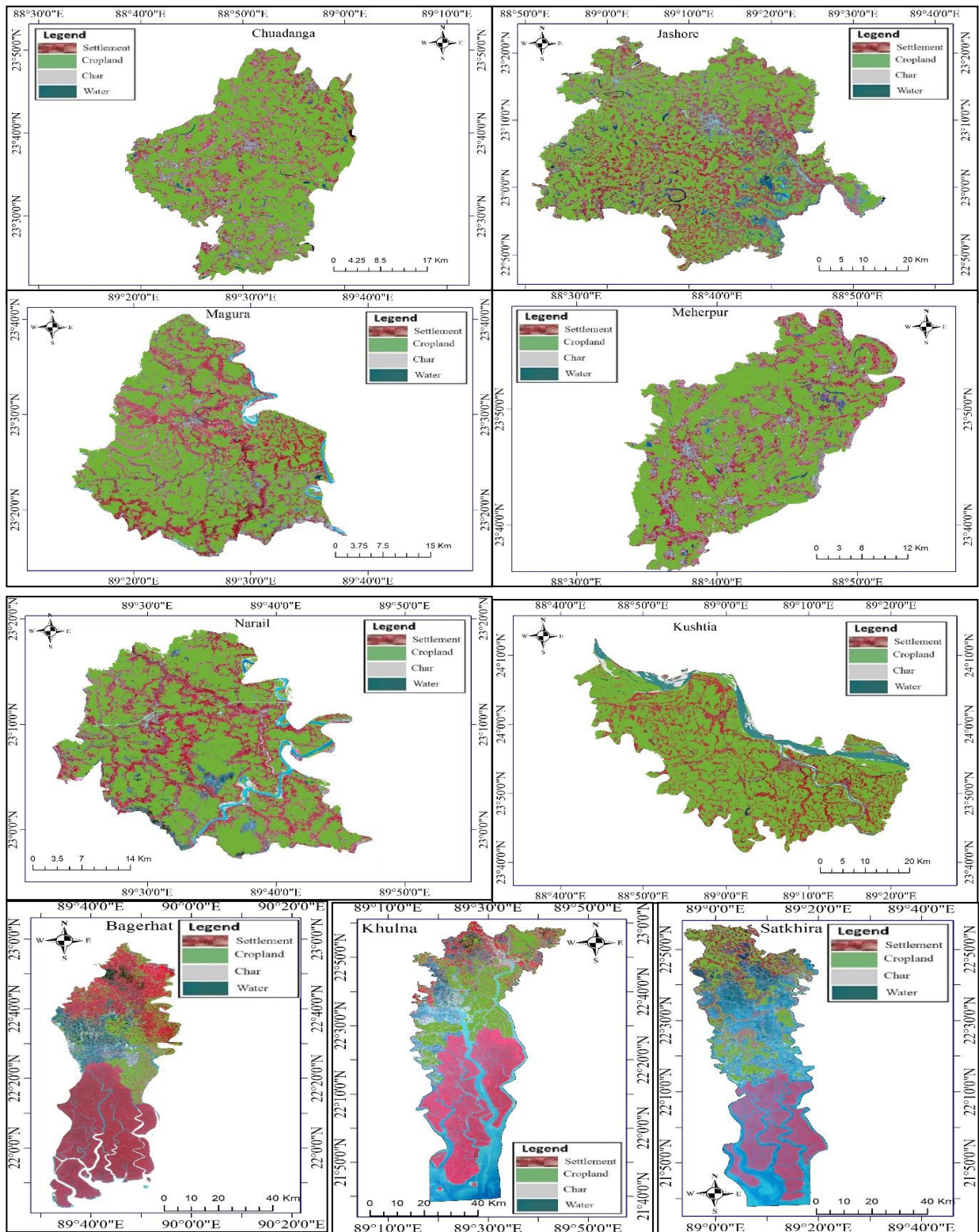
study were scale parameter: 50, shape weighting: 0.6, compactness weighting: 0.7. Since Google Earth provides archive imagery in many places, it is not possible to create a cropland layer of the current time using only Google Earth Image. So, to identify the objects, the Sentinel-2 image of the period from Jan'23 to Mar'23 has been used along with Google Earth Image. If an object represents cropland in Google Earth Image but non-cropland in Sentinel-2 image that object is assigned to the non-cropland class. Each object was manually identified using ArcGIS. In the case of mixed object cut polygon feature of ArcGIS was used to separate cropland from non-cropland.

**Fig. 2.2.3a** Spatial distribution of cropland layer in Dhaka division (continued)





**Fig. 2.2.3b** Spatial distribution of cropland layer in Dhaka division (continued).



**Fig 2.2.3c** Spatial distribution of cropland layer in Khulna division

## **Conclusions**

To generate an updated high-resolution cropland layer for Dhaka district, WorldView-2 (WV02) and WorldView-3 (WV03) satellite images of Dhaka for the 2023-2024 years were purchased from Maxar. By using these images, the cropland layer of the Dhaka district was generated. For the remaining 22 districts of Dhaka and Jessore divisions, Google Earth and Sentinel-2 were utilized to generate the cropland layer. These cropland layers are expected to enhance the accuracy of crop monitoring in the future.

## **2.3 Forestry Division**

### **Research title: Mapping Tree Covers in Bangladesh**

#### **Introduction**

Trees are important as they provide numerous goods and services to society. Tree resources in many countries are changing because of natural and man-made interventions. It is important to monitor tree resources in a country over time. Earlier efforts for preparing country-scale forest cover maps in Bangladesh used visual interpretation and on-screen digitizing techniques, satellite image segmentation, etc., which are time-consuming. The current effort is dedicated to generating tree cover maps and statistics using automated digital classification techniques that will ease the preparation of tree cover maps on a country scale, spending less time and resources. The objectives of this study are (a) to develop a methodology for mapping forests and tree covers with Landsat data using a pixel-based classification approach and (b) to prepare tree cover maps for entire Bangladesh using Landsat-8/9 data. The country has different types of forests, Hill Forest, Sal Forest, Sundarbans Mangrove, Coastal Plantation, Trees Outside Forests (TOF), etc.

#### **Research Methodology**

Landsat-8 Operational Land Imager (OLI)/ Landsat-9 Operational Land Imager-2 (OLI-2) level 1 terrain-corrected data (L1T) for 2022-2024 were downloaded from the United States Geological Survey (USGS) archive. Images were pre-processed in the steps including (1) image resampling, (2) cloud/shadow/water screening and quality assessment (QA), (3) conversion of raw digital numbers (DN) to top of atmosphere (TOA) reflectance and (4) atmospheric correction. The Landsat images were classified using the guided clustering technique which is a hybrid classification. This classification technique is particularly useful where a complex variability in spectral response is present for individual cover types (Lillesand et al., 2015). The training samples were collected from all the major spectral sub-classes, completed the classification with a guided clustering process, and later spectral subclasses were merged into the original land cover classes. Several classification algorithms including the maximum likelihood classification, minimum distance classification, and machine learning techniques, like random forests (a decision trees algorithm, Breiman et al., 1984) were considered to map forest, bamboo or shrub cover, cropland, water-bodies, and other land to non-forest class. The generation of tree cover maps during the 2023-2024 financial year was implemented for Landsat scenes 138-042,

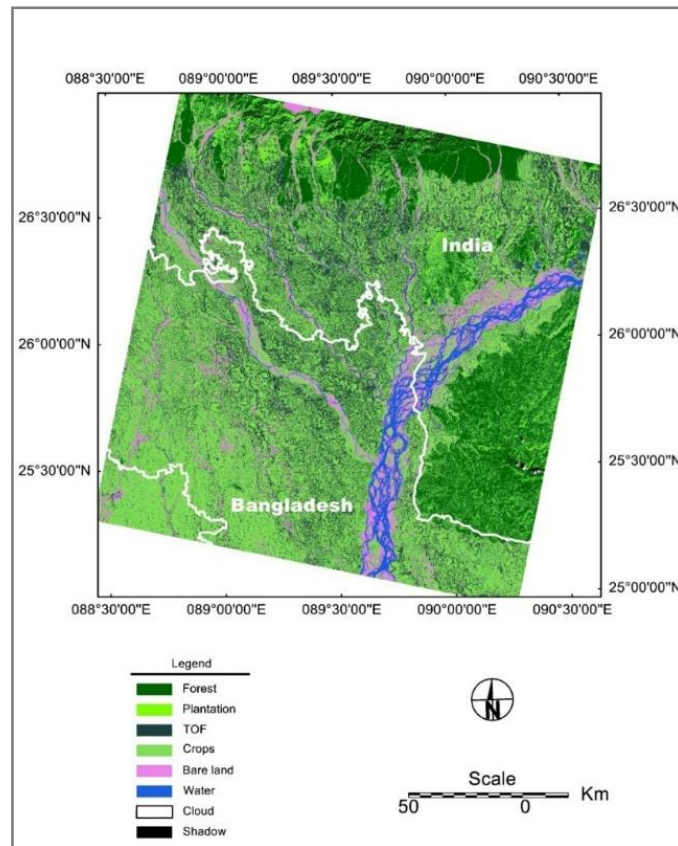
138-043, and 138-043. All the scenes covered the western part of the country and part of the scenes belonged to outside Bangladesh.

## **Results and Discussion**

The Landsat scene 138-042 covered the entire Kurigram, Lalmonihat, Nilphamari, and Rangpur districts, and most parts of Gaibandha, Sherpur Dinajpur districts. Among different classification techniques, the Min Distance Classification technique was finally selected to apply to this image. Tree height data of 2019 developed by the University of Maryland (Potapov et al., 2020) was also included in the classification process. Different classes like forest, plantation, Trees Outside Forests (TOFs), crops, bare land (near the riverside and other areas), and water (dark and blue; appeared in 6 5, and 4 band combinations in a Landsat scene) were selected.

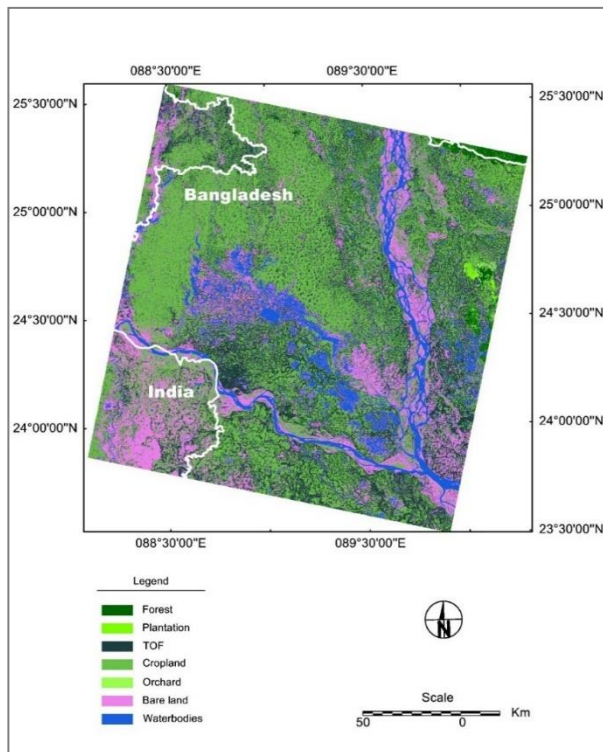
Finally, the following land use and land cover classes: forest, plantation, TOF, cropland, bare land, water, cloud, and shadow were considered as the final class. The classification result was visually checked and found that the class, TOF was better identified on the University of Maryland tree height database. So, TOF derived in this database was superimposed on our classification results except in some places, including the rivers and the adjacent areas where recent changes were visible and the forest areas where the forest class should be kept as forest.

Landsat image of 138-043 (Fig. 2.3.1) frame acquired in 01 November 2023 was used in classification. The area includes Sherpur, Bogra, Joypurhat, Naogaon, Rajshahi, Natore, Shirajganj, and Pabna districts and most of Jamalpur, Tangail, and Gaibandha districts. The Minimum Distance Classification algorithm was applied to separate Sal forest, plantations, rubber plantations, TOF, crops, bare soil, and water. In this scene, three types of crops, two types of bare soil, and two types of water were identified, and these were later merged into the appropriate classes like cropland, bare land, and water classes.

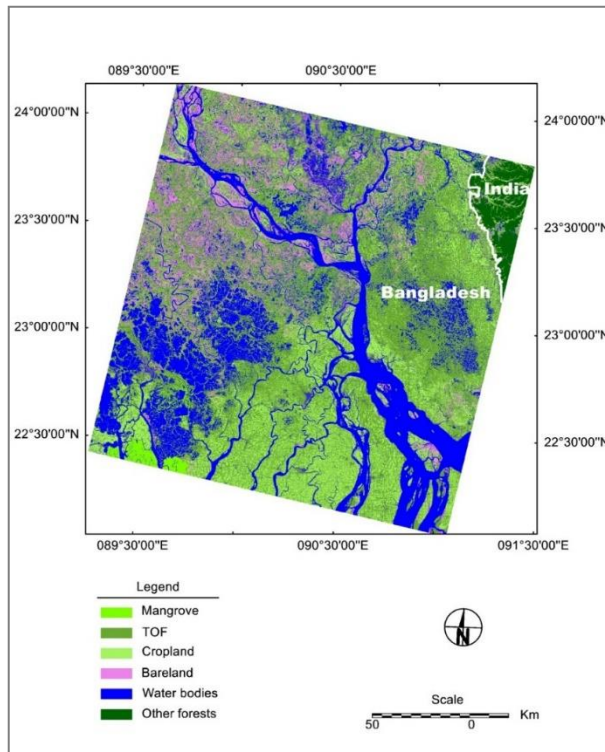


**Fig. 2.3.1** Tree cover map of Landsat scene 138-042

During the classification of 137-044 Landsat scene, two Landsat images acquired in February (03 February 2023) and November (26 November 2023) were tested. Finally, the November scene was selected for classification. In the guided clustering technique, the following classes were identified on the Landsat scene: mangrove bight mangrove dark, TOF, other forests (mostly located outside Bangladesh), crops, dry bare soil, inundated cropland, shrimp farms, and water. These classes were later merged into mangroves, other forests, TOF, cropland, bare land, waterbodies, and other forests. A maximum likelihood classification algorithm was applied in the classification procedure.



**Fig. 2.3.2** Tree cover map of Landsat scene 138-043



**Fig 2.3.3** Tree cover map of Landsat scene 137-044

## Conclusions

Within the pilot study in 2022-2023, the mapping of the three Landsat scenes, 136-043, 137-043, and 137-045 were completed. In this financial year (2023-2024), the maps from three Landsat frames, 137-044 (Fig. 2.3.3), 137-042, and 137-043 were finalized. Within the next financial year, the classification of all the remaining scenes should be completed. All these remaining scenes usually covered some parts of Bangladesh. Most of these scenes cover a major part of outside Bangladesh belonging to India, Myanmar, and the Bay of Bengal.

## 2.4 Water Resource Division

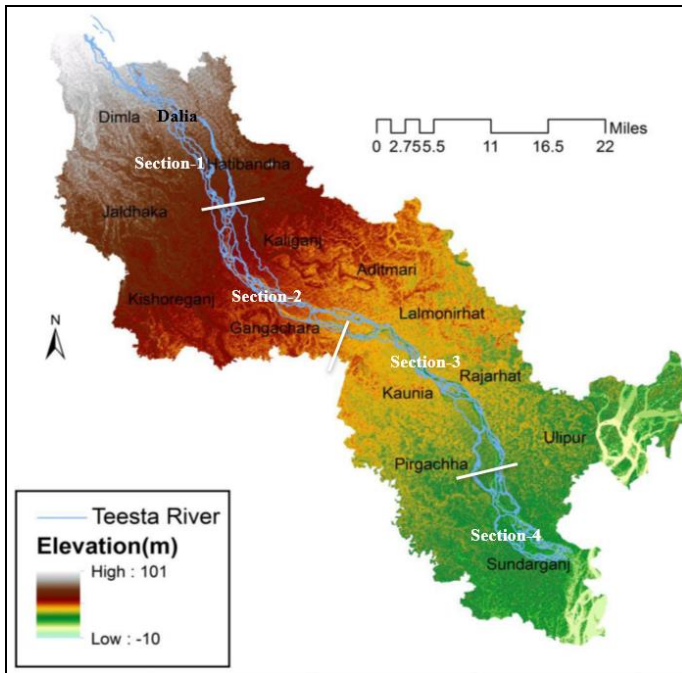
### Research title: Bank-line Shifting and Sand Bar Dynamics of the Teesta River Using Multi-Temporal Satellite Images

#### Introduction

Bangladesh is the second biggest deltaic floodplain in the world having a complex network of 907 rivers in the country including 57 transboundary rivers. One of the main transboundary rivers, Teesta, flows through the five districts of Rangpur, Lalmonirhat, Nilphamari, Kurigram, and Gaibandha. India has built a barrage at "Gagoldoba," a few kilometers upstream of the

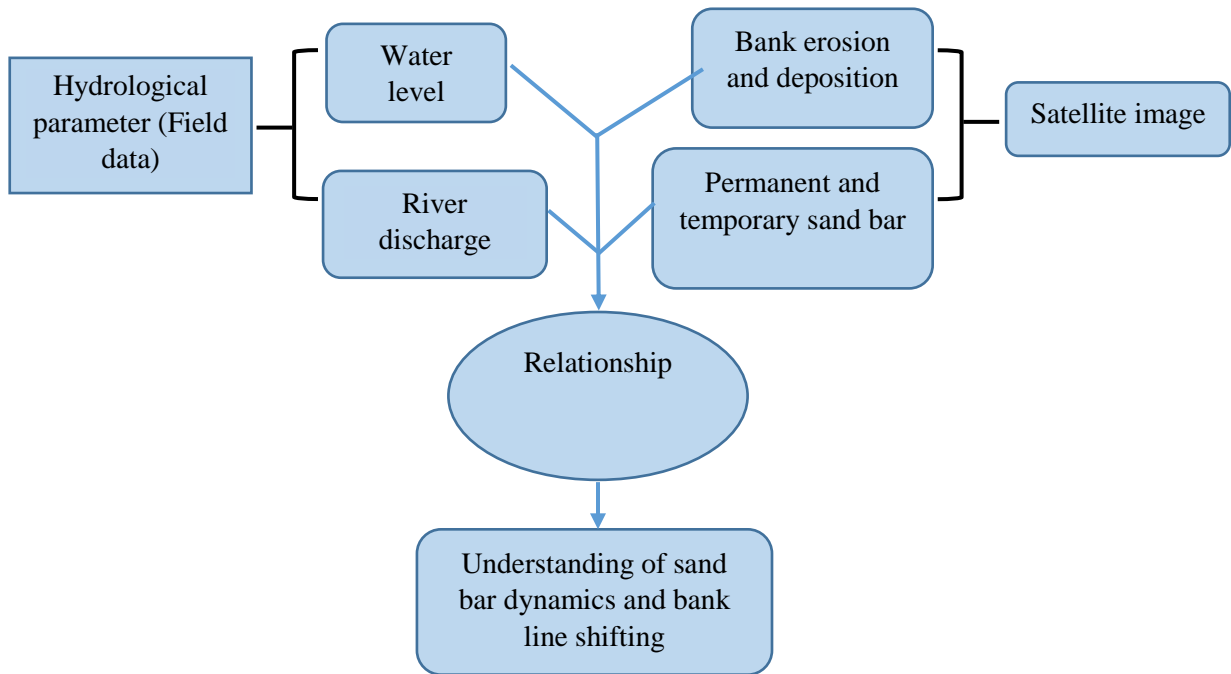
Bangladeshi border and Bangladesh Water Development Board (BWDB) has built Teesta Barrage between 1979 and 1998 to supply water for agriculture. These interventions badly impact the natural flow of water. Interruption in the natural water flow may impact the erosion-deposition characteristics of the river which may cause the sand bar dynamics and bank-line shifting as well.

