ANNUAL REPORT

SPARRSO

July 2022-June 2023

Bangladesh Space Research and Remote Sensing Organization (SPARRSO)
Ministry of Defence
Government of the People's Republic of Bangladesh

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Agargaon, Sher-e-Bangla Nagar
Dhaka 1207, Bangladesh

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SPARRSO

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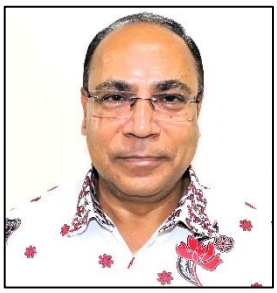
September 2023

Father of the Nation Bangabandhu Sheikh Mujibur Rahman

"We will build Bangladesh as a developed and prosperous country by 2041. That Bangladesh will be a Smart Bangladesh. We will transform into Smart Bangladesh from the digital one"

-Sheikh Hasina, Honourable Prime Minister
The People's Republic of Bangladesh
Dhaka, 12 December 2022



Chairman
Additional Secretary
SPARRSO
& Advisor of Editorial Committee

Foreword

It is my pleasure to present the Annual Report on the Development Activities, Research and Application works of Bangladesh Space Research and Remote Sensing Organization (SPARRSO) for the financial year of 2022-2023.

At the very outset, I would like to pay glowing homage to the Father of the Nation Bangabandhu Sheikh Mujibur Rahman, who has initiated the space application related activities in the country right after the independence in 1972. During his tenure, he adopted Earth Resources Technology Satellite (ERTS) Programme in line with the ERTS Programme of the United States National Aeronautics and Space Administration (NASA). In continuation of this, Bangladesh Landsat Programme (BLP) was introduced in 1975 which later merged with Space and Atmospheric Research Centre (SARC) to establish SPARRSO. With the passage of time, SPARRSO is now turned into the "National Focal Point" for space-related activities at home and abroad.

We are committed to fulfill the requirement Sustainable Development Goals (SDGs) through our research works using space and remote sensing technology. Over the years, our research projects are outlined to contribute to the development agenda of the stakeholder Ministries/Divisions/Organizations. The efforts continued in this 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, in requirement of fulfilling Smart Bangladesh agenda of Honorable Prime Minister Sheikh Hasina, 2041 visionary plan and SDG goals, SPARRSO has also set up short-term, medium-term and long-term plan in this financial year, that will guide this organization to move forward to next decades.

In this regard, I would like to greatly acknowledge the continued support and guidance from the Ministry of Defence and we are looking forward the same to the years to come. The Board of Directors and I would like to highly appreciate the inspiration received from the Scientists, Engineers and support-staff of SPARRSO, who work tirelessly for the progressive development of this organization for space science and technology.

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

Md Abdus Samad

Member
SPARRSO
& 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 2022 to June 2023. 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.

M. Mahmud Ali

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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 & Disaster Management, Environment & Forest, Land, Fisheries & Livestock, Defence and others. It also provides information to different departments and organizations, such as Prime Ministers' Office (PMO), Cabinet Division, Bangladesh Meteorological Department (BMD), 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.

The Honorable Prime Minister of the Government of the People's Republic of Bangladesh recently approved the "Strategy Paper for Modernization of SPARRSO". In this context, short, medium and long-term plans have been adopted for the advancement of knowledge regarding space and remote sensing technology, its progress and utilization and infrastructural development.

This annual report for the fiscal year of 2022-2023 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 conduct 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 government about the space and relevant policies of different countries and advise government in this issue on policy decision.

4. Conduct survey, training, and research using space science and remote sensing technology and collaborate 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 Board of SPARRSO

SPARRSO is governed by a Board consisting of Chairman and four Members. As of 30 June, 2023, the members of SPARRSO Board were as follows:

Name	Position in Board
Mr. Md Abdus Samad	Chairman (Additional Secretary)
Mr. M. Mahmud Ali	Member (Research) (Joint Secretary)
Mr. M. Mahmud Ali	Member (Technology-1) (Additional Charge)
Mr. M. Mahmud Ali	Member (Technology-2) (Additional Charge)
Mr. Manash Mitra	Member (Application) (Joint Secretary)

1.3 Officers of SPARRSO

List of existing officers of SPARRSO is enumerated below: (As of 30 June 2023)

Sl	Name	Designation	Phone (Office)	Email
1.	Md Abdus Samad	Chairman (Additional Secretary)	+88-02-48117692	chairman@sparrso.gov.bd
2.	Mr. M. Mahmud Ali	Member (Research) (Joint Secretary)	+88-02-48118572	membertech1@sparrso.gov.bd
3.	Mr. M. Mahmud Ali	Member (Technology-1) (Additional Charge)	+88-02-48118572	membertech1@sparrso.gov.bd
4.	Mr. M. Mahmud Ali	Member (Technology-2) (Additional Charge)	+88-02-48118572	membertech1@sparrso.gov.bd
5.	Manash Mitra	Member (Application) (Joint Secretary)	+88-02-48113401	memberapp@sparrso.gov.bd
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Sl	Name	Designation	Phone (Office)	Email
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13.	Mr. Md. Abdul Kader	Senior Scientific Officer (on Lien)	+88-02-48113700	imrankadir@sparrso.gov.bd
14.	Mr. B.M. Refat Faisal	Senior Scientific Officer (on higher study abroad)		refatfaisal@sparrso.gov.bd
15.	Ms. Nasrin Sultana	Senior Scientific Officer		nasrin@sparrso.gov.bd
16.	Mr. Mohammad Imrul Islam	Senior Scientific Officer		imrul_islam@sparrso.gov.bd
17.	Ms. Farhana Tazneen	Senior Scientific Officer		farhana@sparrso.gov.bd
18.	Mr. S.A.M. Arif-Ul-Haque	Senior Scientific Officer		sam_arif@sparrso.gov.bd
19.	Mr. S M Ahsan Habib	Senior Scientific Officer		ahsan@sparrso.gov.bd
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21.	Mr. Md Monirul Islam Khondoker	Finance Officer (Acting)	+88-02-9134006	kmanirul@sparrso.gov.bd
22.	Mr. Rubel Kanti Dey	Information Officer	+88-02-58154816	rubelkanti@sparrso.gov.bd

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27.	Mr. Jagobandhu Some	Assistant Engineer	+88-02-48118583	jsome@sparrso.gov.bd
28.	Mr. Muhammad Sharif	Assistant Engineer		sharif@sparrso.gov.bd
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31.	Md. Shamim Reza Saimun	Scientific Officer		saimun.shamimreza@sparrso.gov.bd
32.	Mr. Milan Kumar Shiuli	Scientific Officer		milan.shiuli@sparrso.gov.bd
33.	Mr. Md. Farid Uddin	Scientific Officer		farid.uddin@sparrso.gov.bd
34.	Mostafizur Rahman	Scientific Officer		mostafizur034@gmail.com
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36.	Mehedi Hasan Peas	Scientific Officer		mehedi.inc@gmail.com
37.	Md. Jahidul Ashik	Scientific Officer		ashikurp@gmail.com
38.	Md. Rassal Mollik	Librarian		rassalm.duis@gmail.com

Chapter 2

RESEARCH AND APPLICATION ACTIVITIES

RESEARCH AND APPLICATION ACTIVITIES

SPARRSO's research and application endeavours have proven contributory in providing crucial insights for planning across various sectors, ultimately fostering sustainable development in the country. During the financial year 2022-2023, eleven research works were approved for implementation under Annual Research Works of SPARRSO that were successfully executed within the specified timeframe.

One of the implemented research works belongs to the agricultural sector. The objective of this research was to develop a model that will help in monitoring drought events, This research generated cropland layer of 16 districts of Rangpur and Rajshahi division using Sentinel 2 images. One research was related to the forestry sector which mapped tree cover for selected pilot areas of Bangladesh using Landsat images. It was a pilot study that will continue in the next financial year with an aim to map tree cover at the national scale.

There were three research works related to floods. One of them was to mark the flash flood events that occurred in Tanguar Haor and to find the linkage between those events with different hydro-meteorological parameters. This research will be implemented in two phases. First phase was completed in the last fiscal year. The goal of another research work was to map flood inundation depth using SAR data in Tanguar Haor. Remaining research work regarding flood was to prepare a flood risk map of the flood-prone Rangpur Division.

A research work on landslides was conducted under the Geology Division. It involved developing a landslide susceptibility map of Rangamati Sadar Upazila through field survey, visual analysis of satellite images, and GIS-based information. Another disaster-related research was regarding thunderstorms to understand the current scenario in Bangladesh and also to identify risk zones and the relation of thunderstorm intensity with meteorological variables. Field surveys and secondary data were used in this research. There was one research about analysing Teesta riverbank erosion and its impact on land use and land cover change.

Apart from these remote sensing application research, there were two studies on the space technology domain during the last fiscal year. In one research, the development of space mission simulation was attempted using MATLAB. The other research work was to develop UAV and Rover. The research work consists of two phases. In the first phase, UAV was designed and developed which was done in the last fiscal year and the rover will be designed in the next. Both these machines will be equipped with several remote sensing sensors. Another interesting study was about formulating a draft national space legislation for Bangladesh. All the research works implemented in the last financial year have been briefly described in the subsequent sections.

2.1 Atmospheric Research Division

Title: Study on Intensity, Vulnerability and Casualty of Thunderstorms over Selected Districts in Bangladesh and Find the Correlation between Thunderstorm and Meteorological Variables

Bangladesh is one of the worst disaster-prone areas in the world. Almost every year the country has to face many disaster events i.e., tropical cyclones, storm surges, tornados, norwester's, floods, land slide, heat & cold wave and so on. But, in recent year severe thunderstorm with associated lightning incidents are becoming more frequent and claiming more lives than in the past. Thunderstorms are powerful weather phenomena that can have significant impacts on various aspects of our lives. From heavy rainfall and strong winds to lightning and thunder, thunderstorms bring both awe-inspiring displays of nature's power and potential hazards. Understanding the factors that contribute to thunderstorm intensity is crucial for predicting and preparing for these events. Thunderstorms are violent weather systems. Fortunately, most thunderstorms are spatially small and temporally short-lived. Only a small fraction of all thunderstorms is classified as severe thunderstorms. It forms when moist and unstable air is continuously lifted vertically into the atmosphere. The main objective of this study is to increase the understanding of thunderstorm & associated lightning hazard in the context of Bangladesh and support risk reduction initiatives for saving lives. The present research carried out a systematic process to understand intensity, casualty, vulnerabilities of thunderstorm & lightning hazard based on the observations and satellite data. The specific objectives of the study are: (1) Briefly analyze the intensity, vulnerability, and casualty of thunderstorms over selected districts in Bangladesh; (2) To study and understand the formation mechanism, characteristics, and feature about thunderstorm over selected districts in Bangladesh, and (3) To find out the correlation between thunderstorms and meteorological variables (i.e., pressure, temperature, cloud, and others).

The current research has two parts. Part-1 describes the trend of thunderstorms and thunderstorm risk zones identification over the study areas and part-2 describes the relation of thunderstorm intensity with meteorological variables. This is the study to analyze the current thunderstorms scenario of Bangladesh. It is mostly considered that observed and available meteorological and satellite data are used to understand the characteristics of thunderstorm and have developed the relation between thunderstorms and meteorological parameters (i.e., pressure, temperature, cloud, and others.). The observed meteorological data is collected from Bangladesh meteorological department (BMD). The collected parameters are daily thunderstorms events, temperature, dew point temperature, daily cloud coverage, relative humidity, rainfall, maximum temperature, pressure etc. The collected data is for the time period of 1990 to 2020. Open source satellite data is also used to analyze the lifted index (LI), cloud reflectance & cloud effective radius in specific regions of the study areas. Six random surveys are conducted over six study areas. There are 06 districts selected as the study areas of the research considering the recent vulnerabilities and casualties due to thunderstorms events. The districts are Sylhet, Moulvibazar, Kishoreganj, Mymensingh, Rajshahi and Cox's Bazar.

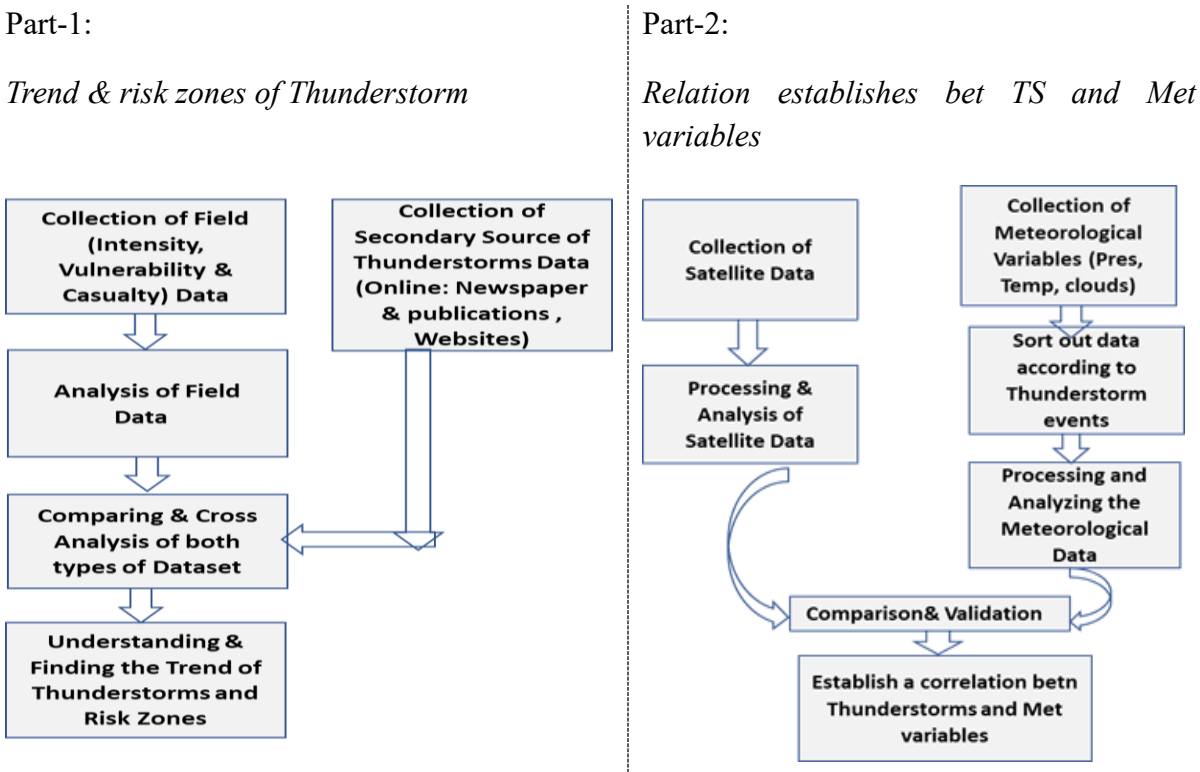


Figure 2.1 Flowchart of Methodology

The meteorological data analysis of the study area Sylhet is given below. Here we have taken meteorological data from 1990 to 2020 for showing yearly trends of Thunderstorm with different variables. The yearly thunderstorms (TS) versus different meteorological parameters such as yearly average cloud coverage (CC), average relative humidity (ARH), average dew point temperature (ADPT), average rainfall, average pressure (AvgP), maximum temperature (MaxT) is presented in Figure 2.2. The thunderstorms are analyzed with two different meteorological parameters to understand the variation of thunderstorms with those two parameters. The three-dimensional analysis of the intensity of thunderstorms with two different parameters is shown in Figure 2.3.

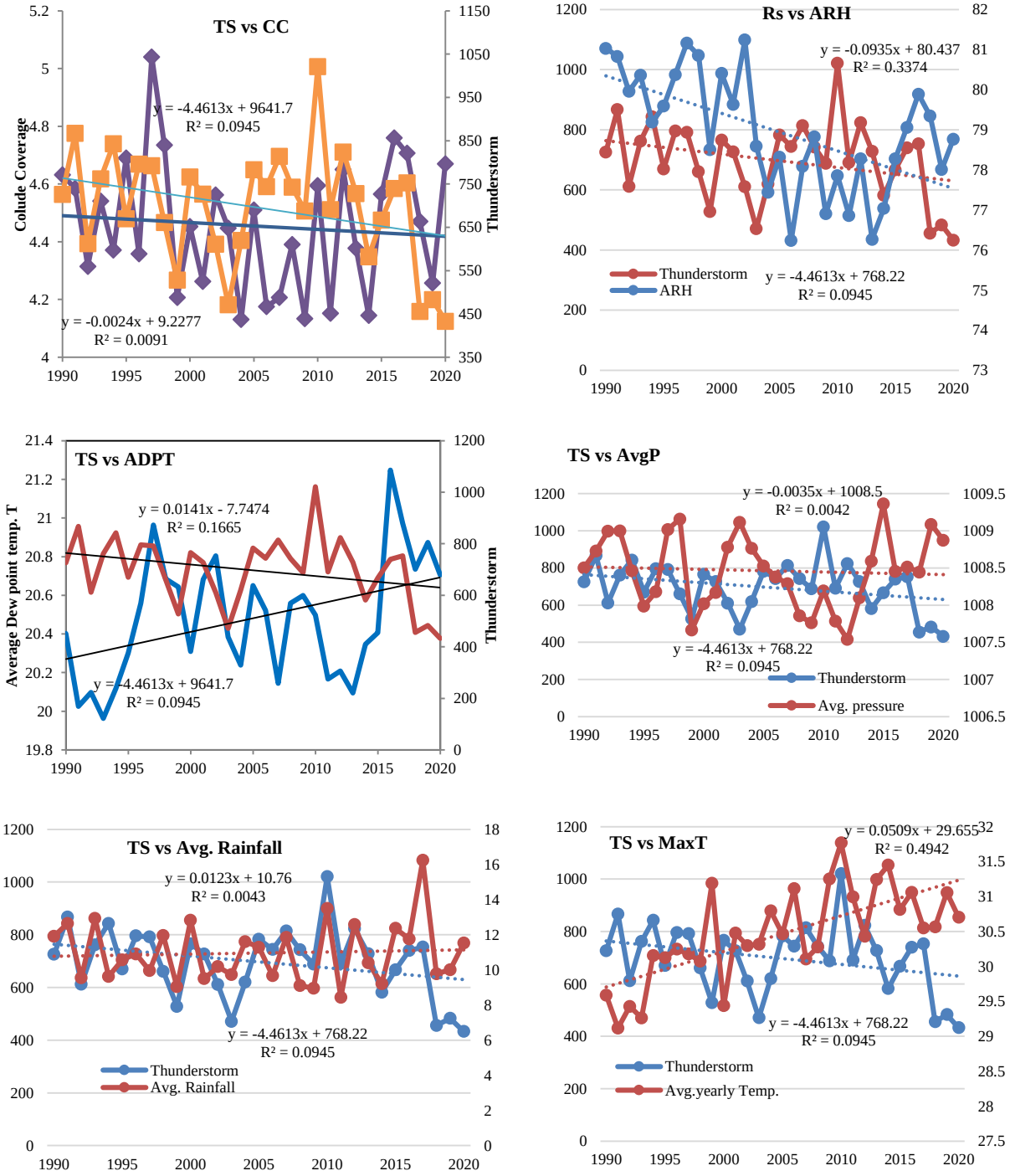


Figure 2.2 Thunderstorms (TS) versus different meteorological parameters.