### Research Methodology



**Fig. 2.4.1** Map of study area

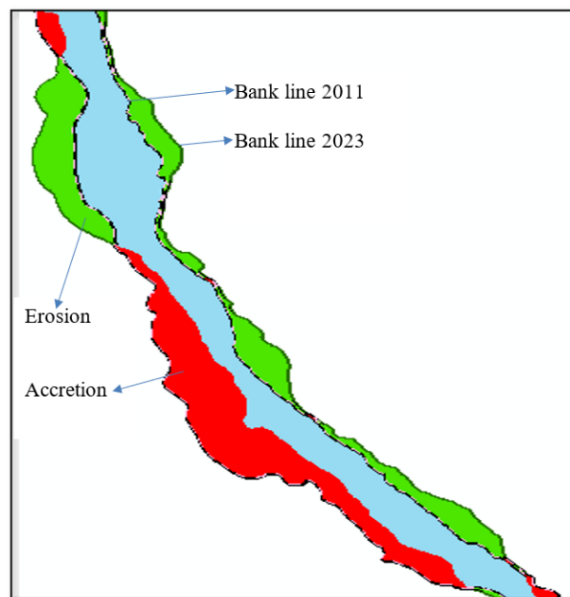
- The river has been separated into 4 sections.
- Sandbars have been categorized as temporary and permanent sandbars.
- Landsat Program satellite data are used from November to December of each year.
- River discharge and water level data from Bangladesh Water Development Board were used to find the relation of river bank shifting and sand bar dynamics with the hydrological



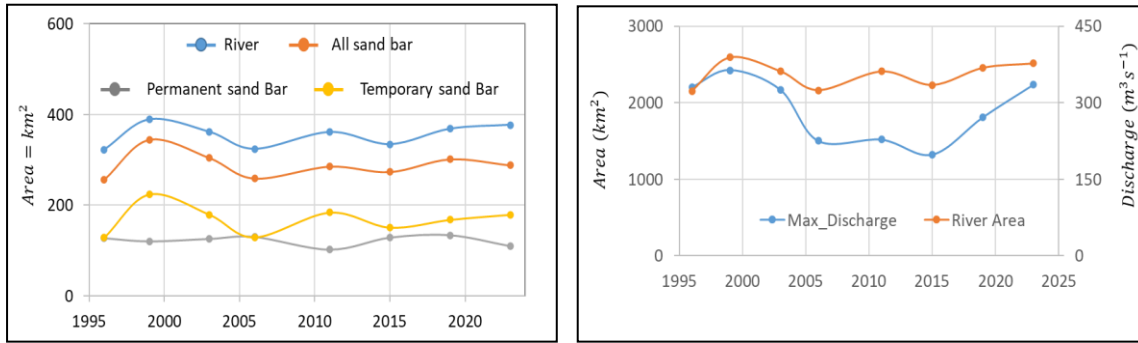
**Fig. 2.4.2** Flow diagram of the study

## Results and Discussion

To get the fundamentals of the analysis and relevancy of management of water resources the correlation between the hydraulic and hydrologic data was calculated from the collected and extracted data for the whole study period. Riverbank lines for different years and its adjacent accretion and erosion were analyzed (Fig. 2.4.3).

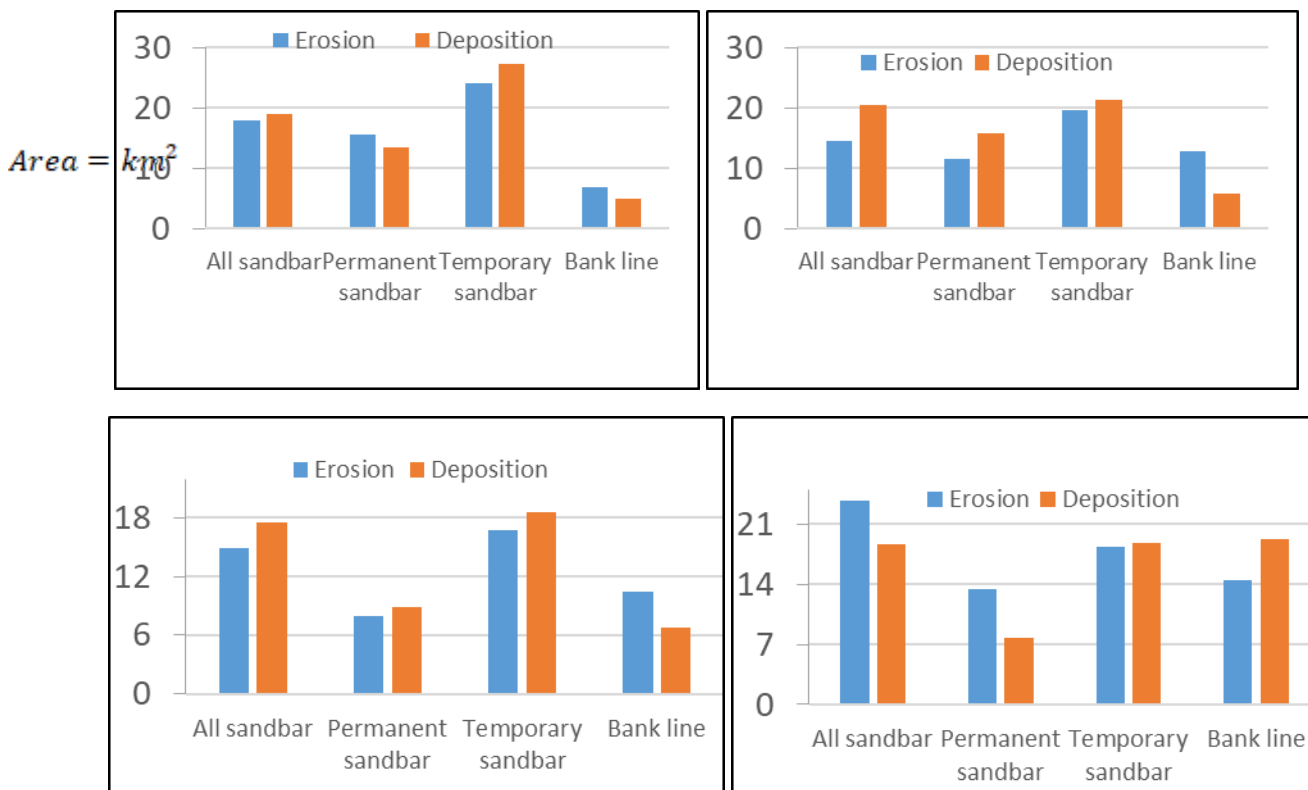


**Fig. 2.4.3** A schematic diagram showing how shifting of the riverbanks from 2011 to 2023 was computed



**Fig. 2.4.4** Changes in the river bank and sand bar during the study period (left). Changes in the river area with the maximum discharge (right).

The present study found that the river area was largely modulated by the all-sand bar area and especially by the temporary sand bar area (Fig. 2.4.4). So, the increase of temporary sand bars increases the river area. Moreover, the river area was found to increase after the large monsoon discharge. So, the higher discharge during the monsoon season may be responsible for the larger sand bar and river area.



**Fig. 2.4.5** Changes in the river bank and sand bar in four different sections during the study period

Among the four sections, deposition is large in the section first in the temporary sand bars whereas erosion is large in the permanent sand bar in the fourth section (Fig. 2.4.5). Deposition

in large in the second and third section for both temporary and permanent sand bars. For the bank-line, only in the fourth section deposition is large otherwise erosion is large.

## **Conclusions**

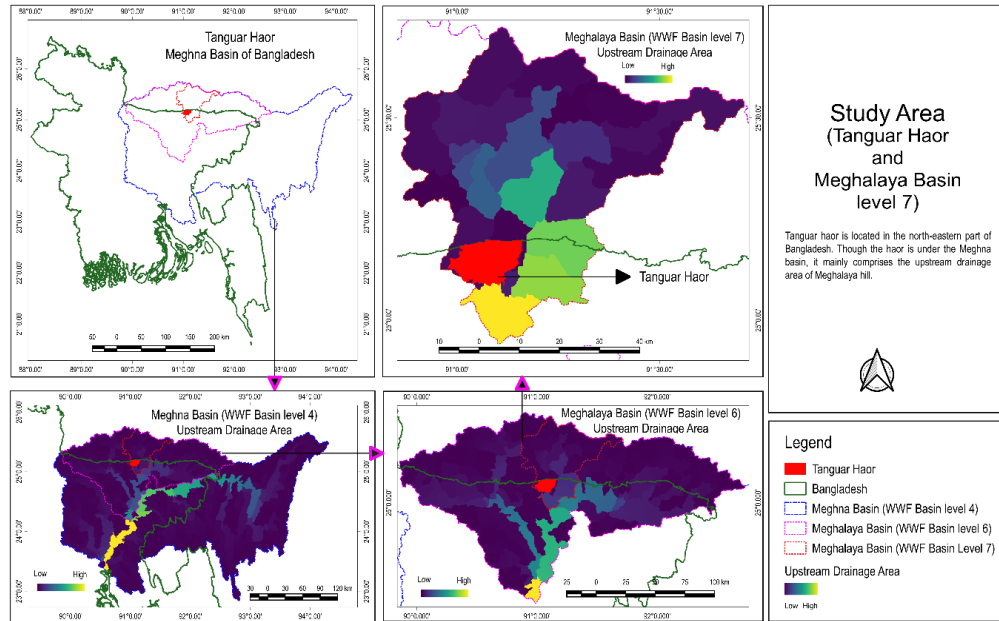
Multi-temporal satellite image was used to detect the change of bank line and sandbar with respect to water level and discharge. The present study found that the inter-annual variation of the river area strongly followed the inter-annual variation of all sand bar areas ( $r=0.89$ ) and temporary sand bar area ( $0.93$ ) which indicated that an increase of the temporary sand bar area increased the river area and vice versa. An opposite relationship was found for the temporary sand bar and bank line. Higher deposition (erosion) in the temporary sand bar lowers the deposition (erosion) in the bank line ( $r=0.98$ ). During the study period, erosion is found dominant in the bank line and deposition is dominant in the temporary sand bar area. Deposition is large in the lower right section and erosion is large in the mid and lower left section of the Teesta River. The area of the river and sand bar area is largely modulated by the maximum discharge of the river.

## **2.5 Fisheries Division**

### **A. Research title: Flash flood monitoring in Tanguar haor: a hydro-meteorological approach**

#### **Introduction**

Disasters, both natural and human-made, are a global issue (Adjei-Darko 2017). Climate and land-use changes are key drivers of increased weather extremes, disproportionately impacting vulnerable nations (Chowdhury 2024; Talukdar 2022). Meteorological hazards account for 78% of global financial losses and 38% of disaster-related deaths, with their frequency rising threefold over the past 35 years due to climate change (Hoeppel 2015). These hazards impact poor populations more severely, particularly in developing countries like Bangladesh, where over one billion people reside in flood-prone areas, a number expected to double by 2050 (UNU 2018).



**Fig. 2.5.1** Study area map

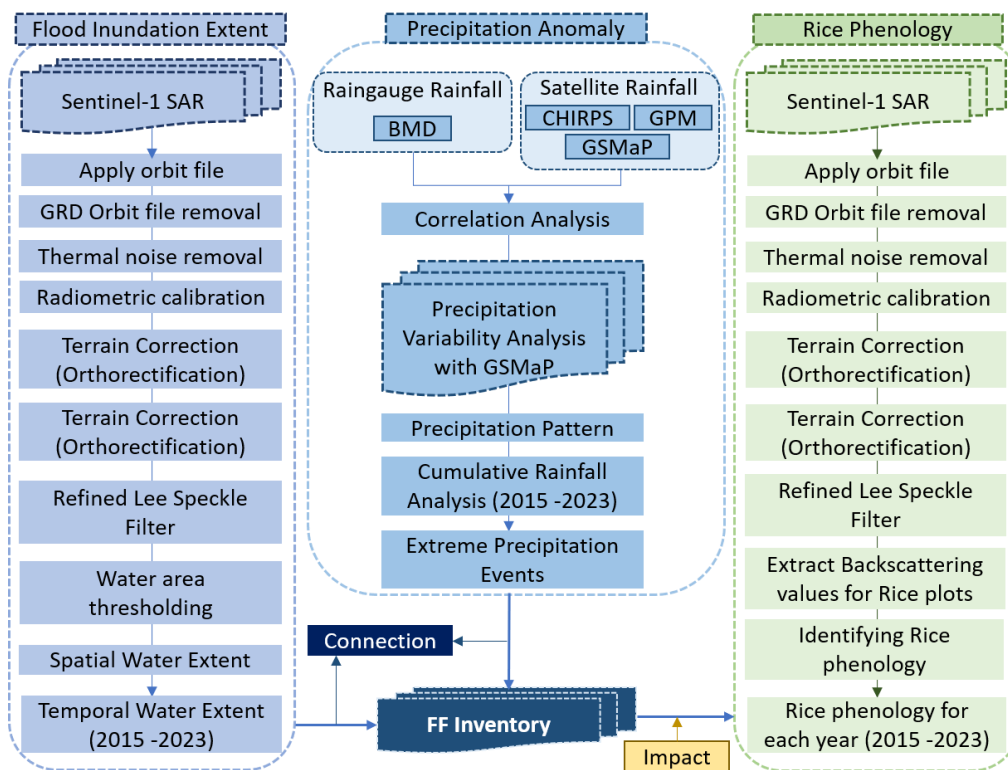
Tanguar Haor, one of the largest freshwater wetlands, is particularly vulnerable. Flash floods not only damage agriculture but also disrupt the ecosystem (Carreno & De Marta, 2019). Such floods are influenced by precipitation, topography, and soil characteristics (Dey et al., 2021). Human activities such as deforestation, unplanned infrastructure, and the effects of climate change have intensified these floods in recent years (Dey et al., 2021).

Understanding the causes of flash floods and the interplay between land use and hydro-meteorological patterns is essential for mitigation. Remote sensing (RS) technology, which monitors earth dynamics at various scales, is a powerful tool for disaster management (Uddin et al., 2019). Several studies have used RS to assess flood impacts on agriculture, particularly Boro rice, in Bangladesh (Ahmed et al., 2017; Uddin et al., 2019). Socio-economic factors, riverbed siltation, and infrastructure also affect rice production in these areas (Akter et al., 2022).

The study aims to monitor flash floods in Tanguar Haor. Specific objectives are a) to identify flash flood events using Sentinel-1 SAR data from 2015 to 2023, b) to analyze the hydro-meteorological patterns in the Meghalaya-Tanguar Haor watershed from 2015 to 2023, and c) to examine the link between flash floods, hydro-meteorological patterns, and agricultural impacts.