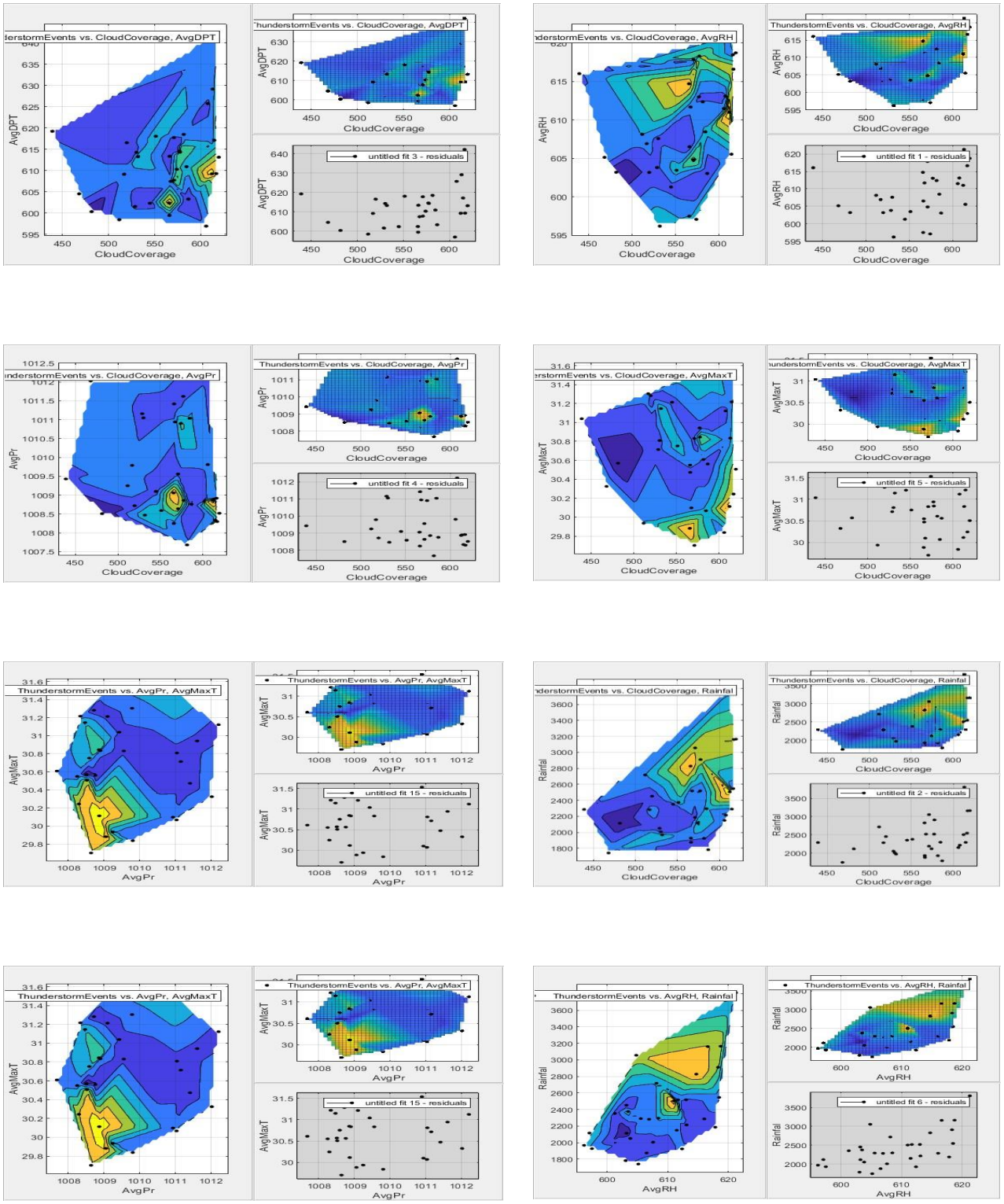


Figure 2.3 The three dimensional analysis of the intensity of thunderstorms with two different parameters.

2.2 Agricultural Division

Title: Developing an Agricultural Drought Monitoring Model Based on Multi-source Remote Sensing Data

Research problem/statement and objectives

On average, there is a drought every 2.5 years or more and local droughts are prevalent. Nowadays, central, northern, and north-western parts of the country are most vulnerable to droughts. Drought typically first affects agriculture after a meteorological drought but before a hydrological one. A recent study has found that in recent decades, North Bengal has undergone considerable increases in rainfall variability, protracted seasonal-scale dry spells, and several occurrences of below-normal rainfall, which has hampered crop growth. Additionally, the yields of crops (such rice and wheat) in North Bengal are significantly impacted by temperature variations. The country is mostly affected by drought during the Kharif seasons among the three (Kharif I, Kharif II, and Rabi) cropping seasons.

Different studies have investigated spatiotemporal aspects of droughts in Bangladesh following traditional and remote sensing approaches. Drought indices (DIs) are used to assess droughts according to their severity, duration, and geographic scope. Over the last few years, researchers have been trying to integrate multiple drought-related parameters to develop comprehensive drought models, whereas traditional remote sensing (RS) based drought monitoring models focus on specific characteristics which may not be accurate. Different multisource RS approaches have been proposed for the last few years. In the realm of scientific study, machine learning algorithms are becoming increasingly popular as state-of-the-art technology along with data mining methods to build precise drought models. Different machine learning algorithms such as random forest classification, and regression trees have been proposed in several studies. This study aims to develop an optimized machine learning algorithm based on the latest RS datasets to monitor droughts.

The objectives of the research:

1. To identify drought indices and remote sensing products capable to detect drought event in Bangladesh.
2. To investigate significant meteorological factors triggering drought events in Bangladesh.
3. To develop a model to monitor drought events.
4. To generate updated cropland layer.

Research Methodology

Study area

The study area comprises north-western region of the country including 16 districts of Rajshahi and Rangpur division.

Data Used

In situ observed meteorological data such as monthly average temperature (minimum, maximum and average), humidity, sunshine hours, and monthly total rainfall available in 6 (six) stations (Bogra, Dinajpur, Ishwardi, Rajshahi, Rangpur and Saidpur) of Bangladesh Meteorological Department (BMD) were collected. MOD09A1.061 Terra Surface Reflectance (Srf_Ref) 8-Day Global data product at 500 meter resolution, MOD11A2.061 product of Terra Land Surface Temperature (LST) and Emissivity 8-Day Global data at 1000 meter resolution, MOD16A2.006 Terra Net Evapotranspiration (ET) 8-Day Global data product at 500 meter resolution, CHIRPS daily rainfall data product at 5500 meter resolution, Soil Moisture (SM) data of GLDAS-2.1: Global Land Data Assimilation System, SRTM Digital Elevation Model (DEM) data at 30 meter resolution and MOD13Q1.061 product of Terra Vegetation Indices (NDVI and EVI) at 16-Day Global and 250m resolution were used in this study using Google Earth Engine (GEE) platform. Evaporative Stress Index (ESI), highlighting areas with anomalously high or low rates of water use across the land surface was collected and used from the following server: https://gis1.servirglobal.net/data/esi/.

Methods

Different datasets are available in different spatiotemporal resolutions, which cannot be used directly. This study's datasets were resampled and reprojected into homogeneous spatiotemporal resolution using GEE. Indices (i.e., NDVI, EVI, VCI, ESI, VHI etc.) calculation, feature importance determination of meteorological factors (i.e., rainfall, temperature, humidity, sunshine hours etc.) and correlation among different aspects were executed using python kernel in Google Colab. Drought modeling based on Random Forest machine learning algorithm was conducted in GEE. Finally, the outputs were analyzed and visualized as figures, graphs, maps, and tables using different tools and libraries such as ArcGIS, MS Excel, Seaborn, Pyplot at Python etc. The whole methodology of this research (Figure 2.4) following is the detailed methodology followed in this study.

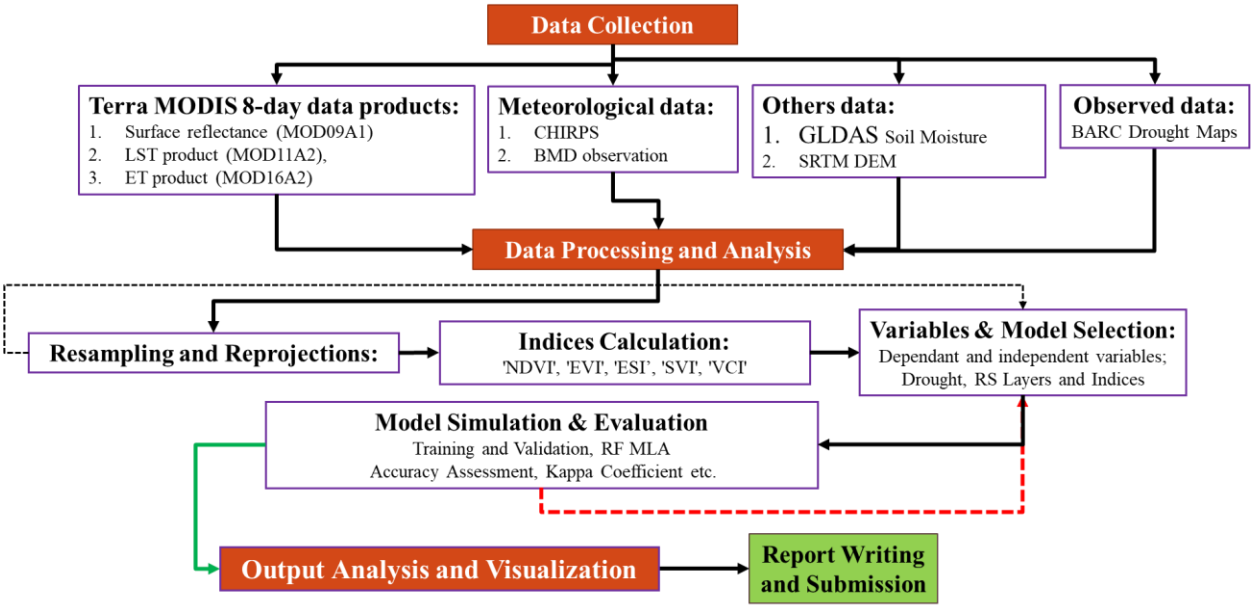


Figure 2.4 Methodology used in this study.

Result and Discussion

Climatology Analysis

In these regions, temperatures are relatively consistent over long periods of time and space, but rainfall is significantly erratic. Historical rainfall climatology and anomaly has been analyzed based on BMD observational records for the last 42 years (1981-2022) and found that there was an upward and downward trend in every 1 to 3-year interval. Based on the average annual rainfall climatology, minimum rainfall was recorded in 1994 followed by 2018. In station wise rainfall climatology rainfall below average is recorded in Rajshahi and Ishwardi stations. Below average rainfall was also recorded in Bogra station indicating the increase of drought threat within the study area.

Correlation between Meteorological factors and drought

A strong negative correlation has been found between drought and rainfall followed by humidity. On the other hand, sunshine hours, average temperature as well as minimum and maximum temperature have been found with moderate positive correlations. Negative correlations indicate that decreased rainfall and humidity can increase the severity of drought while increased temperature and sunshine hours may increase the severity of drought.

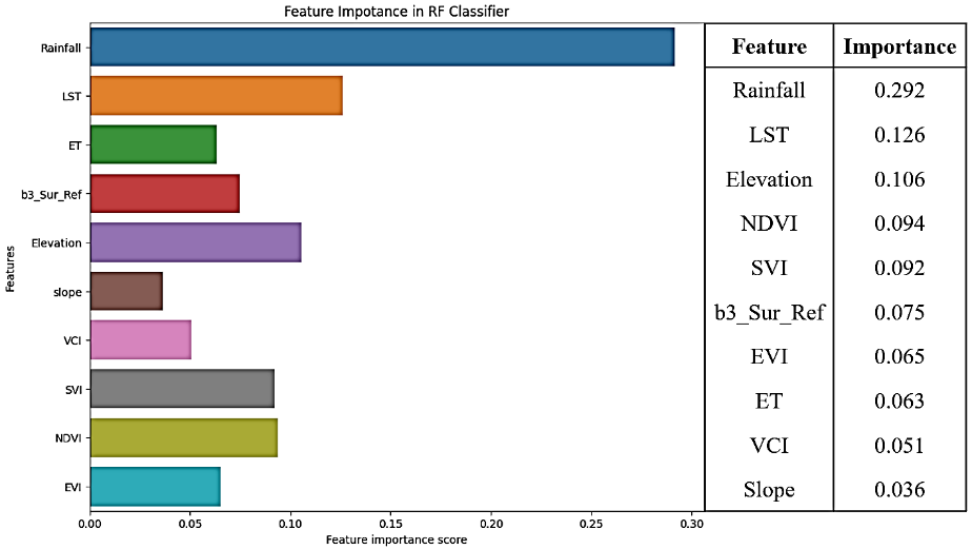
Correlation among Drought Indices, RS Layers and drought

Based on the correlation analysis among meteorological factors with drought severity, CHIRPS rainfall, Terra MODIS Land Surface Temperature (LST) and Evapotranspiration (ET) was considered as meteorological factors in drought modeling. Another correlation analysis was conducted to analyze the influence of different vegetation indices, meteorological factors as well

as other remotely sensed factors like surface reflectance, soil moisture, elevation, and slope on drought severity. The strongest correlation of drought has been found with precipitation (-0.77) followed by LST (0.59). Among the drought and vegetation indices, SVI and NDVI have shown moderate correlation with droughts. Other variables such as elevation, surface reflectance at band 3(459-479nm) of MODIS and slope have shown good correlation with droughts.

Contribution of Model Features

The feature importance of the Random Forest classifier in drought modeling was calculated in python using Google Colab. Among the variables known as features in Machine Learning Models, rainfall has been found with the maximum contribution while slope with minimum contribution in drought modeling. LST, elevation, SVI and NDVI were also found with significant contribution in drought modeling (Figure 2.5).



Feature	Importance
Rainfall	0.292
LST	0.126
Elevation	0.106
NDVI	0.094
SVI	0.092
b3_Sur_Ref	0.075
EVI	0.065
ET	0.063
VCI	0.051
Slope	0.036

Figure 2.5 Feature importance of RF Classifier in Drought Model.

Drought Classification

A classified drought map has been produced using Machine Learning Algorithm (Random Forest) in Google Earth Engine. The classified map has been represented in Figure 2.6 while the reference map has been represented in Figure 2.7 which was used to generate train-test sample points for drought classification. All the RS layers and drought indices have been used in drought monitoring model using Random Forest machine learning algorithm based on 70:30 train-testing ration. The model has performed well with 0.81 overall accuracy and 0.75 kappa values. In the classified drought map, very severe, severe, and moderate drought areas were classified quite well. The output classified map can be assessed visually in Figure 2.6 and Figure 2.7. Most of the areas were found similar to the reference map but due to 250-meter resolution of the classification output, small areas were not properly identified here.

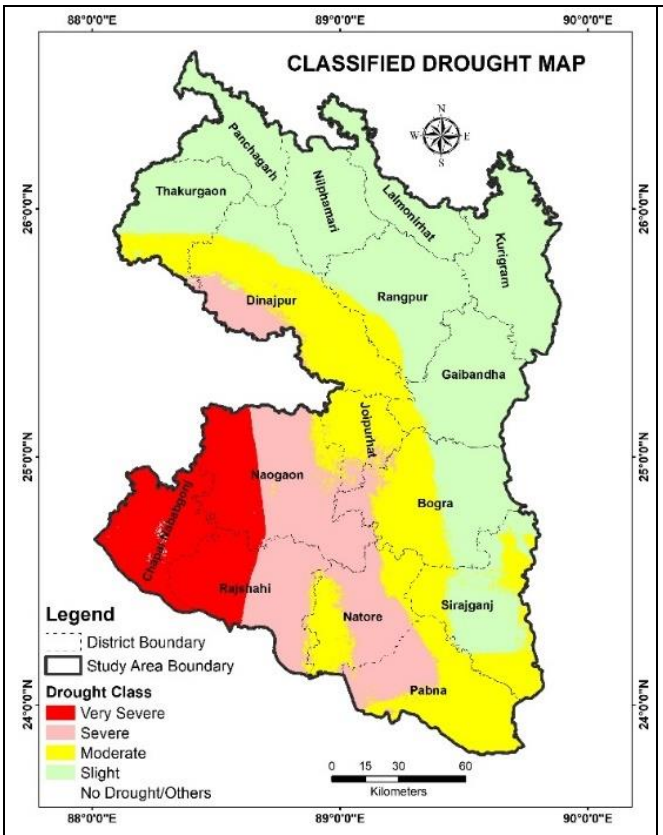


Figure 2.6 Machine learning (RF) based classified drought map of North-Western Bangladesh

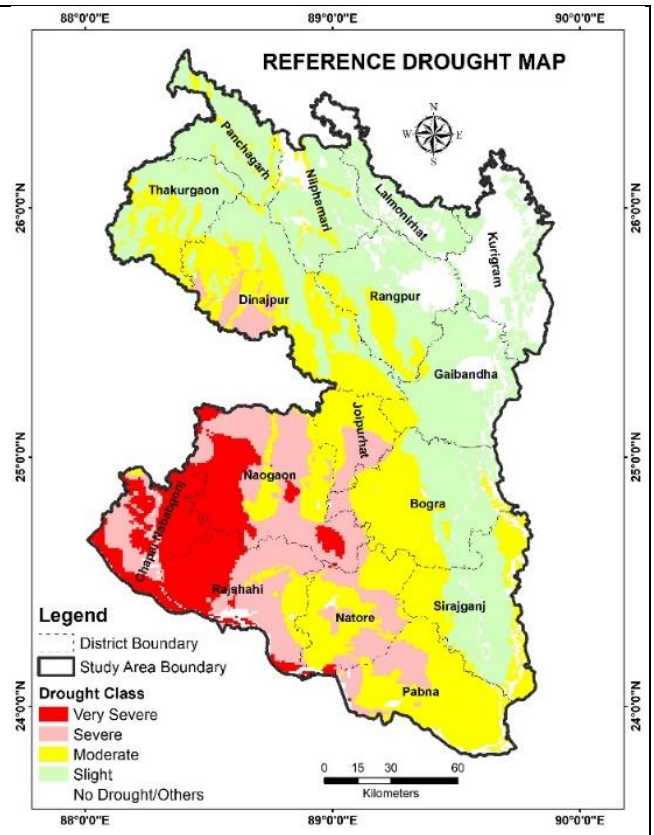
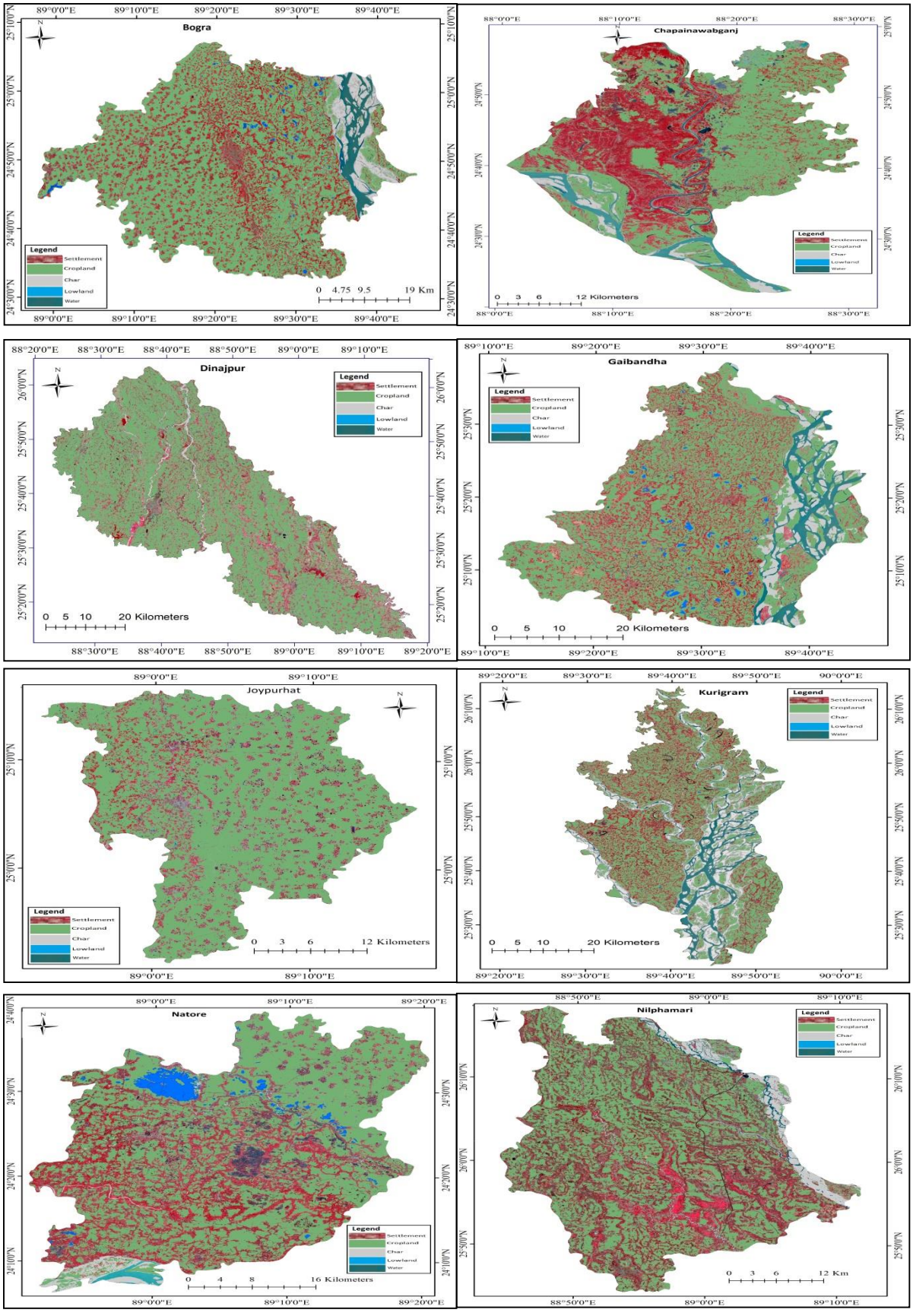


Figure 2.7 Referenced drought map of North-Western Bangladesh (Source: BARC)

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 16 districts of Rajshahi and Rangpur division using Sentinel-2 satellite image and eCognition software by object based approach (Figure 2.8). The object-based approach was chosen because pixel-based approach only extracts the information provided by each individual pixel, which creates the so-called 'salt and pepper' noisy effect on the classification, which can incorrectly classify pixels that are actually part of the same class. In e-Cognition segmentation algorithm uses three parameters: scale, shape weighting, and compactness weighting. Segmentation parameters are determined through a combination of trial and error, and experience. Parameters used in this study are scale parameter: 50, shape weighting: 0.6, compactness weighting: 0.7. The resulting objects are then classified by manually identified each segment in Arc GIS. In case of mixed segment cut polygon feature of Arc GIS was used to separate cropland from non-cropland.