### Research Methodology

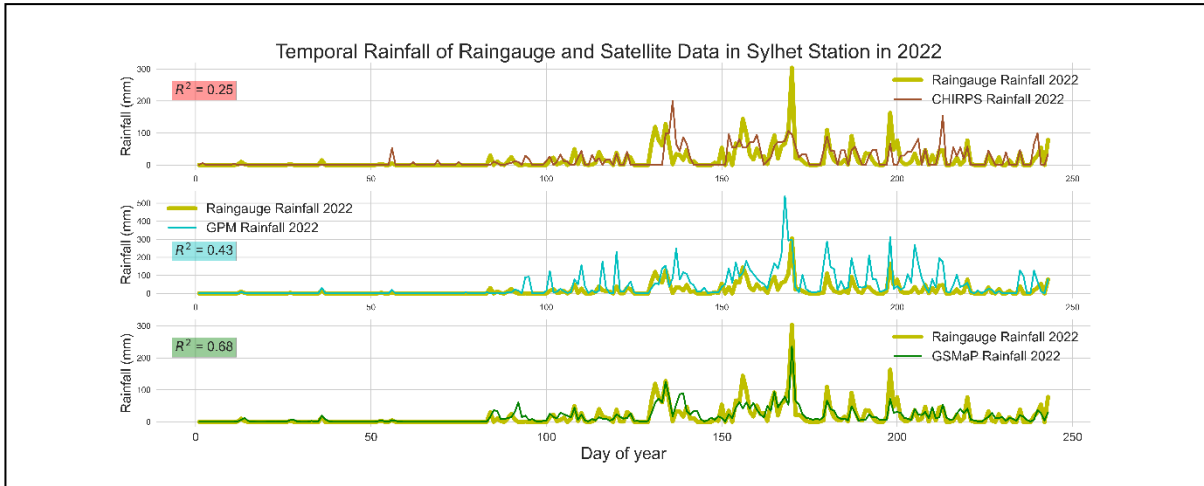
This research has been conducted following the flowchart mentioned in Fig 2.5.2. Various geospatial data have been utilized for conducting this research (Table 2.5.1).



**Fig. 2.5.2** Methodological flowchart.

Table 2.5.1 Geospatial data utilized in this research

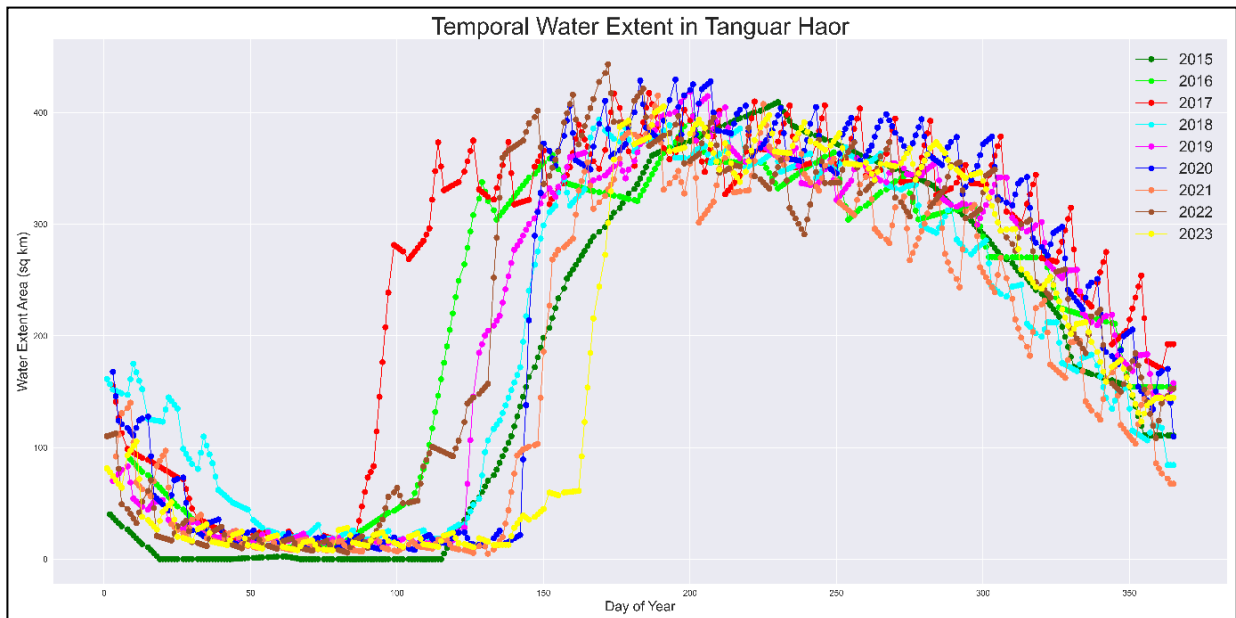
Data			Sources
Shuttle Radar Topography Mission (SRTM)			<a href="https://www.earthdata.nasa.gov/sensors/srtm">https://www.earthdata.nasa.gov/sensors/srtm</a>
Sentinel-1 SAR			<a href="https://sentiwiki.copernicus.eu/web/s1-applications">https://sentiwiki.copernicus.eu/web/s1-applications</a>
Raingauge Rainfall			Bangladesh Meteorological Department (BMD)
Climate Precipitation with Station data (CHIRPS)	Hazards Group	InfraRed	<a href="https://www.chc.ucsb.edu/data/chirps">https://www.chc.ucsb.edu/data/chirps</a>
Global Precipitation Measurement (GPM)			<a href="https://gpm.nasa.gov/missions/GPM">https://gpm.nasa.gov/missions/GPM</a>
Global Satellite Mapping of Precipitation (GSMaP)			<a href="https://developers.google.com/earth-engine/datasets/catalog/JAXA_GPM_L3_GSMaP_v6_operational">https://developers.google.com/earth-engine/datasets/catalog/JAXA_GPM_L3_GSMaP_v6_operational</a>



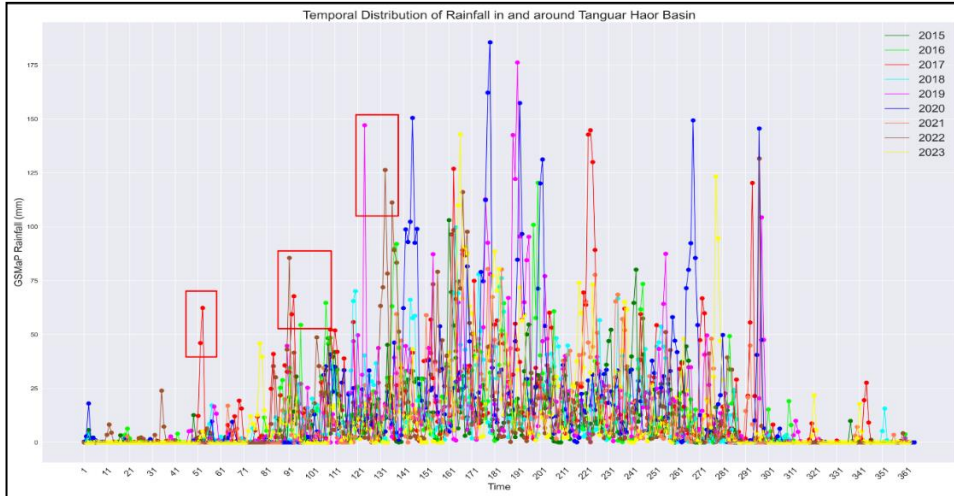
**Fig. 2.5.3** Temporal rainfall of rain gauge in Sylhet station and satellite data in 2022.

## Results and Discussion

Fig 2.5.4 demonstrates the variations in water extent in Tanguar Haor, highlighting differences and trends over the years. Fig 2.5.5 shows the temporal distribution of rainfall in the Meghalaya-Tanguar basin over several years (2015-2023). There is a clear seasonality in the rainfall pattern, with the majority of rainfall occurring during the monsoon season (middle of the year), causing inundation in the haor basin every year. Rainfall tapers off towards the post-monsoon season (October to December), returning to lower values.

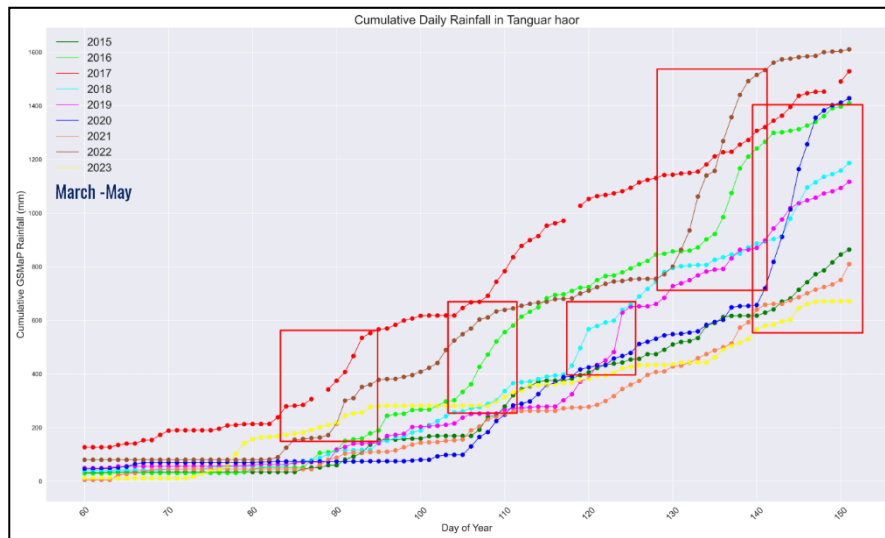


**Fig. 2.5.4** Variation of water extent in each year from 2015 to 2023 in Tanguar haor



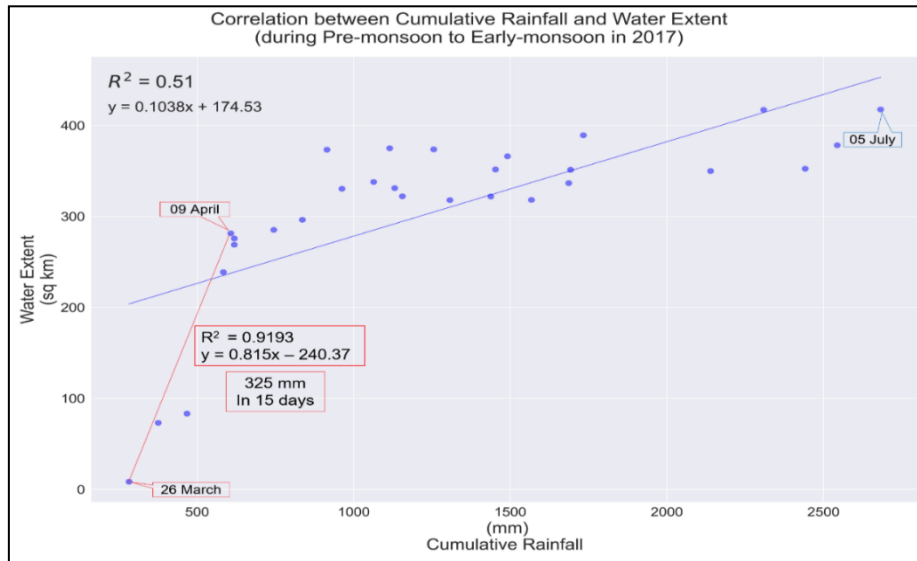
**Fig. 2.5.5** Temporal variability of daily rainfall in the Meghalaya-Tanguar basin from 2015 to 2023

Fig. 2.5.6 focuses on the seasonal variability and irregular patterns of pre-monsoon rainfall. Notably, there are some unusual increases in cumulative rainfall in 2016, 2017, 2019, and 2020. In 2017, the red line indicates sudden rises in cumulative rainfall shortly after day 90 and day 107, which are unusual and harmful, as the Boro rice in the Haor basin is still in its growth stages.

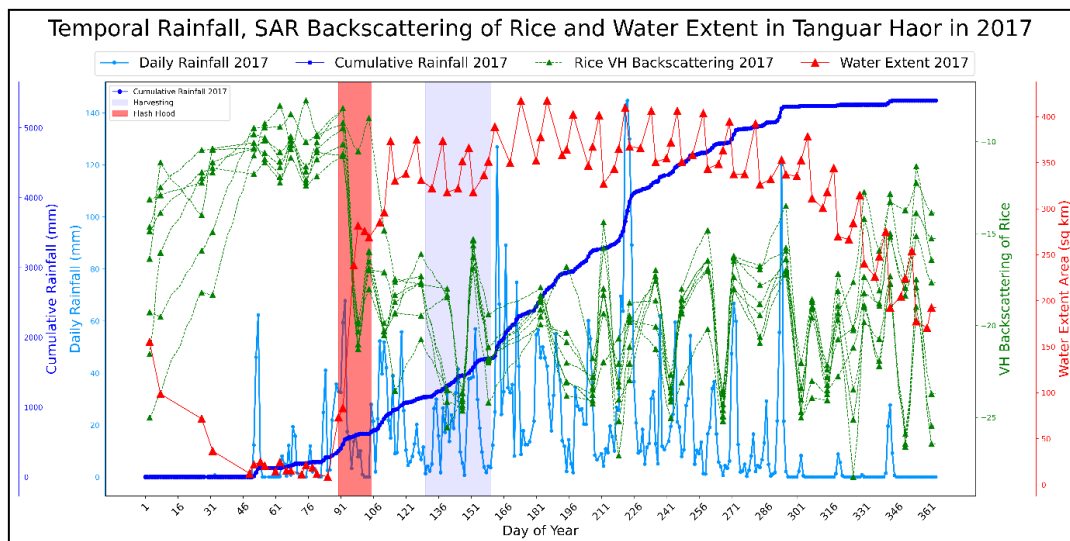


**Fig. 2.5.6** Cumulative daily rainfall of GSMaP in the Meghalaya-Tanguar basin during pre-monsoon

The scatter plot illustrates the relationship between cumulative rainfall and water extent in Tanguar Haor during the pre-monsoon to early-monsoon season of 2017, showing both the overall trend and specific period of rapid change (Fig. 2.5.7). In the red-shaded areas, the VH backscattering values of Boro rice sharply decrease, reflecting the impact of flash floods on rice growth stages, which were expected to decline during the harvesting period shown in the light blue shaded areas (Fig. 2.5.8).



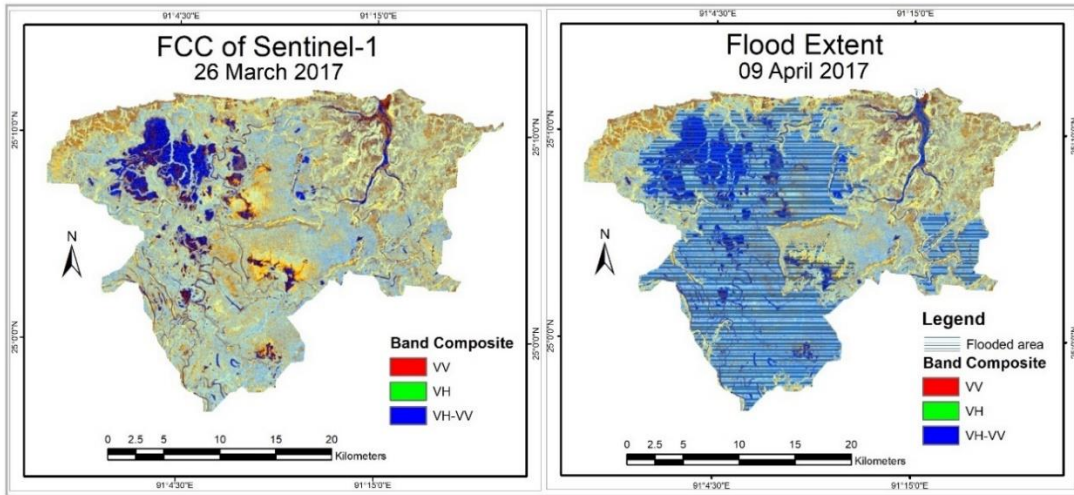
**Fig. 2.5.7** Correlation between cumulative rainfall and water extent in Tanguar Haor during the pre-monsoon to early-monsoon season of 2017



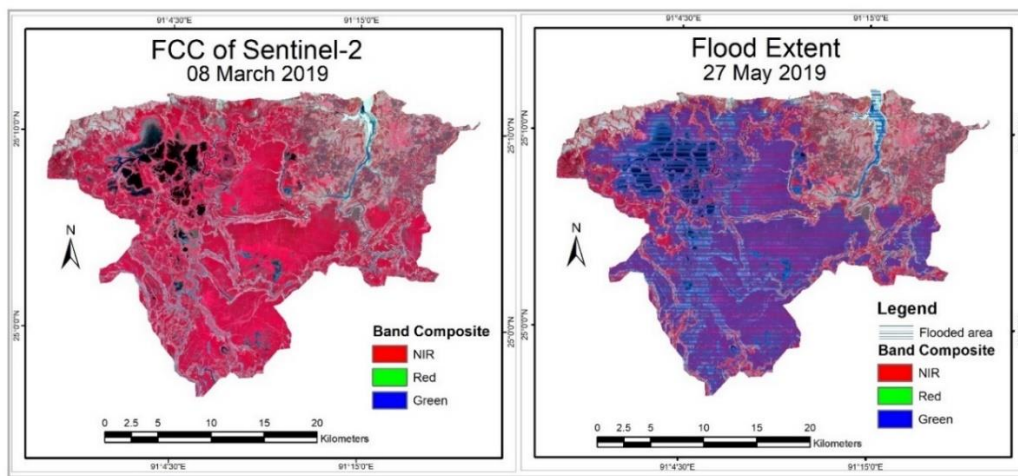
**Fig. 2.5.8** Temporal rainfall, SAR backscattering of rice and water extent in Tanguar haor in 2017

In 2017, farmers experienced a dangerous flash flood from late March to early May. The flood extent map shows the comparatively lower flooded area on 09 April 2017 (Fig. 2.5.9) but it was the most harmful flash flood in recent years since the boro rice didn't reach its ripening/harvesting phase. This FFC (false color composite) image from Sentinel-2, taken on March 8, 2019, shows a dominant bright red color, which represents boro rice with high biomass (Fig. 2.5.10). Red likely represents vegetation, as healthy vegetation reflects near-infrared light

which is displayed in red in a false-color image. This boro rice used to be harvested at the end of May.