Bogra
Legend
Settlement
Cropland
Char
Lowland
Water
0 4.75 9.5 19 Km
Chapainawabganj
0 3 6 12 Kilometers
Dinajpur
0 5 10 20 Kilometers
Gaibandha
0 5 10 20 Kilometers
Joypurhat
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Kurigram
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Natore
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Nilphamari
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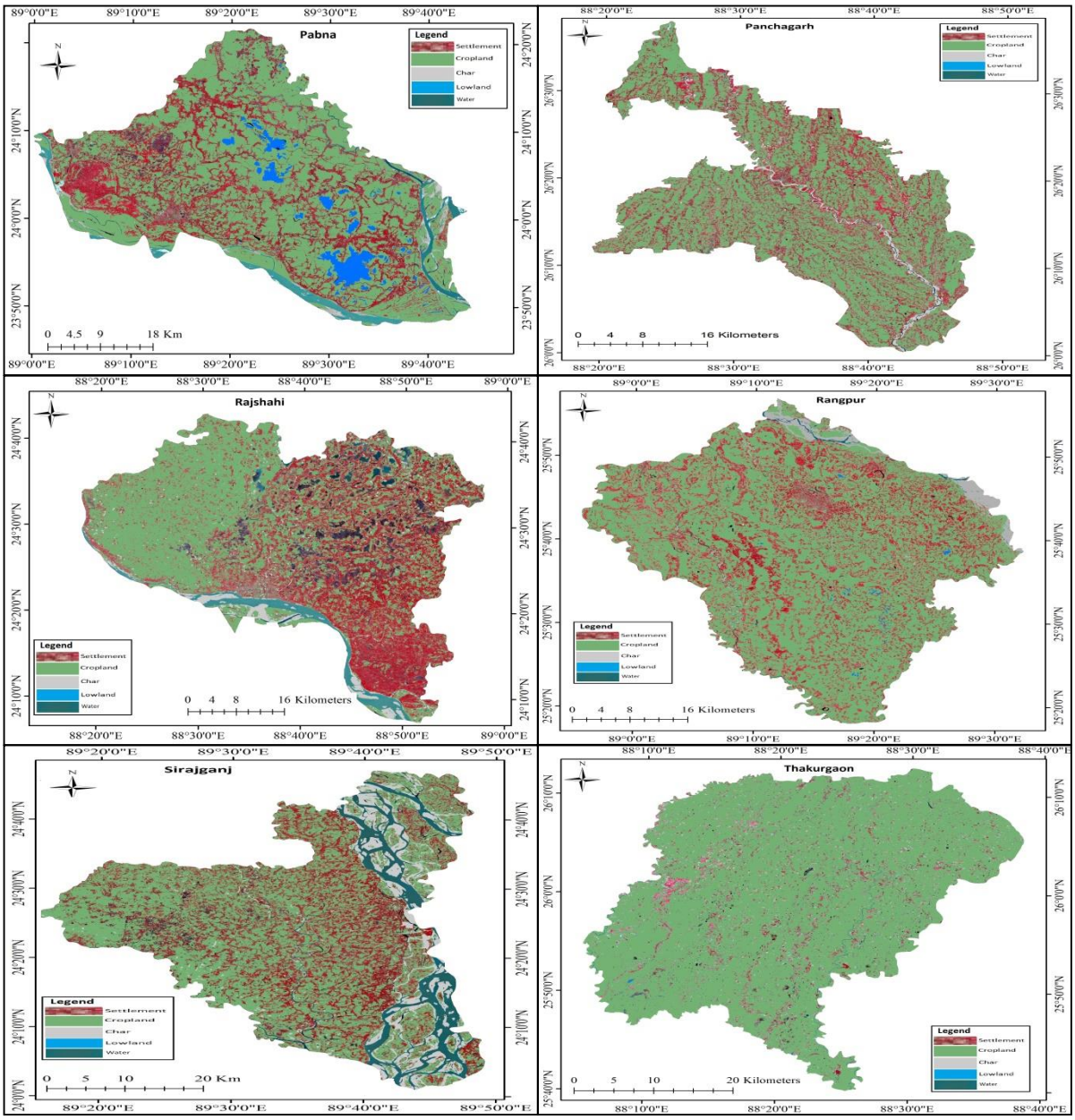


Figure 2.8 Spatial distribution of cropland layer (continued).

2.3 Forestry Division

Title: Pilot Study on Mapping Tree Covers in Bangladesh

Trees are important as they provide numerous goods to society and ecological elements that serve manifold ecosystem services including climate change mitigation, biodiversity conservation, landscape restoration, etc. Trees are facing threats worldwide, particularly to the tropics, especially due to extreme human intervention. The government of Bangladesh has planned to achieve Sustainable Development Goal (SDG), Life on Land, in the country by increasing tree coverage area to land area percentage to 25% by 2030. As a result, much attention and conservation initiatives are needed, which requires quantifying the tree stocks' present and past extents. Remote sensing technologies along with various machine learning techniques appear to be effective in mapping and monitoring tree cover for the past few decades and providing better performance than conventional approaches worldwide.

The objectives of this pilot study are (i) to develop a methodology for assessing tree covers in the country with seasonal Landsat data; knowledge of vegetation phenology will be used to discriminate trees from shrub land, cropland, and other vegetated land and (ii) to prepare tree cover maps using multi-temporal Landsat Data of the selected test site.

The methodological development was examined in the Landsat scene 136043 covering parts of Sylhet, Moulvibazar, and Habiganj Districts. A number of classification techniques including the use of maximum likelihood classification, minimum distance classification, and machine learning technique random forest (a decision trees algorithm) were considered to map forest/non-forest classes, and then to map forests classes within the generic forest mask and bamboo or shrub cover, cropland, and other land to non-forest class. The following parameters of Landsat image pixels were considered in the analysis: band reflectance value; normalized difference vegetation index (NDVI); tasseled cap, and thermal infrared band values.

To build the classification tree model, extensive training sets located in different land covers were created by visual interpretation of the cloud-free observation of Landsat-8/9 OLI/OLI-2 images of 2022-2023. Additional datasets include freely available Very High Spatial Resolution (VHSR) images from GoogleEarth, selected samples of procured VHSR images, and expert judgment were used as reference materials to aid image interpretation and select training data sets. Forest will be defined as the tree cover with 5 meters or more in height. The vast majority of image interpretation efforts were focused on distinguishing tree canopy from other vegetation like shrubs, tea gardens, and agricultural crops. This process has generated tree cover maps of 2023 for the pilot test site.

Finally, the Minimum Distance classification technique was used for map generation. Initially, ten classes were considered to be selected as training samples. The classes include forest, bamboo, aquatic vegetation, bare land (plain land), bare land (hills), water (dark), water (blue), cloud and shadow. Two classes of bare land and two classes of water were later merged to bare land and water, respectively.

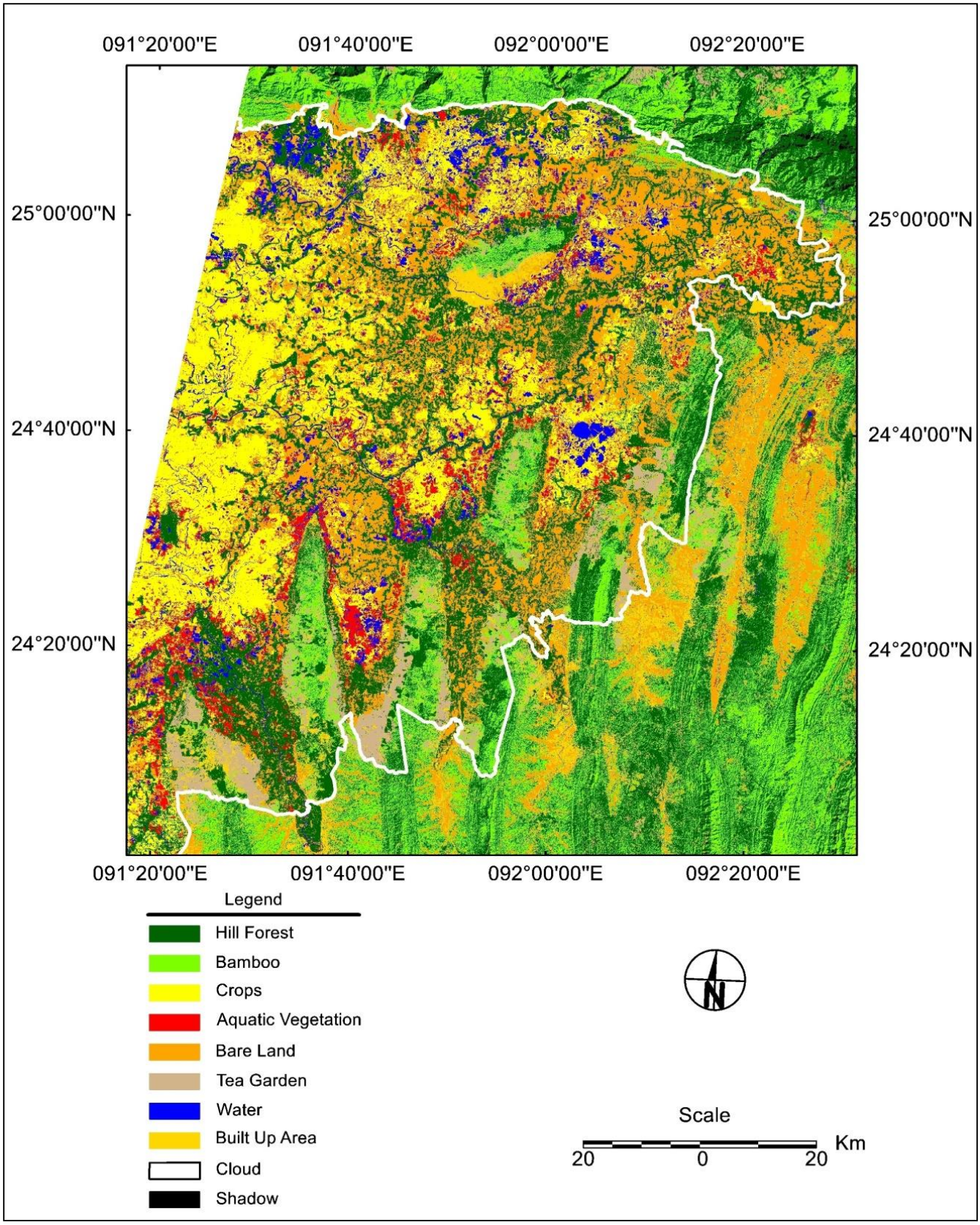


Figure 2.9. Tree cover map of Sylhet region.