**Fig 2.5.9** Flash flooding over the Tanguar basin dominated with Boro cultivation in 2017



**Fig 2.5.10** Flash flooding over the Tanguar basin dominated with Boro cultivation in 2019

## Conclusions

This study sheds light on the intricate spatiotemporal dynamics of flash floods in Tanguar haor, and their strong correlation with precipitation variability from 2015 to 2023. The analysis of this study reveals that water extent in Tanguar Haor experiences rapid increases during the pre-monsoon season, peaks in the monsoon, and declines towards the year's end utilizing Sentinel-1 SAR imagery in the Google Earth Engine (GEE) platform. The exceptional rainfall patterns detected by the Global Satellite Mapping of Precipitation (GSMaP) data, particularly over the Meghalaya-Tanguar basin, underscore the erratic nature of rainfall distributions, with early monsoon rains in some years triggering flash floods. Notably, early pre-monsoon peaks in water extent induced by erratic rainfall over the Meghalaya-Tanguar basin, observed in years like 2016, 2017, 2019, and 2022, resulted in severe agricultural damage. For instance, in 2017, a

rapid rise in water extent was linked to a 325 mm increase in cumulative rainfall within 15 days which particularly destroyed Boro cultivation.

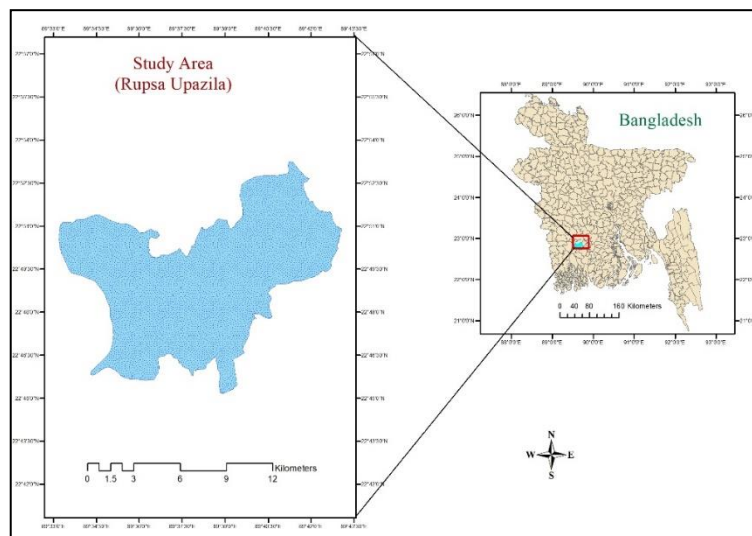
## **B. Research title: Inventory of Water Bodies for Fisheries Resources by Using High Resolution Satellite Sensor Data**

### **Introduction**

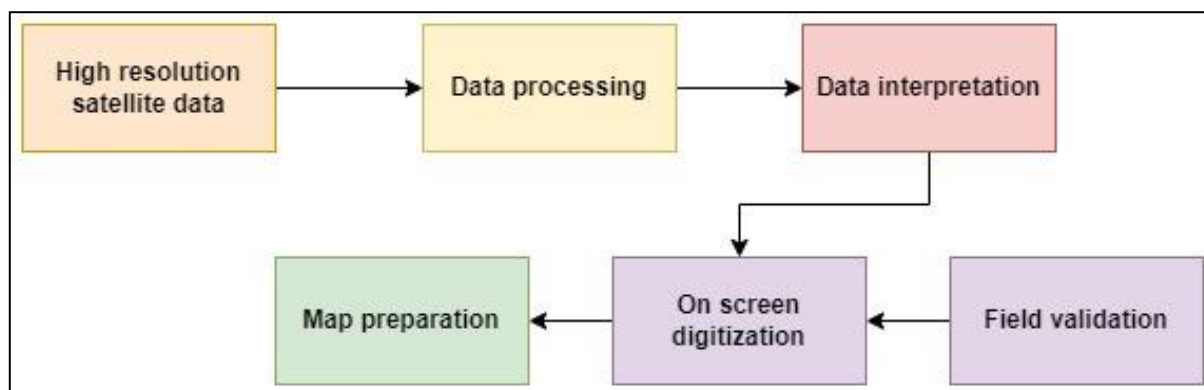
Water coverage on land surface is a crucial part of the water cycle and mapping of waterbodies by interpreting satellite imagery has increased significantly. The surface water of the earth's planet is used for transportation, irrigation, fishing, and other human activities. Human intervention can alter the water level of the earth's surface (Li et al., 2015). The monitoring of water bodies plays a vital role in sustainably using water resources. For this purpose, remote sensing is an excellent tool for surface water management as it can identify and prepare surface water mapping. (Vaibhav et al., 2021). The objectives of this study are to identify different types of inland waterbodies and to map Mapping of different types of waterbodies.

### **Research Methodology**

The selected study area is crucial for the fisheries sector as it covers both open as well as closed-water fisheries resources under aquaculture (Fig. 2.5.11). In addition to this, the targeted area contains both freshwater and coastal water which is the positive parameter of being rich in aquatic biodiversity and a source of protein for Bangladeshi people. Considering the importance of fisheries resources, we selected this area as the area of interest for this study. To achieve the objectives of the study, high-resolution satellite sensor data (world view-3) was used. On-screen digitization was done to identify all types of water bodies. The specification of the data is given below.



**Fig. 2.5.11** Location of the study area



**Fig. 2.5.12** Methodology of the study

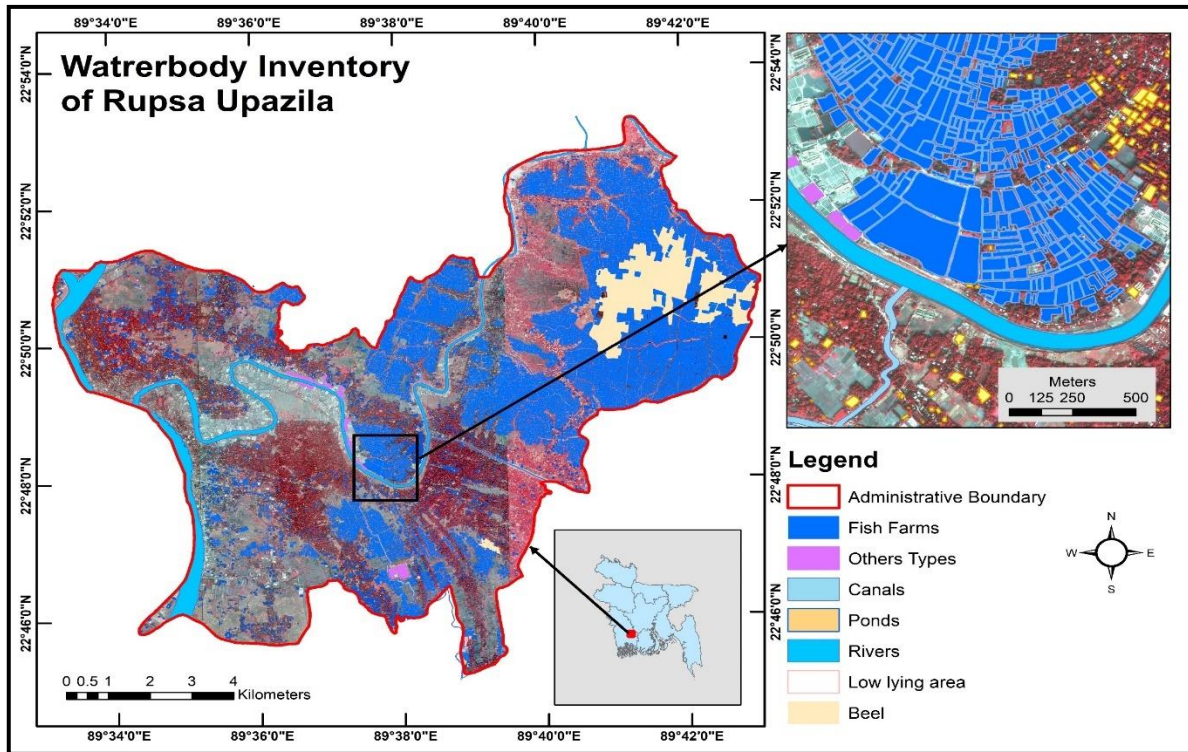
## **Result and Discussion**

A total of five categories of water bodies were found in the study area. There are three major rivers in this area and canals are directly or indirectly connected with rivers. Tidal action was found in both rivers and canals. These canals play a vital role in water discharging from household activities and rainfall runoff. Both resources (river and canal) are the prime source of captured fish for both local as well as country people.

Among all types of fisheries resources of this area, a large area is covered by fish farms/gheer. The former beel area has been converted to the fish farm/ gheer. Both prawn and carp mix cultures are practiced under controlled conditions. A large number of ponds are found in the research area and most of the ponds are under extensive aquaculture systems.

An anomaly found during field validation that ponds close to brick fields are excavated not for aquaculture rather, those ponds relate to rivers. The tidal action brings lots of sediments that fill the pond close to the brick field and the brick field uses the soil of the pond through excavation. In another area pond-like reservoir has been identified, however, it is the Khulna WASA reservoir tank where water is purified through different treatment actions. These two different types of waterbodies have been marked as other fisheries resources during on-screen digitization. The remaining beel area located at the North-eastern part of the upazila is still under capture fishery and indigenous fish species are the main aquatic species.

Overall, the Northeastern part of this upazila bears most of the fisheries resources i.e., fish farm and beel area. The present study focused on the identification of all types of fisheries resources in the selected upazila of Khulna district which is a crucial task for fisheries management of that area (Fig. 2.5.13).



**Fig. 2.5.13** Fisheries resources of Rupsa upazila of Khulna district

## Conclusions

The output of this research could be used for sustainable management of resources that can enhance the overall fish production of that area. Further investigation could be helpful to make the water area of this upazila up to date.

## 2.6 Space Physics and Rocket Dynamics Division

**Research title: Design and assemble of optical telescope for space observation and astronomical research capacity building in SPARRSO (Phase-I)**

### Introduction

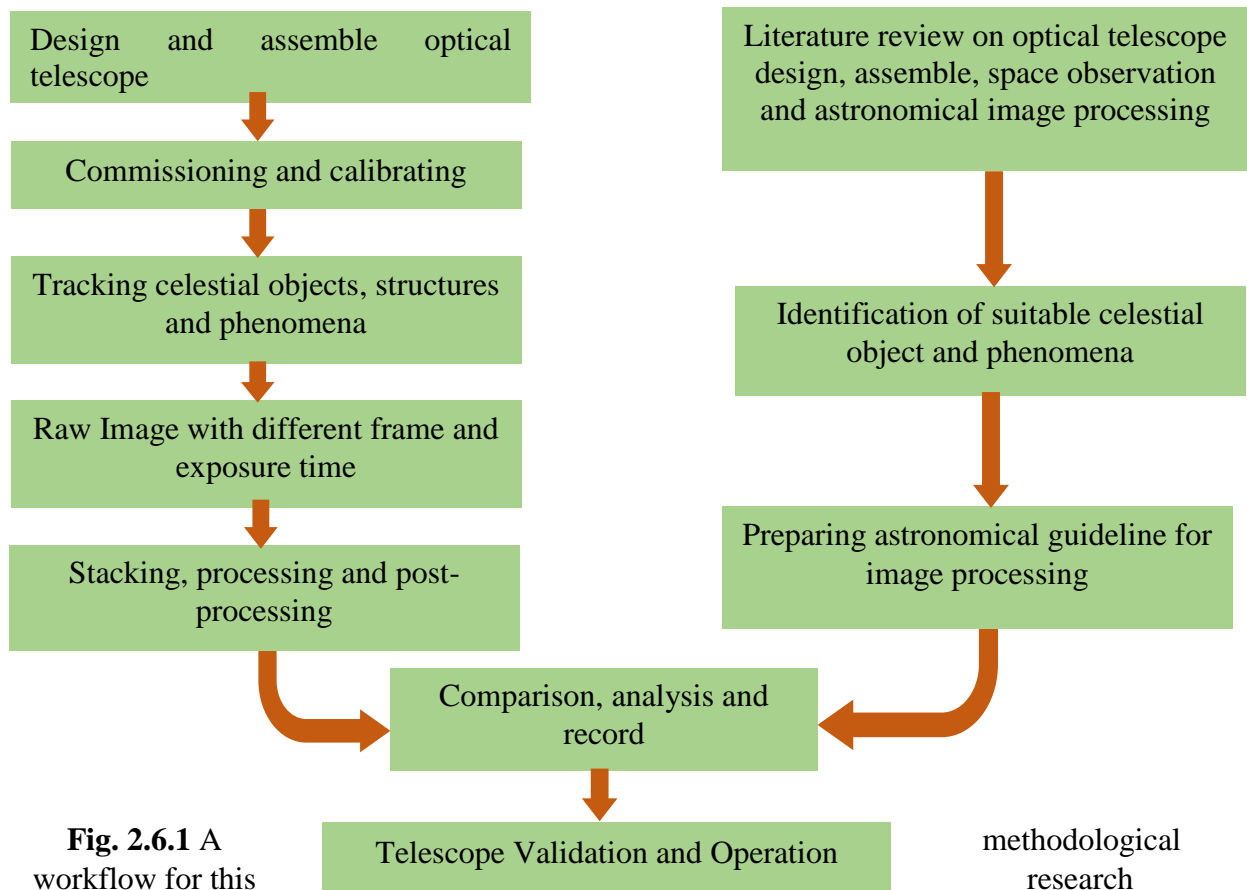
Astronomy is the study of celestial objects, structures, matter, and energy distribution in the universe including both visible and invisible universes like the Sun, the moon, the planets, the stars, the galaxy, the nebula, and the interstellar and intergalactic dust, and cloud beyond earth's atmosphere. The first true breakthrough in humankind's exploration of the universe was the invention of the telescope in the 17th century. Italian astronomer Galileo Galilei was an early

adopter and developer of that technology, which enabled him to make major strides in the understanding of our solar system.

Professional astronomy is divided into two major parts, one is theoretical and the other is observational. Observational astronomy is focused on acquiring data from observations of astronomical objects. Space observation with ground-based optical telescopes also includes astrometry and astrophotography in observational astronomy. Astrophotography, also known as astronomical imaging, is the photography or imaging of astronomical objects, celestial events, or areas of the night sky. High-quality scientific data are gathered and analyzed by using the powerful telescope and various astronomy image processing tools. The objectives of this research are a) to design, construct, and assemble optical telescopes for space observation and astronomical research capacity building, and b) to construct scientific images to compare, analyze, and record.

### Research Methodology

A schematic of this research has been outlined in Fig. 2.6.1, where the design, assembling, calibration, capturing, and processing steps have been mentioned following the standard guidelines.



### Results and Discussion

A successful calibration and validation of the telescope has been completed in this phase (Fig. 2.6.2 and Fig. 2.6.3).



**Fig 2.6.2** Telescope calibration and testing in rooftop



**Fig 2.6.3** Captured images by the fully assembled telescope

## Conclusion

Modern space observation systems are at the core of the current advanced space research organization of all developed countries. This research is one of the fundamental research projects in the field of astronomy which will build the capacity of SPARRSO researchers in space observation, exploration, and further valuable astronomical research in this arena.

## 2.7 Ground Station Division

### A. Research title: Design and Manufacturing of a 1U CubeSat with Optimized Chassis Using 3D Printed Carbon Fiber Composite

#### Introduction

A CubeSat is a square-shaped, small, low-cost satellite (typically 10 cm × 10 cm × 10 cm) 1U or 3U, or 6U designed for specific missions, such as Earth observation, Disaster Monitoring, or scientific research. This research on the 1U CubeSat system is a pioneering project to enhance Bangladesh's capabilities in space technology. This system comprises a CubeSat for data collection and a Ground Segment for communication and data retrieval. This CubeSat can capture images and monitor atmospheric parameters like temperature, humidity, air pressure, etc.

### CubeSat Sub-Systems Design

The CubeSat system with ground station involves the Space Segment and the Ground Segment for Ground Communication (Fig 2.7.1). This integrated system will enable communication, data retrieval, and mission control for the CubeSat.

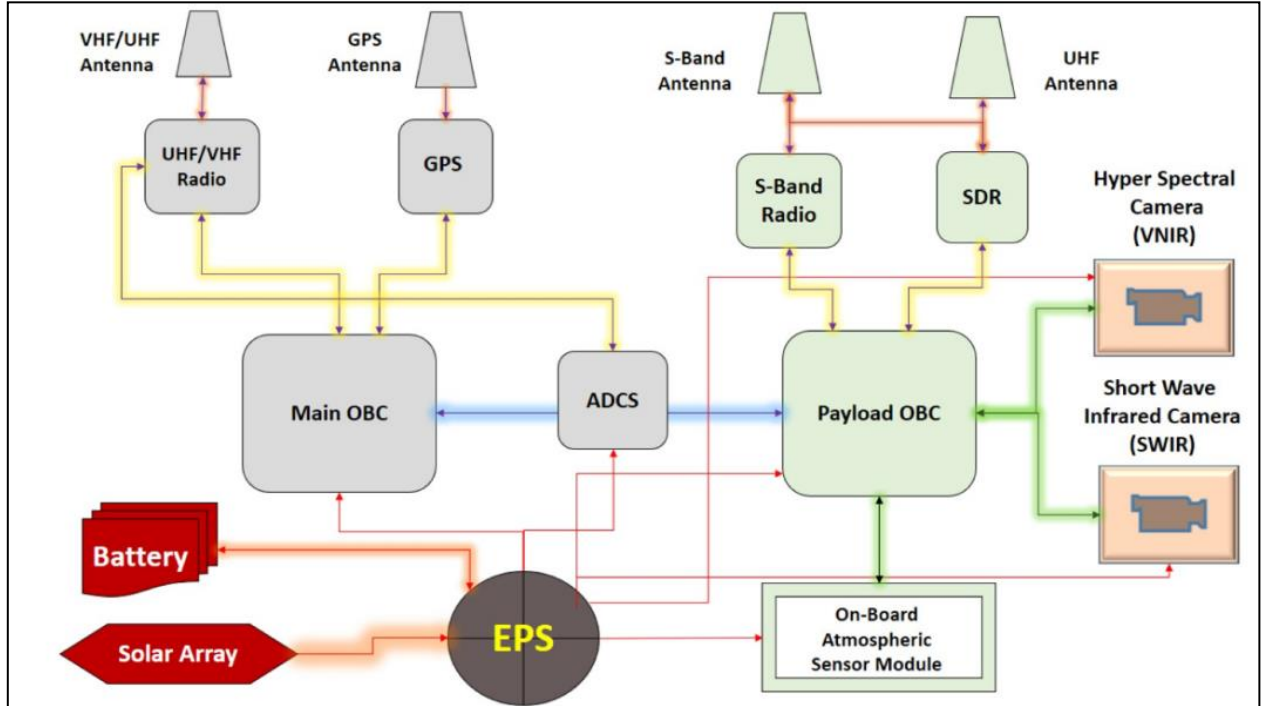


Fig. 2.7.1 Block diagram for preliminary design

### CubeSat Structure Design

This design is crucial for ensuring the CubeSat can withstand the rigors of launch and the harsh conditions of space or upper atmosphere while providing a stable platform for scientific payloads and the attachment of various components and instruments.

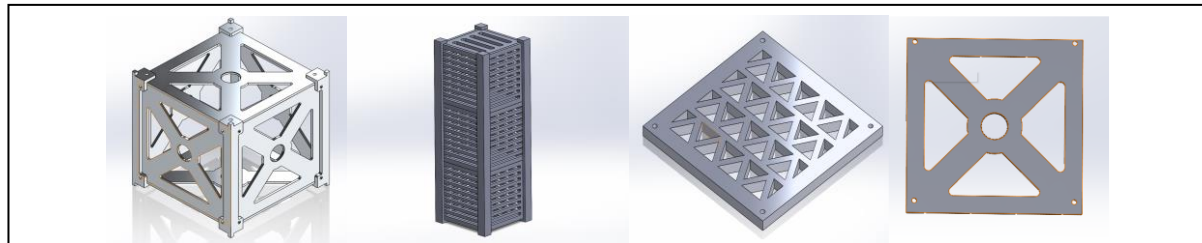


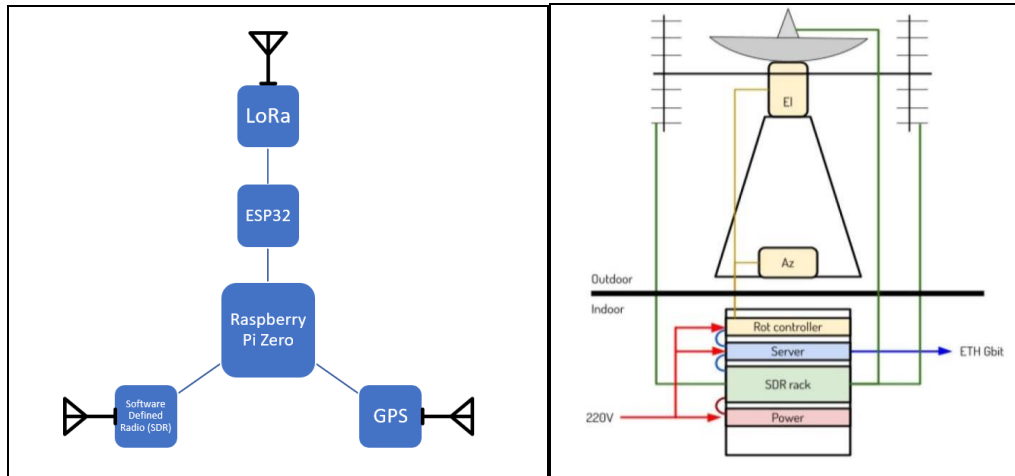
Fig. 2.7.2 SolidWorks CAD design for CubeSat structure developed for 3D printing with G-Code

### Electric Power System (EPS)

The CubeSat Electrical Power System (EPS) manages power collection and distribution within the satellite. It integrates a Battery Management System (BMS) and controls power supply for subsystems and payloads. The EPS stores energy in onboard Lithium-Ion batteries and ensures safe battery operation.

### ***Communication Sub-System***

The Communication Sub-System facilitates robust and reliable communication between the CubeSat and ground station.



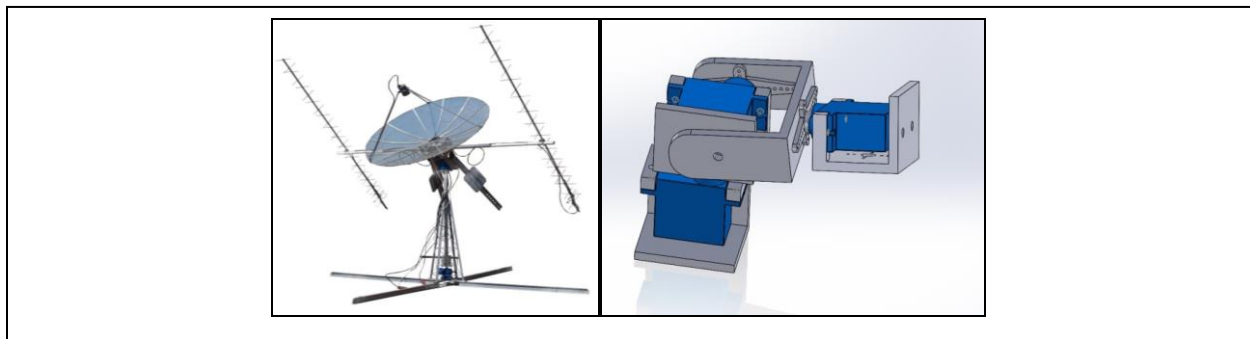
**Fig. 2.7.3** Communication Sub-System Block Diagram and Ground Station Control Unit

### ***Camera and Imaging Sub-System***

The Camera and Imaging Subsystem for our CubeSat integrates advanced thermal and optical imaging capabilities, crucial for atmospheric research and object detection. The subsystem employs two primary cameras: the LWIR Thermal Imaging Camera and the High-Level 30x Optical Zoom Camera, each selected for their unique attributes and compatibility with CubeSat requirements.

### ***Ground Station Design***

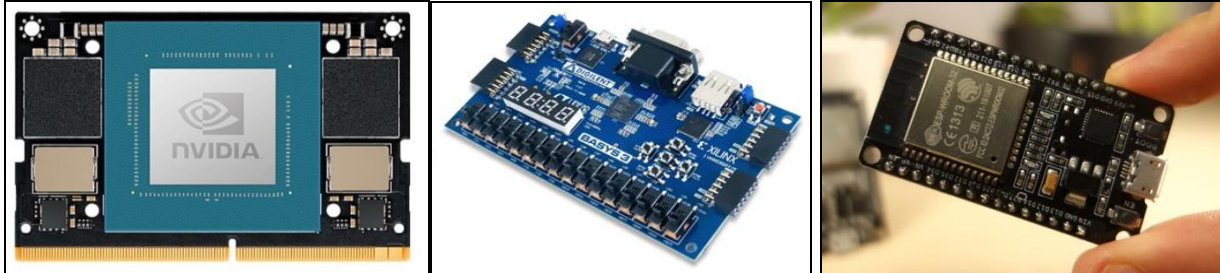
A satellite ground station is a surface-based facility designed for real-time communication with satellites. These stations send radio signals to the satellite (uplink), receive data transmissions from the satellite (downlink), and, in some cases, serve as command-and-control centers for the satellite network.



**Fig 2.7.4** Rotator Antenna of Ground Station and 3-axis rotator control module

**Methodology and Mechanism**

We opt for lightweight materials like ‘Carbon Fiber Composite’ for the CubeSat to minimize the mass but maintaining the required thermal properties and stiffness allowing effective flight.



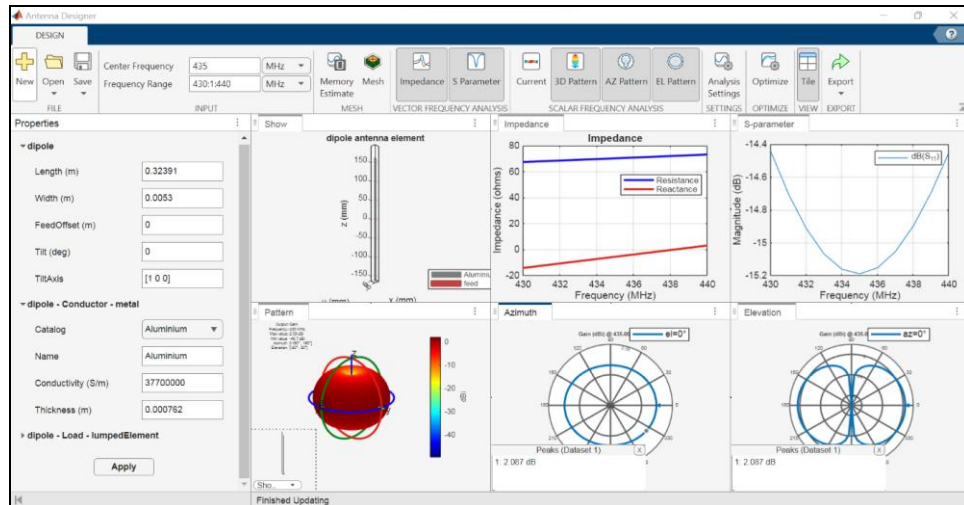
**Fig. 2.7.5** Jetson Orin Nano (main OBC), Basys 3 Artix-7 FPGA (Payload OBC) and ESP-32



**Fig. 2.7.6** Camera, Thermal Imaging sensor, and Jetson Orin NX 16GB (Ground Station)

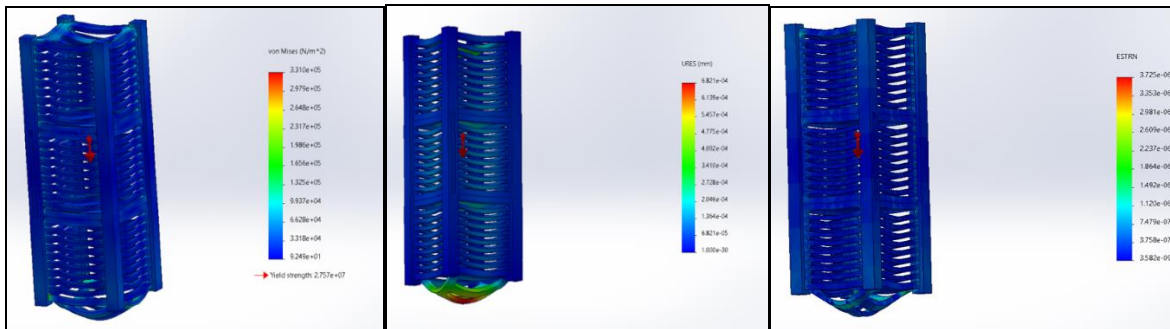
**Development of CubeSat Communication Sub-system**

For the communication we are using Software Defined Radio (SDR) which is configured by GNU Radio and LORA communication Module for Telemetry and Data Communication. In the modulation scheme, BPSK and QPSK methods were applied.



**Fig. 2.7.7** Radiation Pattern of CubeSat Dipole Antenna at 435 MHz

### Development of CubeSat Structure



**Fig. 2.7.8** Static Structural Analysis (Stress, Displacement and Strain)

### Development of Ground Station

The section outlines the key components, such as antennas, tracking mechanisms, and data processing units, required to establish a functional ground station capable of supporting space missions and research initiatives. The Ground Station Communication system consists of Multiple Transceiver and antenna modules.

### Results and Discussions

The development and testing phases of the 1U CubeSat project by SPARRSO had promising results. The CubeSat, equipped with a weather analysis module and camera, successfully collected and transmitted data on atmospheric conditions during its testing.

### Conclusion

The development of the 1U CubeSat by SPARRSO, in collaboration with prominent educational and research institutions, represents a significant milestone in Bangladesh's space research and environmental monitoring capabilities. This project lays a strong foundation for future advancements in the country's space research capabilities.

## **B. Research Title: Design, Analysis & Simulation of an ML-Based Remote Sensing Device and Antenna System**

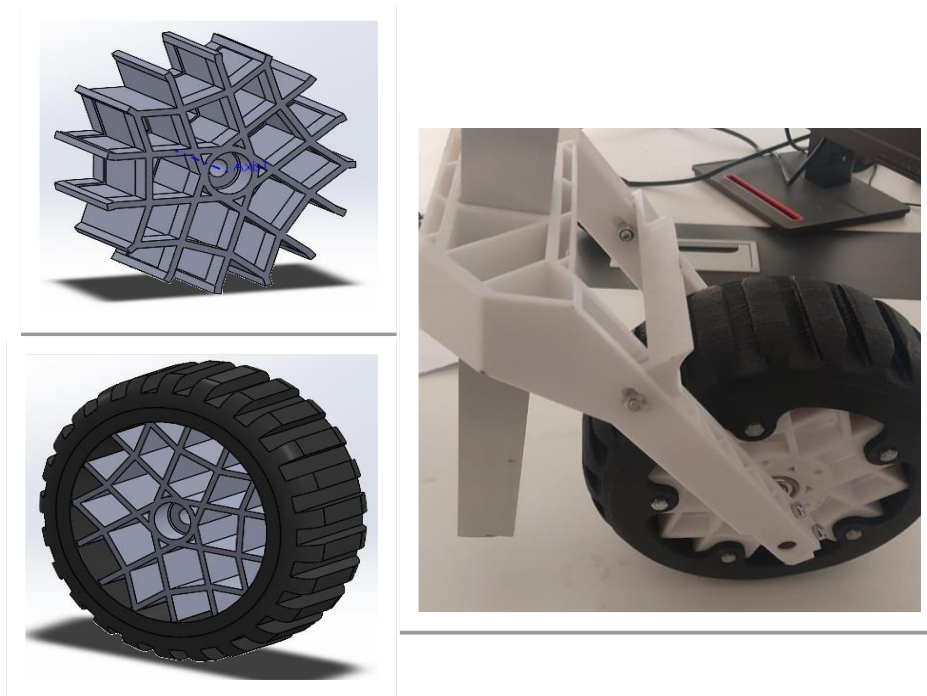
### **Introduction**

Bangladesh Space Research and Remote Sensing Organization (SPARRSO) is the focal space organization of the Government of Bangladesh. SPARRSO is about to enter the arena of space technology through its short-medium-long-term planning. Rover is one of the most sophisticated members of many space missions and is an integral part of “Space Robotics”. This research on designing a Drone and Rover will help SPARRSO develop in this field and pave the way for future space missions in Bangladesh.

### **Methodology**

#### ***CAD Design of Tire, Chassis, Body, Arm, and End Effector***

The CAD design phase involved the creation of intricate designs for essential components of ROVER. The tire design focused on optimizing tread patterns for traction and durability across various terrains, while the chassis and body designs prioritized structural integrity and weight distribution to support the entire system. The arm and end effector designs were engineered for

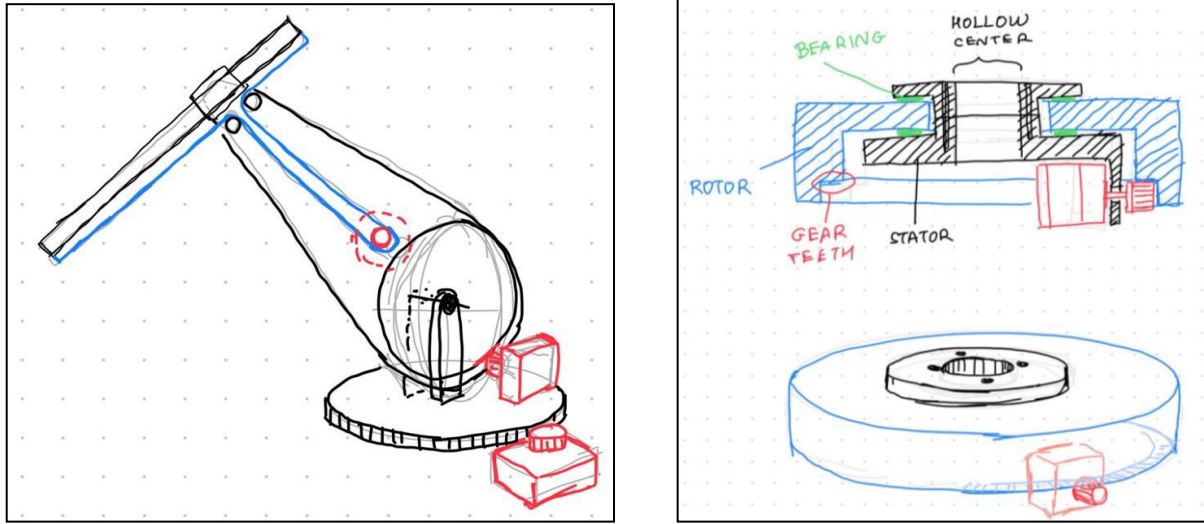


**Fig. 2.7.9** CAD images of the wheel rim and tire, assembly of the wheel parts with 3D printed rim and tire

precision and strength, enabling versatile manipulation capabilities crucial for the rover's intended tasks.