Trees Outside Forests (TOF) was not classified as a separate class. Therefore, TOF was classified as either forest or bamboo. Bamboo in the TOF regions was recorded as a forest. Considerable misclassification for this scene was aquatic vegetation in the haor area that was misclassified as forest. Therefore, recoding was required to separate this class.

The tea garden was not classified as a separate class. The reflectance of most tea gardens acquired in February is classified as bare land. Therefore, all the bare lands in the elevated lands and the hilly regions were checked and recorded as tea gardens, if appropriate. The confusing tea gardens were mapped as polygons on Google Earth VHSR images and misclassified pixels on these polygons were recoded to the appropriate classes on the map

Aquatic vegetation grown in the haor areas was mixed with four different cover types, such as forest, cropland, aquatic vegetation, or bamboo. Finally compared with the unclassified satellite image, the aquatic vegetation grown in the haor areas was recorded as aquatic vegetation. This vegetation is seen on the dry period satellite images, for example, the images acquired in February. On the post-monsoon images, for example on the November satellite image, aquatic vegetation remains not visible as those are submerged underwater. The tree cover map of the Sylhet region is presented in Figure 2.9.

Upon successful development of tree-cover maps for the pilot area, the procedure will be extended to the entire country to generate tree-cover maps at the national scale. The mapping of test sites with reasonable accuracy will lead to the preparation of tree cover maps using satellite sensor data for the entire country in the next few years. However, it is understood from the pilots that the classification process took considerable time, and more manpower should be required. Also, it is also understood from the pilot that the remaining work to classify and generate tree cover maps might take even more than a year.

2.4 Water Resource Division

Title: Flood Risk Mapping of the Flood-prone Rangpur Division Using Remote Sensing and Multi-Criteria Analysis

Research problem/statements and objectives

Rangpur division of Bangladesh is situated south of Himalaya Mountains where upstream flow of mighty Brahmaputra River and its tributaries inundates this land and causes damage to the property almost every year during monsoon season (Jun-Sep). Flood risk mapping of the flood-prone Rangpur division can be the proper way to design the flood risk management system of the area to minimize the risk of the impact and loss of flooding.

In recent years, remote sensing and GIS tools has been intensely used for flood risk and vulnerability mapping. GIS environment can provide considerably satisfying results with good accuracy. Flood incidence and intensity are influenced by a variety of factors such as climate, geomorphological structure etc. Social and economic conditions of a region also influence the risk of flood. Thus, multi-criteria-based flood risk estimation will be more reliable and valid than the single criterion-based flood risk estimation. Some studies on flood susceptibility maps for the northwest part of Bangladesh which accounted physical parameters only. Since social aspects improves the reliability of flood risk mapping, present study has addressed social aspects along with physical aspects in risk mapping.

So, the aim of the present study is to prepare a comprehensive flood risk map for the flood-prone Rangpur Division of Bangladesh by integrating GIS and multi-criteria decision analysis using suitable physical and social vulnerability indicators in an expert-based model.

Research methodology

Rangpur division is one of the 8 (eight) administrative divisions of Bangladesh located in the northwestern part of the country. The division is located in latitude 25°20' to 26°37' north and longitude 88°50' to 89°53' east.

In the present study Digital Elevation Model (DEM), Sentinel 1 and 2, Rainfall data, River Network data and Social data are collected from USGS Earth Explorer, Sentinel open access hub, Bangladesh Meteorological Department, Local Government Engineering Department and Bangladesh Bureau of Statistics, respectively.

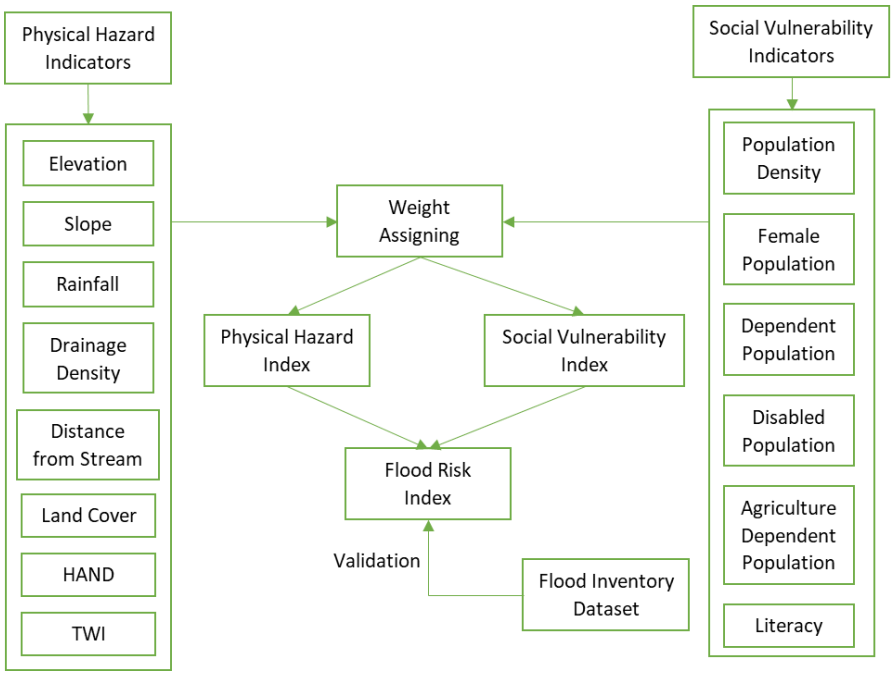


Figure 2.10 Flow chart of the methodology.

Results and Discussion

Flood hazard map was developed using eight physical indicators for flood contributing factors i.e., elevation, slope, land cover, rainfall, distance from river, drainage density, height above nearest drainage, and topographic wetness index. Overall weightage assigned process was carried out using AHP pairwise matrix comparison. Similarly, social vulnerability map was developed using six social indicators i.e., population density, dependent population, disabled population, female population, agriculture dependent population and literacy.

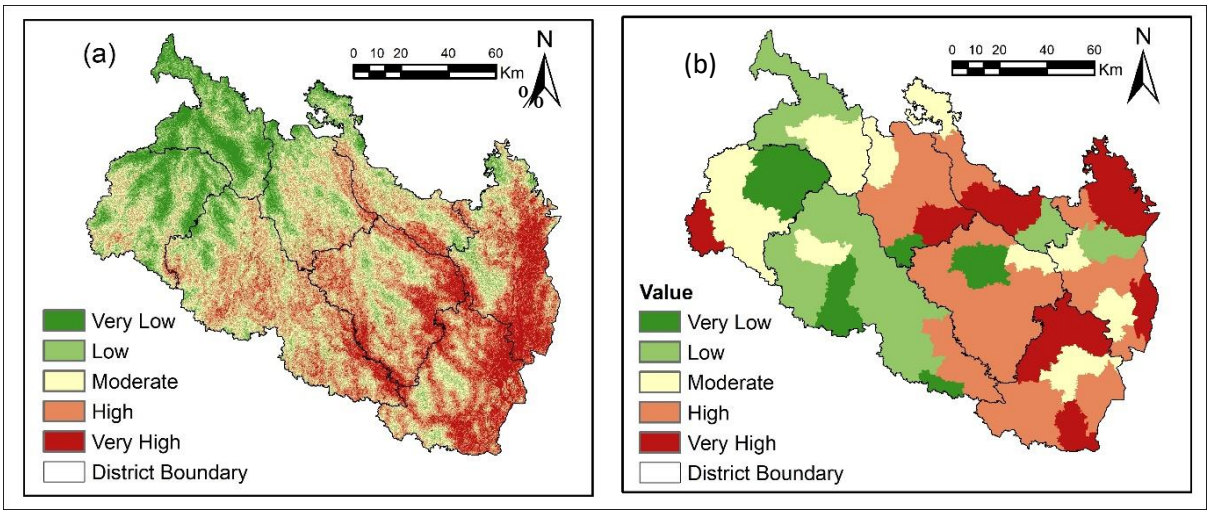


Figure 2.11 (a) Physical hazard index map and (b) Social Vulnerability index map.

Flood risk map was generated using the equal weight between the physical hazard and social vulnerability. The risk map layer is classified into five classes by using Natural Breaks classification algorithm. The five classes are very low, low, moderate, high, and very high risk classes. Most of the area of the study area fell into moderate risk zone with 30.76% of total area.

At the district level, Gaibandha stands out as the most flood-prone district, with 45.21% of its total area falling within the very high-risk zone. Kurigram follows closely as the second most risky district of flooding, with 34.22% of its total area falling within the very high-risk zone.

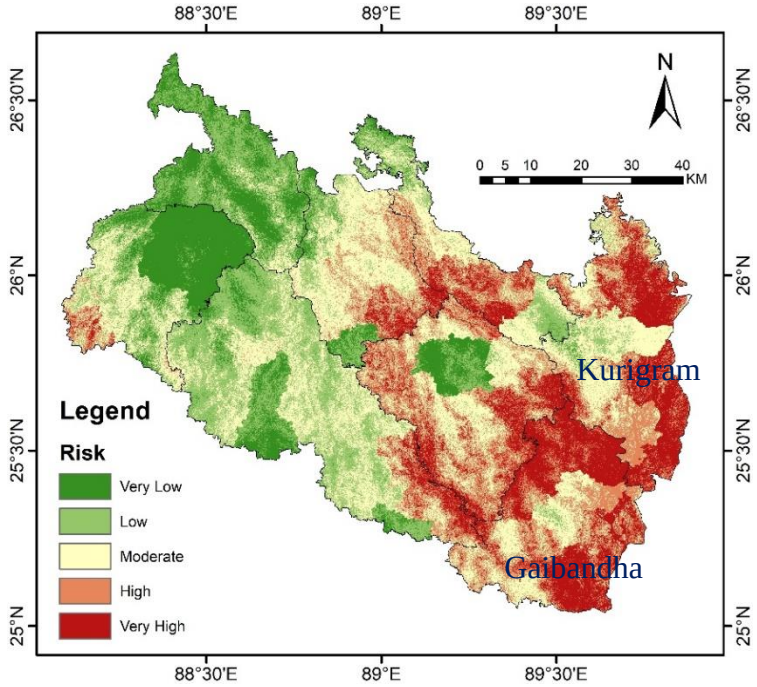


Figure 2.12 Flood risk map for the Rangpur division of Bangladesh.

Title: Assessment of Inundation Depth Mapping Using Synthetic Aperture Radar (SAR) Remote Sensing

Research problem/statements and objectives

Flooding is the most common hydrological hazard on the planet, having an impact on water management, environmental protection, economic activity, hydro-morphological changes on ecosystem services, and health impacts. Access to actionable near real-time information on surface water extent, floodwater depth, and impacted agricultural lands are often the main limitation of disaster management systems. This is especially true in many developing countries like Bangladesh, where in-situ observations for monitoring the impacts of rainfall and inundation on agriculture are often lacking. The occurrence of flash floods, although common in the northeastern wetland regions of Bangladesh, is now becoming more frequent with higher intensity and magnitude. Identifying the inundation depth is important for mapping of flood-damaged areas and successful flood management as well.

Remote sensing is a gifted mechanism to document agronomic activity on a regional scale and assess the impact of flooding events on crop health and crop productivity. However, the cloud cover associated with many of these events limits vegetation monitoring with optical systems. Data from Synthetic Aperture Radar (SAR) sensors such as Sentinel-1 can supplement visual analyses by providing weather- and illumination-independent observations that are sensitive to vegetation structure and have proven capability to map surface water extent.

This research aimed to evaluate an operational system for rapid inundation depth and probable flood-damaged area mapping to aid in a quick and effective event response.

Research methodology

Bangladesh has a unique wetland habitat in the northeastern section of the country known as 'Haor.' During the monsoon, a vast water body located in a low-lying bowl-shaped basin gets inundated for 7 to 8 months of the year to a depth of 5 meters or more. There are around 373 Haors in this region, encompassing 858,000 hectares of land. Among those 373 haors, this study has chosen the Kacchar haor area in the Sunamgonj district.

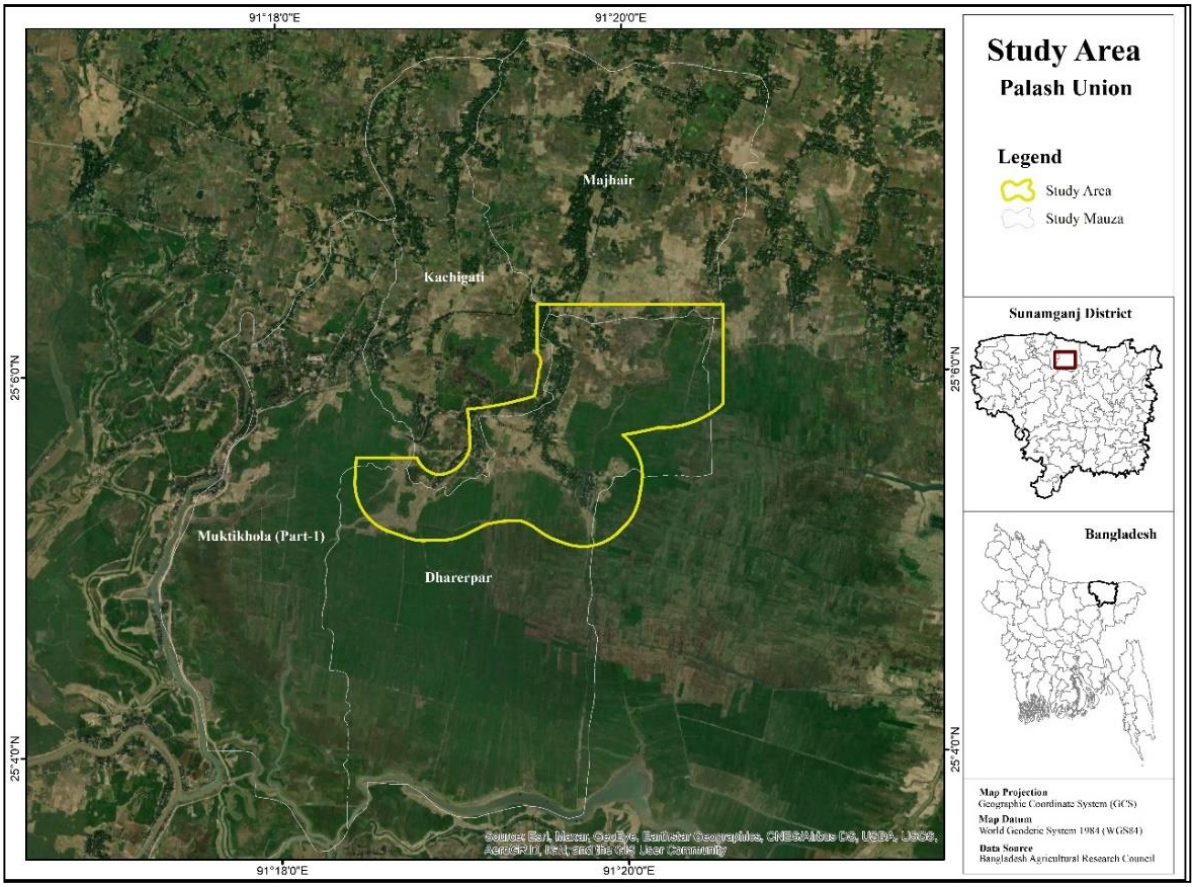


Figure 2.13 Yellow contour indicates the study area at Bishwamvorpur Upazila in Sunamganj.

This study used Real-Time Kinematic (RTK) surveys for 5 cm accuracies. RTK is a technique that uses carrier-based ranging and provides ranges (and therefore positions) that are orders of

magnitude more precise than those available through code-based positioning. This study used the CHC i80 RTK rover station connected with the 3D Benchmark station (BM 7417).

For this study, the mini-UAV platform was used, which was called Mavic 3 Enterprise, developed by DJI. The drone is equipped with a 4/3 CMOS (20 Mega Pixel) sensor with a 5280×3956-pixel resolution with RGB bands. The photos were taken in auto mode and geo-referenced using the UAV GNSS system (IMU).

The data analysis was done by the Pix4Dmapper (version 4.4.12) software, which was developed at Computer Vision Lab in Switzerland by Pix4D Company using the Computer Vision image processing algorithm. Finally, 10 cm resolution Digital Surface Model (DSM) and Digital Elevation Model (DTM) have been obtained and used for further analysis.

Road network information and administrative boundary data have been collected from OpenStreetMap and the database of Global Administrative Areas (GADM), respectively.

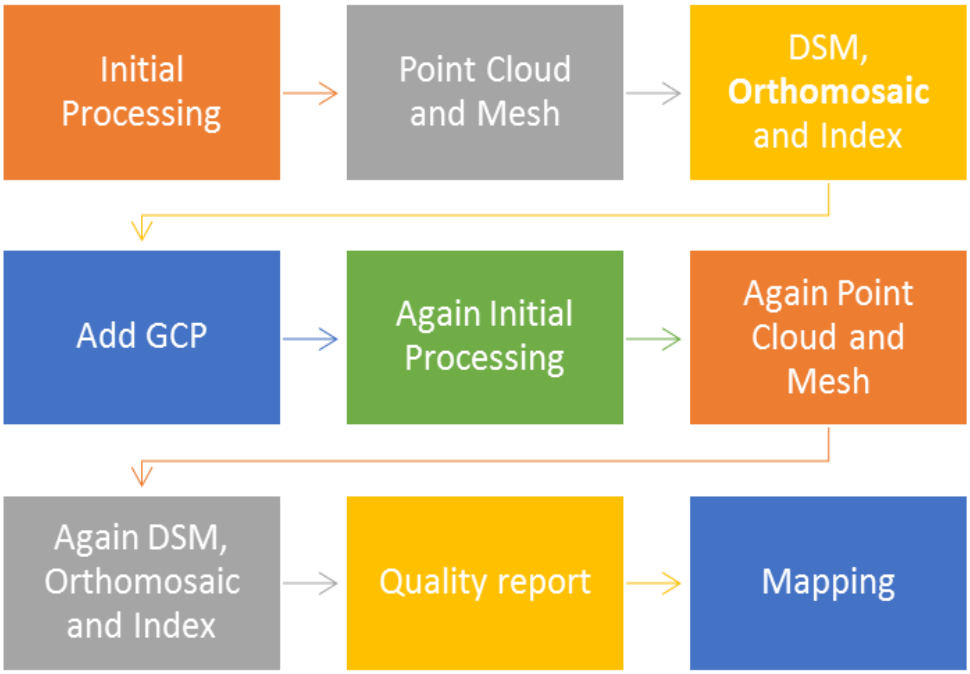


Figure 2.14 Workflow of Pix4D

The Sentinel-1 images used in this investigation were publicly acquired from the Alaska Satellite Facility open access hub data portal.

OpenSARlab is operated in Jupyter Notebook platform using Python programming. The cloud-based analysis has followed six steps, such as 1. Image Geocoding and Calibration (RTC Processing), 2. Automatic and adaptive threshold calculation, 3. Initial flood map creating, 4. post-processing to remove false alarms 5. Discrimination of permanent and flood-related water 6. Data dissemination.

Results and Discussion

The flood inundation map is show in Figure 2.16. That map present current scenario in June 2023, some of the areas experienced unceasing inundation, while some areas were gradually inundated, and types (Figure 2.16). This study has found 96% inundation area matching.

Severe weather conditions are more common during floods in Bangladesh. Freely available and frequently collected Sentinel-1 SAR earth observation data offers a lot of promise for creating flood information with high accuracy for Bangladesh with a geographic resolution of twelve-day interval. Cloud-based computation environments, such as the OpenSARLab, is useful in preparing a flood-related emergency response and evaluating flood damage through land cover mapping. Flood inundation mapping and flood damage assessment tools are important for emergency response and disaster management.