### 3D Print of Designed Parts

Following meticulous CAD design, the next step was translating these designs into physical components through 3D printing.



**Fig. 2.7.10** Conceptualized rover arm and its base



**Fig. 2.7.11** Conceptualized rover arm and its base

### ***Electrical and Communication Subsystem Layout***

Efficient power distribution was designed to ensure efficient operation and reliability across the system. Wireless technologies enable real-time data transmission and remote-control capabilities, essential for mission-critical operations and situational awareness. The telemetry system helps with real-time monitoring of ROVER's operational parameters and environmental feedback.

### ***Initial Prototype Assembly***

Assembly of the initial prototype marked a significant milestone in integrating mechanical, electrical, and software components into a cohesive system.

### ***Calibration of Sensors***

Sensor calibration was essential to ensure accurate data acquisition and interpretation. This phase involved fine-tuning sensors such as cameras, LiDAR, and environmental sensors to optimize performance across different operational scenarios enhancing ROVER's ability to gather relevant data for autonomous navigation.

### ***Testing of Basic Functionalities***

This phase included comprehensive checks on movement controls, sensor data acquisition, and actuator responsiveness.

### ***Preliminary Field Testing***

Preliminary field testing provided crucial feedback on ROVER's performance in real-world environments.

### **Result and Discussion**

Continued assembly and integration of the robotic arm are ongoing tasks to enhance ROVER's manipulation capabilities. Continued development of ROVER's electrical subsystem is underway to further refine power distribution and component integration. Configuration of motor drivers is essential to optimize the performance and efficiency of ROVER's propulsion and actuation systems. ROVER's control system encompasses software updates and algorithmic enhancements. Iterative adjustments based on field test data and feedback aim to enhance ROVER's agility and adaptability in dynamic environments. ROVER's user interface (UI) development is going on to enhance operator interaction and control capabilities.

## **2.8 Information Section**

### **Research Title: Formulation of Draft National Space Legislation in Bangladesh (Phase 2)**

#### **Introduction**

The development of national space legislation is crucial for any country looking to establish a viable space industry. Bangladesh, a rapidly developing country, is also exploring the prospects of expanding its space program. In the year of 1986, Bangladesh became a state party of the Outer Space Treaty 1967 through accession. Except for this treaty, Bangladesh has not ratified

any of the other international space law treaties, nor has it established any major national legal framework in this area. However, the country faces significant challenges in this endeavor, including the need for technical expertise, knowledge, collaboration between institutions and regulatory alignment with international space laws. Regarding many issues relating to space affairs, Bangladesh does not have any legal framework that would guide any authority to act in accordance with a specified formal procedure. There are no proper rules, regulations or acts in Bangladesh that will guide us on comprehensive issues related to space law. As a result, Bangladesh faces constant challenges and complications in dealing with matters related to space law. Moreover, Bangladesh Vision 2041 aims at achieving high-income status through industrialization and encourages expansion and investment in various ranges of industries. Nevertheless, the potential benefits of developing national space legislation, such as foreign or private company investment, economic development, commercial use of the space industry, establishment of spaceport and spacecraft manufacturer, collaboration between institutions, environment protection, etc., are substantial. The previous research works examine the prospects and challenges of developing national space legislation in Bangladesh and formulate a draft space act considering the various countries' legislation primarily considering fundamental needs from Bangladesh's perspectives. The proposed research aims to review the draft legal framework, identify gaps, and propose a comprehensive legislative framework for the space sector in Bangladesh. It concludes that, despite the difficulties, the country must pursue this goal to realize the full potential of its space research and technological development, eyeing on space economy and industrial prospects. So, Bangladesh needs to develop domestic space legislation in accordance with international space law and other model laws around the world. The objectives of this research are a) To find out and fill up the required reformations, additions, and amendments of the previous phase draft space activities act of Bangladesh. b) To assess feedback from different organizations/ministries and organize stakeholder meetings/seminars in favor of space affairs and legislation. and c) To finalize the national space legislation covering all the issues related to space law.

## **Research Methodology**

A qualitative, doctrinal approach to research methodology follows the research. The paper likely adopts a multi-disciplinary approach, drawing upon legal research, comparative analysis, and studies to inform the formulation of the draft national space legislation. The report analyses international space law treaties, legal frameworks of various space-faring nations, and the prospects and challenges for developing national space legislation in Bangladesh. The study aims to investigate new possibilities of space law in Bangladesh. It also tends to search for potential solutions and steps for the development of the space industry of Bangladesh. The study explores the scope and benefits of adopting a national space law and finding out the challenges to doing so.

## Results and Discussion

### *Draft Space Activities Act*

The following draft act has been outlined by reviewing and analyzing different countries' space activities related legal documents. Whereas, making provisions promoting the responsible and sustainable development of space activities, remote sensing, and geographical information system (GIS); outlining the provisions of authorization, supervision, registration, liability, insurance, environment protection, space debris mitigation of such activities, penalties; incorporation of UN principles, guidelines, and international space treaties such as: Outer Space Treaty, Registration Convention, Liability Convention etc. and for matters ancillary has been counted for further space activities. This draft act has 7 chapters and 25 sections, which is entitled as “Bangladesh Space Activities Act, 2023”.

This act applies to space activities, remote sensing and geographical information system (GIS) activities carried out within the People’s Republic of Bangladesh or such activities carried out outside of Bangladesh on:

- (a) space object, aircraft, vessel, vehicle, or facilities registered in Bangladesh; or
- (b) by operators, owners, or companies registered in Bangladesh.

The listed in the chapters have been mentioned in Table 2.8.1.

Table 2.8.1: List of chapters considered for Draft National Space Legislation

<b>Topic</b>	<b>Description</b>
Chapter 1: Preliminary	1. Short title, application, and commencement, 2. Definitions
Chapter 2: Authorization, Formulation and Supervision of Space Activities	3. Compliance with International Law, 4. Formulation of Policy, Rules, Regulations and Guidelines, 5. Authorization for Space Activities, Remote Sensing and GIS, 6. Prerequisites for authorization, 7. Application for authorization. 8. Withdrawal, suspension or amendment of authorization, 9. Supervision
Chapter 3: Registration	10. Registry of Space Objects, Remote Sensing and Geographical Information System
Chapter 4: Liability and insurance	(11) Liability for damage done by operator or owner, (12) Insurance
Chapter 5: Protection of Environment	(13) Environmental Protection, (14) Space Debris Mitigation
Chapter 6: Remote Sensing and GIS Data Management	(15) Approval of Remote Sensing and GIS Activity, (16) Supervision of Remote Sensing and GIS Data, (17) Acquisition and Distribution of Remote Sensing and GIS Data, (18) Remote Sensing Data Distribution Standard
Chapter 7: Penalties	(19) Punishment for unauthorized space activity, (20) Punishment for unauthorized remote sensing and GIS activity, (21) Punishment for misinformation and false document, (22) Punishment for non-compliance with supervising authority, (23) Punishment for non-

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	compliance with environment protection and space debris mitigation rules
Chapter 8: Miscellaneous	(24) Intellectual property rights, (25) Right of authority for information

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### ***Development of a Questionnaire for Stakeholder Meetings/Seminar***

To assess feedback from different organizations/ministries and organize stakeholder meetings/seminars in favor of space affairs and legislation, the following questions have been prepared in accordance with present and future perspectives of space-related affairs of Bangladesh.

### **Conclusions**

Creating effective and comprehensive space laws will require significant effort, resources, and expertise, particularly in policy development and legal infrastructure. After reviewing the draft act and comprehensive questionnaire, further progressive development will be continued to the next financial year. Despite the challenges, Bangladesh has the potential to become a prominent player in the space sector through the development of national space legislation. While developing national space legislation in Bangladesh is a complex and challenging task, it is also a necessary step towards ensuring the country's participation and competitiveness in the global space community. In conclusion, developing national space legislation in Bangladesh presents both promising opportunities and significant challenges. After considering feedback from different organizations/ministries organizing stakeholder meetings/seminars in favor of formulating space affairs and legislation will create a strong impact in finalizing this research output.

## **Acknowledgments**

The research and application activities mentioned here would not have been possible without the generous contributions of all the divisions of SPARRSO. The researchers are grateful to the relevant stakeholders for their time, effort, and commitment to sharing knowledge in their respective fields of study. The researchers would like to express their deep appreciation to the internal reviewers for their critical review and invaluable feedback, which played a crucial role in enriching the report at various stages.

Besides, the researchers are grateful to the USGS Earth Resources Observation and Science (EROS) Center, NASA Land Processed Distributed Active Archive Center (LP DAAC), European Space Agency (ESA), and other relevant parties for providing satellite images and related products for the research.

Also, research works mentioned in this report were highly improved from various geospatial data obtained from different organizations, i.e., Bangladesh Meteorological Department (BMD), Bangladesh Bureau of Statistics (BBS), Bangladesh Forest Department (BFD), Department of Fisheries (DoF), Bangladesh Water Development Board (BWDB), and so on.

Besides, the researchers appreciate the continuous efforts of different officers, research fellows, and staff of SPARRSO during the ground validation activities, which highly improved the research findings in the respective research works.



# **Chapter 3**

## **RESEARCH LAB FACILITIES**

### 3.1 Atmospheric Research Lab

The Atmospheric Research Lab focuses on studying atmospheric conditions and processes that impact weather, climate, and environmental health. Equipped with state-of-the-art instruments for measuring atmospheric composition, radiation, and air quality, this lab plays a key role in monitoring changes in the atmosphere that affect climate patterns and air pollution levels. Research in the Atmospheric Research Lab is geared towards understanding climate change, to support national policies on environmental protection and climate resilience. By analyzing atmospheric data, the lab contributes to improving weather forecasting accuracy which is crucial for disaster preparedness and agricultural planning.



### 3.2 Agriculture Research Lab

The **Agriculture Research Lab** at SPARRSO is a pivotal facility dedicated to advancing agricultural practices through the integration of space technology and scientific research. This lab leverages satellite imagery, remote sensing, and geospatial data to monitor crop health, soil conditions, moisture levels, and vegetation growth, providing critical insights that enhance agricultural productivity and sustainability. By offering real-time data on weather patterns, land use, and water resources, the lab plays a vital role in enabling precision farming, optimizing resource management, and reducing the environmental impact of agricultural activities. The lab has worked on satellite-based models to predict crop yields and monitor soil degradation, aiding policymakers and farmers in making informed decisions to ensure food security and efficient land use. Additionally, the lab has collaborated with agricultural institutions and international organizations to enhance the accuracy of its data and expand its research capabilities.



### 3.3 Forest Research Lab

The **Forest Research Lab** at SPARRSO is a specialized facility dedicated to the study and monitoring of forest ecosystems using space technology and remote sensing techniques. This lab plays a crucial role in supporting national efforts to conserve forests, protect biodiversity, and manage natural resources sustainably. By utilizing satellite imagery and geospatial data, the Forestry Research Lab monitors forest cover changes, assesses deforestation rates, and detects illegal logging activities. It also provides valuable insights into forest health, carbon sequestration, and habitat preservation, contributing to both climate change mitigation and biodiversity conservation. The Forestry Research Lab has made significant advancements in mapping forest degradation and implementing satellite-based systems to support reforestation initiatives. The lab works closely with national and international environmental agencies to develop data-driven strategies for forest conservation.



### 3.4 Water Resource Research Lab

The **Water Research Lab**, another key facility within SPARRSO, is dedicated to studying and managing water resources through the application of satellite technology and geospatial analysis. This lab focuses on monitoring water bodies, river systems, and coastal zones to provide real-time data on water availability, quality, and usage. By leveraging remote sensing technology, the lab plays a vital role in addressing challenges related to water scarcity, flash flood, and climate change impacts on aquatic ecosystems. The Water Research Lab has contributed significantly to the development of early warning systems for flood prediction, drought assessment, and water-related disaster management. By analyzing satellite data, the lab provides critical insights into riverbank erosion, groundwater depletion, and sedimentation patterns which are essential for managing Bangladesh's water resources effectively.



### 3.5 Fisheries Research Lab

The Fisheries Research Laboratory serves as a hub for scientific investigation and innovation in aquatic ecosystems, focusing on sustainable fisheries management, aquaculture development, and conservation of marine and freshwater species. Researchers employ advanced techniques, including molecular biology remote sensing and data analytics to study fish population dynamics, habitat health, and environmental impacts. The lab plays a critical role in the blue economy sector by addressing challenges like overfishing, climate change, and habitat degradation, aiming to enhance fishery resources, improve food security, and promote biodiversity conservation. By fostering collaboration among scientists, policymakers, and stakeholders, fisheries research laboratories contribute to the sustainable development of aquatic resources and ecosystems.



### 3.6 Space Technology Research Lab

The **Space Technology Research Lab**, established within SPARRSO, is a pioneering center for space activities in Bangladesh, driving the nation's ambitions in space science and technology. As a key component of SPARRSO's mission to harness space-based tools for national development, the lab serves as a hub for research, innovation, and capacity building in space technology. Its core focus lies in utilizing satellite data, remote sensing, and geospatial analysis. Moreover, the lab is at the forefront of integrating advanced technologies such as artificial intelligence, big data analytics, and machine learning into its space research, which enhances its ability to interpret vast amounts of satellite data for real-time decision-making. As a beacon of scientific advancement within SPARRSO, the Space Technology Research Lab is not only supporting national space activities but also inspiring a new generation of scientists and engineers. Its role in contributing to national development through space technology is a testament to SPARRSO's vision of a future where space science plays a pivotal role in addressing the country's developmental challenges and fostering global cooperation in space research.



On 18<sup>th</sup> January 2024, SPARRSO successfully launched its inaugural drone flight for advanced remote sensing and research within its office premises, in the presence of the SPARRSO Chairman. This milestone event signifies a major leap forward in SPARRSO's capability to utilize drone technology for enhanced data collection, environmental monitoring, and research initiatives. The drone will play a pivotal role in supporting SPARRSO's mission to strengthen national capacity in space research, agriculture, disaster management, and climate studies through more precise and real-time data acquisition.



**Photograph 3.6.1: Chairman of SPARRSO observing the drones**

On 27<sup>th</sup> June 2024, SPARRSO officials visited the Space Technology Research Laboratory (STRL) to explore advanced research opportunities and foster collaboration. The visit provided an in-depth look at STRL's cutting-edge technologies and research capabilities in space technology. SPARRSO officials engaged in discussions with STRL researchers to identify potential areas for cooperation, particularly in leveraging space technology for national development, environmental monitoring, and disaster management. This visit marks a step forward in strengthening partnerships aimed at enhancing innovation and technological progress in space research.



**Photograph 3.6.2: SPARRSO Officials visit STRL lab**

### **3.7 Ground Station Resource Lab**

The Ground Station Lab at SPARRSO plays a crucial role in enabling real-time communication with satellites, serving as the nerve center for receiving, processing, and analyzing satellite data. This lab is equipped with satellite tracking systems and data reception technologies that provide continuous monitoring of Earth's surface and atmosphere. The lab supports a wide range of applications, including weather forecasting, disaster monitoring, and environmental surveillance. Through its operations, the Ground Station Lab enables timely access to critical satellite data, which is vital for informed decision-making in areas such as disaster management. It is also an integral part of national efforts to strengthen Bangladesh's space capabilities and enhance its participation in global space initiatives.



### **3.8 Others Research Lab**

Moreover, the Geology Lab at SPARRSO focuses on studying the Earth's structure, composition, and processes using remote sensing technology. By mapping geological formations and monitoring seismic activity, this division plays a crucial role in identifying natural resources, assessing mineral deposits, and analyzing earthquake risks. Their work supports national development by providing vital information for resource management, land use planning, and disaster preparedness. The Oceanography Lab, on the other hand, is dedicated to the study of marine environments, using space-based tools to monitor ocean currents, temperature patterns, sea-level rise, and coastal erosion which ultimately create a potential impact on blue economy research in Bangladesh. Meanwhile, the Agro & Hydrometeorology Lab uses satellite data to assess the geomorphic connectivity and its associated impacts on agro-ecological zones in Bangladesh. The Instrumentation and Data Processing Lab plays a crucial role in developing and maintaining the advanced technologies and sensors required for satellite data collection, ensuring accurate and reliable data for various research projects. Lastly, the Space Physics and Rocket Dynamics Lab focuses on studying on astronomy and astrophysics, space observation, satellite orbits, and rocket dynamics, contributing to advancements in Bangladesh's space research capabilities. Moreover, there is a dedicated Geo-informatics lab and Education and Training Center (ETC) in SPARRSO.



# **Chapter 4**

## **PUBLICATIONS**

### List of published articles

- Faisal BMR, Hayakawa YS. Topographical dynamics based on global and UAV-SfM derived DEM products: a case study of transboundary Teesta River, Bangladesh. *Geografiska Annaler: Series A, Physical Geography* 2024, 105(2–3), 143–165. <https://doi.org/10.1080/04353676.2024.2323347>
- Islam MS, Masum SMIH, Ali MM, Uddin MF, Md. Talukdar NI, Siddika SE. Analysis and determination the correlation between thunderstorm occurrence and cloud coverage in Srimangal region of Bangladesh. *Dewdrop (A scientific journal of Meteorology and Geophysics, Bangladesh Meteorological Department)*, 2023, 9(1). ISSN 2414-6056.
- Islam MS, Masum SMIH, Uddin MF, Md. Talukdar NI, Ali MM, Siddika SE. A meteorological parameters study and its relationship with thunderstorms in Rajshahi district of Bangladesh. *The Atmosphere (A scientific journal of Meteorology and Geo-physics, Bangladesh Meteorological Department)*, January 2024, 10(1). ISSN: 2311-486X.
- Rana SS, Habib SA, Sharifee MNH, Sultana N, Rahman SH. Flood risk mapping of the flood-prone Rangpur division of Bangladesh using remote sensing and multi-criteria analysis. *Natural Hazards Research* 2024, 4(1), 20-31. <https://doi.org/10.1016/j.nhres.2023.09.012>

# **Chapter 5**

## **DEVELOPMENT PROJECT**

**Project Name: Strengthening SPARRSO**

**Implementing Agency: SPARRSO**

**Total Budget: 3862 lac taka**

**Objectives of the Projects:**

Peaceful application of space and remote sensing technology is SPARRSO's primary missions. Considering global perspective, there is a need to embrace the economic opportunities arising in space sector. In this context the objectives of the project are as follows:

(a) Development and peaceful use of Space and Remote Sensing technology to collect, process, analyze and generate spatial data from satellite imagery and enhance the capacity of SPARRSO as per the requirements of various

Ministries/Departments/Organizations:

(i) Interim satellite imagery will be procured.

(ii) Satellite image-based maps will be created.

(iii) Polar orbiting satellite ground-stations to be established; and

(iv) Skilled manpower will be developed with technical knowledge in space and remote sensing technologies.

(b) An action plan for the peaceful application of space and remote sensing technology will be formulated.

(c) Research and peaceful applications of space and remote-sensing technologies in continuation with measurable parameters.

**Project Functions:**

(a) Signing of MoU with Bangladesh Meteorological Department and Bangladesh Survey Department as necessary collaborators.

(b) Collection/assessment and supply of satellite imagery requirements of various Ministries/Departments/ Organizations.

- (c) Establishment of polar orbiting satellite ground-stations for obtaining real time satellite imagery.
- (d) Processing/research/analysis of procured and collected satellite imagery and generation of satellite data.
- (e) Provision of satellite imagery data required by concerned Ministries/Departments/Organizations.
- (f) Recruitment of required manpower and consultants under the project.
- (g) Provision of training for skill enhancement of SPARRSO manpower in peaceful satellite technology and applications.
- (h) Adoption and implementation of action plan to achieve “Smart Bangladesh”



# **Chapter 6**

## **ADMINISTRATIVE AND FINANCIAL ACTIVITIES**

## ADMINISTRATIVE AND FINANCIAL ACTIVITIES

### 6.1 Administration

#### 6.1.1. New Chairman of SPARRSO



Mr. Md. Rashedul Islam has been working as the Chairman Bangladesh Space Research and Remote Sensing Organization (SPARRSO) since 06 December 2023. He is an Additional Secretary to the Government of the People's Republic of Bangladesh. He belongs to Bangladesh Civil Service (Administration) cadre and served various positions at the field administration. Mr. Md. Rashedul Islam obtained his M.Sc. degree with honours in Physics from Jagannath University in 1995.

#### 6.1.2. New Member of SPARRSO



Mr. Md. Abdur Rab has been working in Bangladesh Space Research and Remote Sensing Organization (SPARRSO) as a Member (Joint Secretary) since 31 January 2024. He joined Bangladesh Civil Service in 2001. During his career he worked various Ministries like Ministry of Food, Textile & Jute, Education, Industries, Finance, Public Administration and Post and Tele communication. Before that he obtained Bachelors and Master's degree in Mathematics from the University of Dhaka. He has got opportunities for foreign exposure to Germany, Scotland, Italy, China and Bhutan in Various Workshops, Seminars and Training that enhanced his Knowledge of performing job activities properly.

### **6.1.3. New Member of SPARRSO**



Dr. Md. Mahmudur Rahman, Chief Scientific Officer (CSO) of Bangladesh Space Research and Remote Sensing Organization (SPARRSO) has been appointed as new member of SPARRSO Board. He joined in this position on 28 February 2024.

Dr. Rahman started his professional career at Bangladesh Space Research & Remote Sensing Organization (SPARRSO) in 1995 as Scientific Officer (SO). He completed M.Sc. (2000) and PhD (2004) from Faculty of Forest, Hydro- and Geosciences, Dresden University of Technology, Germany. He conducted post-doctoral research at Center for Environmental Remote Sensing (CEReS), Chiba University, Japan during 2007-2009, which was funded by the Japan Society for the Promotion of Science (JSPS).

He completed many research activities utilizing optical and Synthetic Aperture Radar (SAR) remote sensing data in the thematic fields of forestry, environmental applications etc. He presented his research-work at many international conferences including those organized by International Society for Photogrammetry and Remote Sensing (ISPRS), European Association

of Remote Sensing Laboratories (EARSeL) and International Union of Forest Research Organizations (IUFRO). He published peer-reviewed articles in scientific journals, i.e., International Journal of Remote Sensing (Published by Taylor & Francis), Geocarto International (Published by Taylor & Francis), and Applied Geomatics (Published by Springer). His doctoral dissertation was published by Rhombos-Verlag, Berlin, Germany in a book entitled ‘Tropical Deforestation and Carbon Emission: Estimations Based on Remote Sensing’.

#### 6.1.4. SPARRSO Scientist awarded Ph.D. Degree



B.M. Refat Faisal, Senior Scientific Officer (SSO) has been working in Bangladesh Space Research and Remote Sensing Organization since 09 February 2017. He received the prestigious Japanese government (MEXT) scholarship in October 2020 for continuing his Ph.D course. He was awarded a Doctor of Philosophy (Ph.D.) in Environmental Science Development from Hokkaido University, Japan. Dr. Faisal did research in geospatial analysis on multiscale geomorphic processes and sediment connectivity in the Brahmaputra River basin. His research interest focuses on the land surface processes from the Himalayan mountains to the coast using advanced remote sensing techniques such as Unmanned Aerial Vehicle (UAV)-Structure from Motion Photogrammetry (SfM) and Lidar. He published several articles in relevant fields of study in renowned international journals (Geomorphology, Progress in Earth and Planetary Science, Geografiska Annaler: Series A, Physical Geography, etc.). Dr. Faisal also shared his research as a presenter and session chair through participating in various international and national seminars and conferences. He completed his Honors and master’s in environmental science from Jahangirnagar University.

#### 6.1.5. Manpower Status of SPARRSO (as of 30 June 2024)

Category	Approved post	Working	Vacant	
Officer	67	27	40	59 %
Staff	102	50	52	50 %
Total	169	77	92	54 %

### 6.1.6 Board Meetings

SPARRSO is governed by a Board consists of Chairman and four Members. In 2022-2023 Financial year there were Four (04) board meetings held, which are listed below:

No	Number	Name of the Meeting	Date
1	121(1/2023	Board Meeting	19/01/2023
2	122(2/2023	Board Meeting	17/04/2023
3	123(3/2023)	Board Meeting	23/05/2023
4	124(4/2023)	Board Meeting	12/06/2023

### 6.1.7. Retirement and Post Retirement Leave (PRL)

Md.Fazlul Haque, Junior Engineer has gone to Post Retirement Leave (PRL) with effect from 21/08/2023. He joined SPARRSO on 18 May 1985 and served the organization for more than 38 years.

Md.Alauddin, Office Shohayak has gone to Post Retirement Leave (PRL) with effect from 05/10/2023. He joined SPARRSO on 01 August 1983 and served the organization for more than 40 years.

Mrs. Nasreen Banu, Office Shohayak has gone Post Retirement Leave (PRL)with effect from 01/03/2024. She joined SPARRSO on 22 April 1985 and served the organization for more than 38 years.

Mr. Md. Shahjahan Ali, Principal Scientific Officer, has gone to Post Retirement Leave (PRL) with effect from 18/03/2024. He joined SPARRSO on 22 April 1985 and served the organization for more than 38 years.

Mr.Manirul Islam Khandaker, Finance Officer has gone to Post Retirement Leave (PRL) with effect from 01/01/2024. He joined SPARRSO on 22 April 1985 and served the organization for more than 28 years.

### 6.1.8 List of Promoted officials in the July 2023-June 2024

NO	Name and Designation	Date of Birth	Grade and Pay Scale	First Joining of SPARRSO: Position and date
1	Md. Ziaul Islam Assistant Scientific Officer (ASO)	01/01/1971	Grade: 11 Pay Scale: 12500-40230	Field Assistant, 11/09/1995,
2	Md. Jahangir Alam Senior Scientific Assistant (SSA)	05/03/1969	Grade:13 Pay Scale: 11000-26590	Laboratory Attend, 09/09/1995
3	Mr. Mukesh Banik Scientific Assistant (SA)	13/12/1988	Grade: 14 Pay Scale: 10200-24680	Tech-2, 03/09/2018

## 6.2 Budget and Expenditure

SPARRSO meets its recurring expenditure from the revenue budget of the Government. The revenue budget and the expenditure for the financial year July 2023 to June 2024 are given below:

Organization and Code	Financial Year	Allocated Budget (BDT)	Revised Budget (BDT)	Expenditure (BDT)	Remarks
SPARRSO & 131003300	2023-2024	208500000	178470000	129305686	Unspent (BDT). 49164314/- *

\* has been deposited to the government treasury.

## 6.3 Store and Procurement Section

In the Light of the demand for the financial year 2023-2024 obtained from various departments / divisions/branches of SPARRSO. The HOPE (Chairman, SPARRSO) approved Annual Procurement Plan (APP) including 36(Thirty-Six) Package. SPARRSO spent TK. 3,00,34,655.00 (Three Core Thirty-Four Thousand Six Hundred Fifty-Five Taka) by following PPR rules and regulations in the financial year 2023-2024. For Procuring Goods, Works and Services related packages, different methods such as Open Tender Method (OTM) (National), Quality and Cost-Based Selection (QCBS), Direct Procuring Method (DPM), Framework Agreement through OTM, Request for Quotation (RFQ) etc. have been applied according to the Public Procurement Act (PPA)-2006 and Public Procurement Rules (PPR)-2008. Through the e-GP system,

SPARRSO have procured about TK. 32,48,657/- (Thirty-Two Lac Forty-Eight Thousand Six Hundred Fifty-Seven Taka).

Description of procurement package for Goods/Works/Services are listed below:

Package No	Description of Procurement Packages Goods / Works / Services	Procurement Method and Type
GR1	Procurement of Stationary and Hygiene Material (framework Agreement)	OTM (framework Agreement)
GR2	Procurement of Books and Periodicals	OTM
GR3	Printing of Publications	RFQ
GR4	GR4: Procurement of Health Care Products (Sanitation)	OTM (e-GP)
GR5	GR 5: Procurement of Security Service and Materials	OTM
GR6	GR6: Procurement of Computer Equipment & IT Accessories	OTM
GR8	GR8: Procurement of Raw Materials and Spare Parts	OTM
GR9	Procurement of Crockeries & Cutleries	RFQ
GR10	Procurement of Other Machinery and Equipment	OTM
GR11	GR 11: Procurement of Software	OTM
GR12	Procurement of Satellite Data (VHSR) for Research Works on Developing an Agricultural Drought Monitoring Model Based on Multi-Source Remote Sensing Data	DPM
GR13	GR 13: Procurement of Computers and Accessories	OTM
GR14	GR14: Supply of Electrical Equipment (Appliances)	OTM
GR15	GR15: Procurement of Telephone Sets	RFQ
GR16	Lot 1: Procurement of Research and Engineering Instruments for Space Technology Research Lab	OTM
	Lot 2: Procurement of Research and Engineering Instruments for Geo-Informatics Lab	OTM
	Lot 3: Procurement of Research and Engineering Instruments for Space Physics and Rocket	OTM

	Dynamics Lab	
GR18	GR18: Procurement of Furniture	OTM
GR19	GR19: Procurement of Satellite Data (VHSR) for Research Works on Inventory of water bodies for Fisheries Resources using High Resolution Satellite Sensor Data	DPM
GR21	GR 21: Purchase of Vehicle Spare Parts	RFQ
GR22	GR22: Purchase of Vehicle Tyres	RFQ
WR1	WR1: Renovation of Conference Room	RFQ
WR2	Repair and Maintenance of Furniture	RFQ
WR4	WR4: Repair, Maintenance and Installation of Electrical line in SPARRSO	OTM
WR6	WR6: Renovation of Administrative and Research Buildings	RFQ
WR8	WR8: Renovation of SPARRSO Boundary Wall, Premises and Different Room	OTM (e-GP)
SR4	Procurement of Internet Service for SPARRSO	RFQ

## 6.4 Library and Documentation

Bangladesh Space Research and Remote Sensing Organization (SPARRSO) has a rich library that contains valuable books, journals, periodicals, pamphlets, newsletters, bulletins, reports and proceedings of workshops, symposia and conferences etc. covering different thematic areas of space science and remote sensing. It is an automated library that has self-developed library management software, namely Microsoft Access Database that supports circulation control, reference service, and readers' guidance service, literature search facility by author, title, publisher, subject, accession number, ISBN number and issuing reminder letters to the users for returning the library materials. The library database management system avoids duplication of the work by introducing a computerized library management system and it helps to improve the existing services.

At present, there are about 16,621 books, journals and reports covering a large number of fields such as remote sensing, space science, agriculture, biology, cartography, chemistry, computer science, ecology and environmental science, electronics and instrumentation, engineering sciences, fisheries, forestry, geography, geology, GIS, hydrology, mathematics, meteorology, oceanography, photogrammetry, photography, physics etc. in the library. Besides, the library has religious and other reference books, government and non-government publications and other departmental collections.

During the reporting period of July 2023 to June 2024, the following books were procured. The category-wise numbers are listed below:

**List of procured books**

S.N.	Title	Copy	Year
1	Scientific Books	183	2023-2024
2	General Books	123	
3	Accounting Books	06	

**Readers/Users**

All the employees of SPARRSO are entitled to use the library. Besides, students and teachers of different educational institutions and scientists, engineers, research workers and policymakers of government and non-government organizations can use the library with the permission of the authority of SPARRSO. Scientists, engineers, other officials and research students of SPARRSO use the library for their study and research purposes every working day.

**Library Hours**

SPARRSO library remains open from 9:00 am to 4:00 pm on all working days (Sunday to Thursday) and it remains closed on all government holidays.

**Contact Numbers:** +88-02-9113957, Cell Phone: +88-01515696838

**Address:** Bangladesh Space Research and Remote Sensing Organization (SPARRSO), Agargaon, Sher-e-Bangla Nagar, Dhaka-1207. Bangladesh. Email: [rassalm.duis@gmail.com](mailto:rassalm.duis@gmail.com)



# **Chapter 7**

## **INTERNATIONAL RELATIONS**

## 7.1 International Collaboration

### 7.1.1 Asia-Pacific Space Cooperation Organization (APSCO)

Asia-Pacific Space Cooperation Organization (APSCO) is an inter-governmental organization with full international juridical nature. The institution has been working for the peaceful exploitation of space technology in order to promote sustainable economic and social development among the member states and regional countries in the Asia-Pacific region. APSCO started its formal operation in December 2008 and has been granted the permanent observer status to the Committee on Peaceful Uses of Outer Space of United Nations since 2009. Currently, APSCO has eight Member States namely Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand and Turkey and one Signatory State namely Indonesia which is under respective domestic procedures of its ratification on APSCO Convention.



**Photograph 7.1: APSCO Headquarters in Beijing**  
(Source: [www.apsco.int](http://www.apsco.int))

Bangladesh joined the Asia-Pacific Space Cooperation Organization (APSCO) to accelerate peaceful exploitation of space technology in order to promote sustainable economic and social development. Bangladesh signed APSCO Convention on 28th October 2005 and the Convention was ratified on 1st August 2006. Since then, Bangladesh has been actively participating different programs and events organized by APSCO.

### 7.1.2 Other Collaboration Partners

In addition to APSCO, the following regional and international organizations are partners of Bangladesh Space Research and Remote Sensing Organization (SPARRSO), both bilaterally and multilaterally namely, Regional Centre for Space Science and Technology Education in Asia and the Pacific (RCSSTEAP), Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP), United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), Japan Aerospace Exploration Agency (JAXA), Asian Conference on Remote Sensing (ACRS) and Asia-Pacific Regional Space Agency Forum (APRSAF), Japan International Cooperation Agency (JICA), Asian Institute of Technology (AIT), International Centre for Integrated Mountain Development (ICIMOD). SPARRSO often takes part in a range of international workshops, symposiums, meetings, and training sessions that these various organizations arrange.

## 7.2 International Events Participation

### 7.2.1 International Meridian Circle Program (IMCP) Space Weather School in Beijing



**Photograph 7.2.1 Group Photo of IMCP program participants after the Inauguration ceremony on 14 September 2023**

The International Meridian Circle Program (IMCP) Workshop & Training, held under the Space Weather School from September 14-23, 2023, in Beijing, China, represents a significant opportunity for global collaboration in space weather research. This event is co-organized and sponsored by the Asia-Pacific Space Cooperation Organization (APSCO) and the National Space Science Center (NSSC) of the China Academy of Sciences (CAS). The workshop aims to provide participants with a comprehensive understanding of the International Meridian Circle Program (IMCP), a flagship international project focused on the Sun-Earth relationship. The IMCP Observation System is designed to deliver critical data for the space weather community,

deploying a network of monitoring instruments across the middle to upper atmosphere. This includes ionosphere incoherent scatter radars in Southern China, along the 120°E/60°W meridian, covering regions from China to Southeast Asia, Australia, and the Americas. The program also features a space-based component, including missions to study solar activity (ASO-S), magnetosphere boundaries (SMILE), Magnetosphere-Ionosphere coupling (MIT), and the effects of natural disasters (CSES-1 and 2). For Bangladesh, the practical utility of this program is immense. Although the country has made strides in space technology with the launch of the Bangabandhu-1 satellite, it lacks extensive experience in space weather research. The participation of Bangladesh's Space Research and Remote Sensing Organization (SPARRSO) in this program could accelerate knowledge acquisition and strengthen the nation's capacity in space weather monitoring and research, contributing to the country's advancement in space science.

### 7.2.3 The Third APSCO & ISSI-BJ Space Science School Held in Thailand



**Photograph 7.2.3 Snap of the delegates who attended in the International Program**

Mahmuda Masum, Senior Assistant Secretary & Nasrin Sultana, Senior Scientific Officer participated in the 3<sup>rd</sup> APSCO & ISSI-BJ Space Science School which was organized by APSCO jointly with International Space Science Institute in Beijing (ISSI-BJ), hosted by the Geoinformatics and Space Technology Development Agency (GISTDA) in Si Racha, Chon Buri, Thailand on 17-24 October 2023. Participants from APSCO Member States Bangladesh, China, Iran, Mongolia, Peru, Thailand and Türkiye attended the school.

The instructor team of International Space Science School was consisted of renowned experts in the field of planetary science, who presented in-depth lectures on the scientific mission of lunar exploration with young scholars from APSCO Member States, Germany and other countries. The event provided young outstanding students in the field of space science from various countries

with an opportunity to learn about the development of planetary science in China, the frontiers of international planetary science, organizing and participating in international cooperation, and also learned about methods of using data collected and provided by the China's space science missions. All scholars were divided into two working groups on topics of Understanding the Gravity Field of the Moon and Field Geology of the Moon. On the last day of the school, participants provided excellent presentations based on their case studies in the working groups.

#### **7.2.4 International Workshop on Aerospace Application for Earthquake Early Warning and Quick Response**

M. Nur Hossain Sharifee, Chief Scientific Officer, Mohammad Imrul Islam, Senior Scientific Officer, Farhana Tazneen, and S M Ahsan Habib, Senior Scientific Officer of SPARRSO participated in the “International Workshop on Aerospace Application for Earthquake Early Warning and Quick Response” and short training course “Aerospace Application for Earthquake Early Warning and Quick Response” organized by APSCO (Asia-Pacific Space Cooperation Organization) in Turkiye on 23-27 October 2023. In this workshop, researchers and delegates of different countries presented their research related to earthquake early warning mechanisms. Besides, delegates of different countries presented their research under the APSCO Framework Project and final presentation on the research project entitled “Estimation of population affected by flood using Remote Sensing and GIS Techniques” was presented.



**Photograph 7.2.4 Snap of the delegates attended in the International Workshop on Aerospace Application for Earthquake Early Warning and Quick Response**

### 7.2.5 Seminar on Emergency Rescue for Bangladesh

Mohammad Imrul Islam, Senior Scientific Officer participated seminar on “Emergency Rescue for Bangladesh” organized by Red Cross Society of China in Beijing, China from 16<sup>th</sup> April 2024 to 29<sup>th</sup> April 2024. The seminar on Emergency Rescue for Bangladesh focuses on sharing the knowledge, skills and good practice in the field of emergency response practiced in China to the officials of Bangladesh.



**Photograph 7.2.5** Few snaps during seminar.

### 7.2.6 The Second Workshop on International Lunar Research Station (ILRS) and Short Training on Lunar and Planetary Science



**Photograph 7.2.6:** Participants attended Short Training on Lunar and Planetary Science

The Lunar Exploration and Space Engineering Center of the China National Space Administration (CNSA), the Asia-Pacific Space Cooperation Organization (APSCO), and Deep

Space Exploration Laboratory co-organized the Second Workshop on International Lunar Research Station (ILRS) and Short Training on Lunar and Planetary Science in Wuhan, Hubei Province, China, April 24-28, 2024. The workshop was attended by invited professionals and scholars from space agencies, research institutes, universities, and the scientific and engineering fields of the APSCO Working Group for Joint Study on ILRS. The training and workshop were scheduled immediately after China's Space Day. The APSCO-CNSA Joint Study on ILRS was the workshop's main topic. Presentations on the Chang'e 8 Mission's plans and deep space exploration-related subjects were given by experts from APSCO Member States and Observers. There was a discussion over the joint study's scientific objectives on ILRS. Besides, the short training on Lunar and Planetary Science was organized on 28 April 2024. The training contents included Water in the Moon, Lunar-based Astronomy-probing cosmic origin and evolution from the Moon and Space Weather Station on the Moon. SPARRSO's Senior Scientific Officer, Farhana Tazneen and Scientific Officer, Muhammad Sharif participated in this program.



# **Chapter 8**

## **LOCAL EVENTS**

## 8.1 Significant Local Events

### 8.1.1 Memorandum of Understanding (MoU) Signing with Bangladesh Bureau of Statistics (BBS)

A Memorandum of Understanding (MoU) was formally signed between the Bangladesh Bureau of Statistics (BBS) and the Bangladesh Space Research and Remote Sensing Organization (SPARRSO) at BBS auditorium in the presence of the esteemed secretary of Ministry of Planning and senior representatives from SPARRSO and BBS on 3<sup>rd</sup> April 2024. This agreement marks a significant step toward enhancing collaboration in data sharing, statistical analysis and the application of remote sensing technologies for national development. The partnership aims to leverage the strengths of both institutions to improve decision-making processes, foster innovation and promote sustainable development initiatives across Bangladesh.



**Photograph 8.1.1a: MoU Signing Ceremony between SPARRSO and BBS**



**Photograph 8.1.1b: Chairman, SPARRSO and Director-general, BBS were signing MoU**

### **8.1.2 Annual Performance Agreement (APA) Signing with Ministry of Defence (MoD)**

The Annual Performance Agreement signing ceremony was held on 30<sup>th</sup> June 2024 at the Ministry of Defence, with the Secretary of the Ministry of Defence, the Chairman of SPARRSO and the chiefs of several organizations in attendance. This significant event marked a unified commitment to ensuring the smooth execution of procurement plans aimed at enhancing national capabilities in defense, space research and technological advancements. The agreement fosters collaborative efforts among the organizations, ensuring resource optimization and technological integration.



**Photograph 8.1.2a: Participants of APA Signing Ceremony**



**Photograph 8.1.2b: APA signing ceremony between Secretary, MoD and Chairman, SPARRSO**

## 8.2 In-House Workshop

### 8.2.1 Inception workshop on Research Activities of SPARRSO

The inception workshop on the research activities of SPARRSO was held on 7<sup>th</sup> November 2024, presided over by Mahmud Ali, Member of Research at SPARRSO. The workshop aimed to provide a platform for discussing ongoing and future research initiatives, with a focus on leveraging space technology and remote sensing for national development. Researchers from various sectors participated, sharing insights and exploring collaborative opportunities in areas such as environmental monitoring, disaster management, agriculture, and climate studies. The event emphasized the importance of innovative research in addressing critical challenges and advancing SPARRSO's mission to contribute to sustainable development in Bangladesh.



**Photograph 8.2.1: Workshop on Research Activities of SPARRSO**

### 8.2.2 Workshop on Ocean Remote Sensing

On 16<sup>th</sup> November 2023, a workshop on "Ocean Remote Sensing" for Building Smart Bangladesh under the e-Governance innovation action plan 2023-24 was held, presided over by Mahmud Ali, Member of Research at SPARRSO. The workshop focused on the strategic use of ocean remote sensing technologies to support the national vision of a Smart Bangladesh, particularly through enhanced marine resource management and environmental monitoring. Participants discussed how remote sensing can provide critical data for decision-making,

contributing to the broader goals of the E-Governance Innovation Action Plan. The event highlighted the role of cutting-edge technology in promoting sustainable development, improving governance, and advancing digital solutions for ocean monitoring and national progress.



**Photograph 8.2.2a: Workshop on Ocean Remote Sensing**



**Photograph 8.2.2b: Participants of the Workshop on Ocean Remote Sensing**

### **8.2.3 Workshop on SPARRSO Capacity Building Project**

On 2<sup>nd</sup> January 2024, a workshop on the "SPARRSO Capacity Building Project" was held, with Principal Secretary Tofazzal Hossen Mia as the chief guest and attended by about ten secretaries from various government ministries. The workshop focused on enhancing SPARRSO's capabilities in space technology, remote sensing and research to support national development goals. Key discussions revolved around strengthening institutional capacity, improving technical infrastructure and fostering collaboration between government agencies for better data-driven decision-making. The presence of high-level officials underscored the importance of building a robust framework for SPARRSO's future growth, ensuring it remains a critical player in advancing Bangladesh's technological and environmental research landscape.



**Photograph 8.2.3a: Workshop on SPARRSO Capacity Building Project**



**Photograph 8.2.3b: Participants of the Workshop on SPARRSO Capacity Building Project**

### 8.2.4 Others Important Workshop in SPARRSO

SL. No.	Heading/Caption of Workshop	Description in Brief	Date of Workshop
01	Consultation Workshop on the Activities of SPARRSO	The Consultation Workshop held on to focus SPARRSO's activities under the Annual Performance Agreement (APA). It brought together officials, researchers and stakeholders to evaluate the organization's ongoing initiatives, emphasizing alignment with the strategic goals set under the APA framework	20 <sup>th</sup> November 2023
02	Memorandum of Understanding (MoU) Signing Workshop	Two Memorandums of Understanding (MoUs) were signed in a ceremony held at the SPARRSO auditorium. The first MoU was signed between SPARRSO and the Bangladesh Meteorological Department (BMD) and the second MoU was signed between SPARRSO and the Survey of Bangladesh (SoB). The MoU aims to strengthen cooperation among the three organizations in the areas of space research, meteorological data sharing and geospatial information for national development	31 <sup>st</sup> January 2024
03	Workshop on Application of Space Technology in Fisheries	Workshop on the "Application of Space Technology in Fisheries" was held, bringing together experts, researchers, and stakeholders from both the space technology and fisheries sectors. The workshop focused on exploring how space-based remote sensing and satellite data can be applied to improve fisheries management, enhance resource monitoring, and support sustainable fishing practices	6 <sup>th</sup> February 2024
04	Workshop on Application of Space Technology in Forestry	Workshop on the "Application of Space Technology in Forestry" was held, bringing together forestry experts, scientists and stakeholders to explore the use of space-based technologies in forest management and conservation. The workshop highlighted how satellite remote sensing and geospatial data can be applied to monitor forest cover, detect deforestation, assess biodiversity and manage forest resources more sustainably	13 <sup>th</sup> February 2024

05	Workshop on Application of Space Technology in Agriculture	The workshop on, focusing on the "Application of Space Technology in Agriculture," brought together agriculture officers, scientists, and technology experts to explore how satellite data and remote sensing can revolutionize agricultural practices. The discussions centered on using space technology for precise crop monitoring, resource management and farming strategies that could improve soil health, moisture tracking and crop growth analysis	19 <sup>th</sup> February 2024
06	Workshop on Promotion and Development of the Website for SPARRSO	Workshop on the "Promotion and Development of the Website for SPARRSO" was held, focusing on enhancing the organization's digital presence and accessibility. The workshop brought together IT experts, web developers and SPARRSO officials to discuss strategies for creating a user-friendly, informative and interactive website that showcases SPARRSO's research, projects and services	3 <sup>rd</sup> March 2024
07	Workshop on Finalization of Annual Performance Agreement	On, a workshop on the "Finalization of the Annual Performance Agreement (APA)" for the financial year 2024-25 was held, involving SPARRSO officials and key stakeholders. The aim was to review and finalize the organization's performance targets for the upcoming year. The workshop concentrated on aligning SPARRSO's objectives with national development priorities, improving accountability, and enhancing operational efficiency	16 <sup>th</sup> April 2024
08	Workshop on Preparation of Development Project Proposal (DPP)	Workshop on the "Preparation of Development Project Proposal (DPP)" was held, with Dr. Md. Taibur Rahman as the keynote speaker. The workshop focused on equipping SPARRSO officials and project planners with the knowledge and skills needed to effectively draft and submit development project proposals. Dr. Rahman emphasized the importance of a well-structured DPP in securing government approval and funding for key initiatives, particularly in the areas of space technology, environmental research, and national development	21 <sup>st</sup> May 2024

## 8.3 In-House Training

### 8.3.1 Training on Online System of Concessional Funds Allocated and Payment Process Through EFT

A training session on the "Online System of Concessional Funds Allocation in favor of Autonomous Institutions and the Payment Process through EFT" was held at the SPARRSO auditorium on September 23<sup>rd</sup>, 2023 under National Integrity Strategy. The event aimed to familiarize participants with the mechanisms for accessing and managing concessional funds allocated to autonomous institutions, ensuring smooth operations through the efficient use of the Electronic Funds Transfer (EFT) system. Attendees gained insights into the procedural requirements, digital tools and payment workflows, fostering a deeper understanding of the online processes critical for institutional financial management.



**Photograph 8.3.1a: Training on Online System of Concessional Funds Allocated and Payment Process Through EFT**



**Photograph 8.3.1b: Participants of the Training on Online System of Concessional Funds Allocated and Payment Process Through EFT**

### **8.3.2 Training on Ocean Remote Sensing (Application)**

A four-day training program on "Ocean Remote Sensing (Application)" is set to commence on November 15<sup>th</sup> 2023, in the Geo-informatics Lab. Key-note speaker of the training was Dr. N. Srinivasa Rao and Dr. Atish Latikar, the Scientist of Indian National Centre for Ocean Information Services (INCOIS). This program is aimed at providing participants with in-depth knowledge and practical skills in using remote sensing technologies for ocean-related applications. The training will cover advanced techniques for analyzing oceanographic data, with a focus on real-world uses such as marine resource management, environmental monitoring, and climate change studies. Through interactive sessions and expert guidance, participants will gain hands-on experience in leveraging these technologies for ocean research and conservation.



**Photograph 8.3.2: Participants of the Training on Ocean Remote Sensing**

### 8.3.3 Others Important Training in SPARRSO

SL. No.	Heading/Caption of Training	Description in Brief	Date of Training
01	Training on Office Management	Training session on "Office Management" under National Integrity Strategy (NIS)" was held, focusing on enhancing administrative efficiency and management practices within the framework of the National Integrity Strategy (NIS). The training aimed to equip participants with the skills and knowledge required to improve office operations, ensuring transparency, accountability, and better coordination in line with NIS guidelines	17 <sup>th</sup> January 2024
02	Training on Financial Management	Training session on "Financial Management" under Annual Performance Agreement (APA)" was conducted for officers and staff. The session aimed to enhance participants' understanding of financial planning, budgeting, and reporting within the framework of the Annual Performance Agreement	30 <sup>th</sup> January 2024

		(APA). Emphasizing fiscal responsibility and accountability, the training covered essential topics such as resource allocation, expenditure tracking, and financial compliance	
03	Training on Public Procurement Rules (PPR)	Training session on "Public Procurement Rules (PPR)" was conducted for officers and staff. The session focused on familiarizing participants with the key principles and procedures of public procurement, ensuring transparency, fairness and compliance with legal regulations. The training covered essential topics such as procurement planning, tender processes, contract management and ethical considerations	7 <sup>th</sup> February 2024
04	Training on Project Management	Training session on "Project Management" was conducted, aimed at enhancing the skills of participants in managing projects efficiently from initiation to completion. The session covered key aspects of project planning, execution, monitoring, and evaluation, emphasizing the importance of time management, resource allocation, and risk mitigation. Participants were introduced to modern project management tools and techniques to ensure successful project delivery while adhering to organizational goals and timelines	5 <sup>th</sup> May 2024
05	Training on Development Project Proposal (DPP)	Training session on "Development Project Proposal (DPP)" was conducted, focusing on equipping participants with the skills to design and develop comprehensive project proposals. The session covered critical elements of the DPP process, including project justification, cost estimation, timeline creation and alignment with organizational and national development goals	12 <sup>th</sup> May 2024

#### 8.4 Visitors to SPARRSO

During this time, numerous visitors from various organizations/agencies visited to SPARRSO. They have an intense curiosity to learn more about SPARRSO and its activities. Below is a list of the officials from various organizations who visited SPARRSO during the reporting period:

Sl. No.	Organization	Date
01	A2I visit	3 July 2023
02	ICIMOD delegate visit	9 July 2023
03	Korean delegate visit	19 July 2023
04	French delegate visit	22 July 2023
05	ISPR visit	5 September 2023
06	NOAMI visit	19 November 2023
07	Bangladesh Air Force	3 March 2024
08	Bangladesh Navy	14 May 2024



**Photograph 8.4a: ICIMOD and Korean delegate visit to SPARRSO**



**Photograph 8.4b: French delegate visit to SPARRSO**



**Photograph 8.4c: AZI and ISPR visit to SPARRSO**



**Photograph 8.4d: NOAMI and BD Air Force visit to SPARRSO**



**Photograph 8.4f: BD Navy visit to SPARRSO**