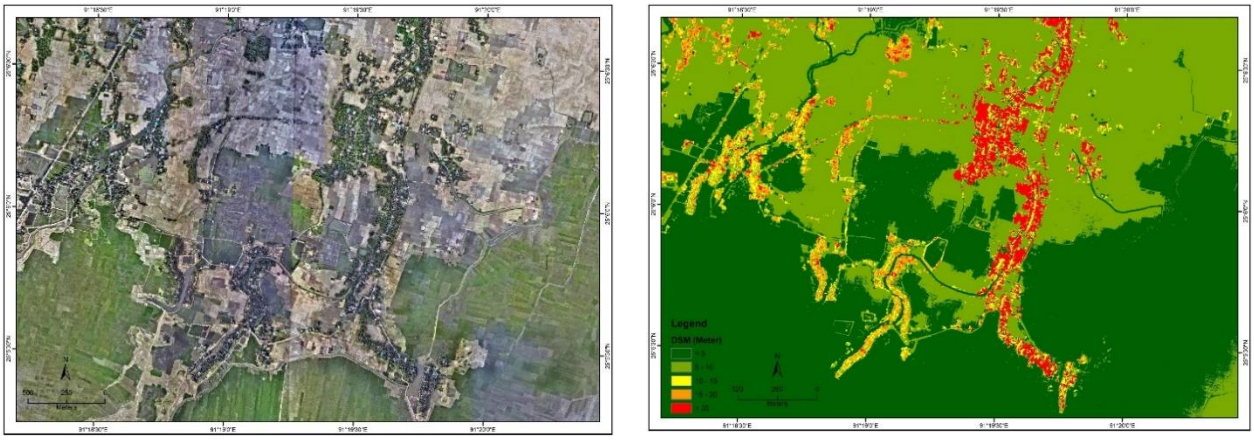


Figure 2.15 *left*, Orthophoto *right*, Digital Surface Model (DSM) of study area.

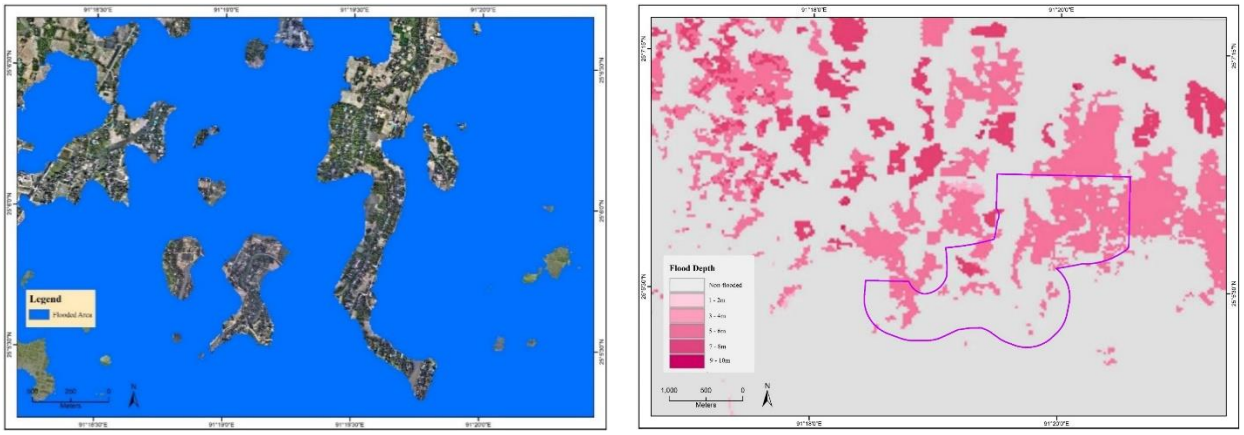


Figure 2.16 *left*, Inundated area mapping (blue shaded) *right*, inundation depth map (pink shaded).

2.5 Photography Division

Title: Analysis of Teesta Riverbank Erosion and Its Impacts on Land Use and Land Cover Changes in Gangachara Upazila Using RS & GIS Technology

Research problem/statements and objectives

This study has been taken for land use and land cover changes assessment, Riverbank erosion identification using RS and GIS technology. The following objectives have been taken into consideration- to Prepare Land use and Landcover Map for the year 2016 and 2022. Riverbank erosion identification using RS and GIS technology, impacts analysis through data analysis and field data collection and generation of data set and statistics.

Research methodology

Cloud-free Sentinel2 data of 2016 and 2022 has been downloaded from Sentinel Hub (https://scihub.copernicus.eu/dhus/#/home) website. After extraction of different bands data, layer stacking has been conducted for making the multi bands images. Band 2 (Blue), Band 3 (Green), Band 4 (Red) and Band 8 (Near Infra-Red) were considered for layer stacking. On screen digitization has been performed to explain the different land use land cover classes. Global Positioning System (GPS) based ground verification has also been conducted in different land cover classes to define accurately the land cover classes in the study area. The whole methodology of the study has been shown in Figure 2.17.

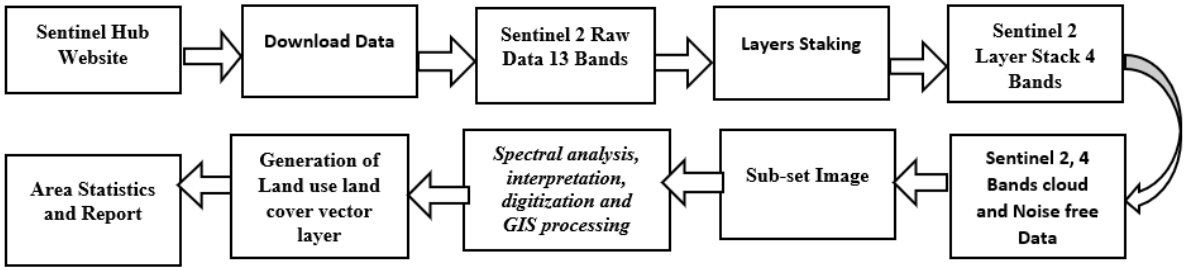


Figure 2.17 Flowchart of Methodology.

Results and Discussion

Land use and land cover map of the study area has been shown in figure 18 for the year 2016 and 2022. We found five identified classes of land use and land cover. Individual land use and land cover area has been shown in Table 2.1. This research work examines the changes in land use and land cover from the year 2016 to 2022 for the Gangachara Upazila. We found a significant variation in land use and land cover of that region by satellite image processing. The information gained from the Satellite image of Gangachara Upazila indicated that in 2016, there were 18.39 sq. km of settlement area which increased to 26.86 sq km in 2022. We noticed that the forest area of 2016 is diminished by 7.01 sq km in 2022. Besides, land used for Agriculture in 2016 was 36.99 sq km, and in 2022 was 49.16 sq km. showing an increase in the agriculture area which is 12.17 sq km. People of this region increasing their agricultural activities in the riverbed of Teesta River

specially in the dry season. That is one the cause of agriculture area increasement. In 2016, 7.52 sq km of land was covered as water bodies but in 2022 it increased to 10.87 sq km. It is found that in 2016, Bare Land, Roads and other areas were 90.87 sq km. But in 2022 it decreased to 73.89 sq km.

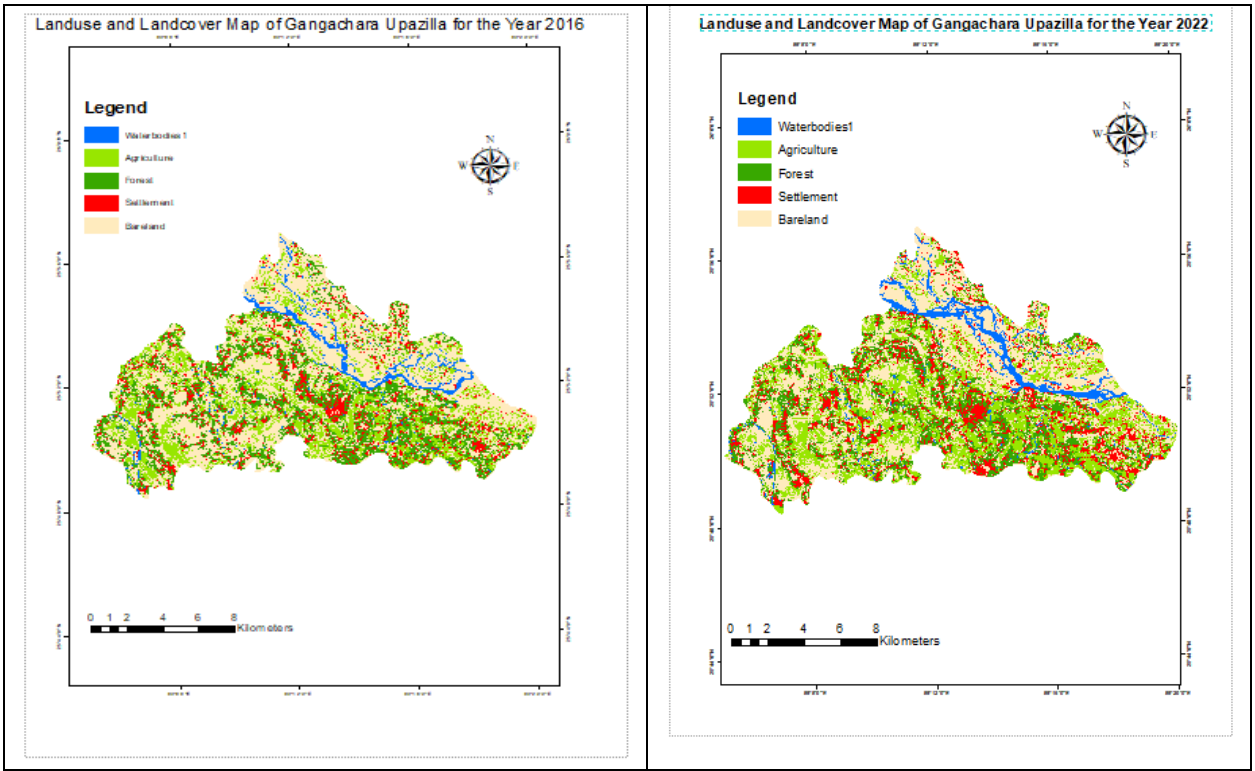


Figure 2.18 Land use and Landcover Change Map of Gangachara Upazilla.

Table 2.1 Land use and Landcover change statistics.

Land use and Landcover change statistics of Gangachara Upazila for the Period of 2016 to 2022:			
Class Name	**Sentinel-2 Image 2016 (sq.km)**	**Sentinel-2 Image 2022 (sq. km)**	**Area Changed in 2016 to 2022 (sq. km)**
Settlement	18.39	26.86	8.47(Area Increased)
Forest	42.05	35.04	7.01(Area Decreased)
Agriculture	36.99	49.16	12.17(Area Increased)
Waterbodies	7.52	10.87	3.35(Area Increased)
Bare Land	90.87	73.89	16.98(Area decreased)

Settlement area has increased between the years 2016 to 2022. Settlement area increased as the normal growth of population increases. We found that the forest area of 2016 is diminished by 7.01 sq km in 2022. Erosion is the major cause of deforestation in the area. Reduction of forests is

a major problem for the natural environment and ecology of the region. Bare land area of 2016 has decreased in 2022 which is sq.km. 16.98. Cause of decreasing bare land area is increasing population, extended agricultural activities and erosion of Teesta River.

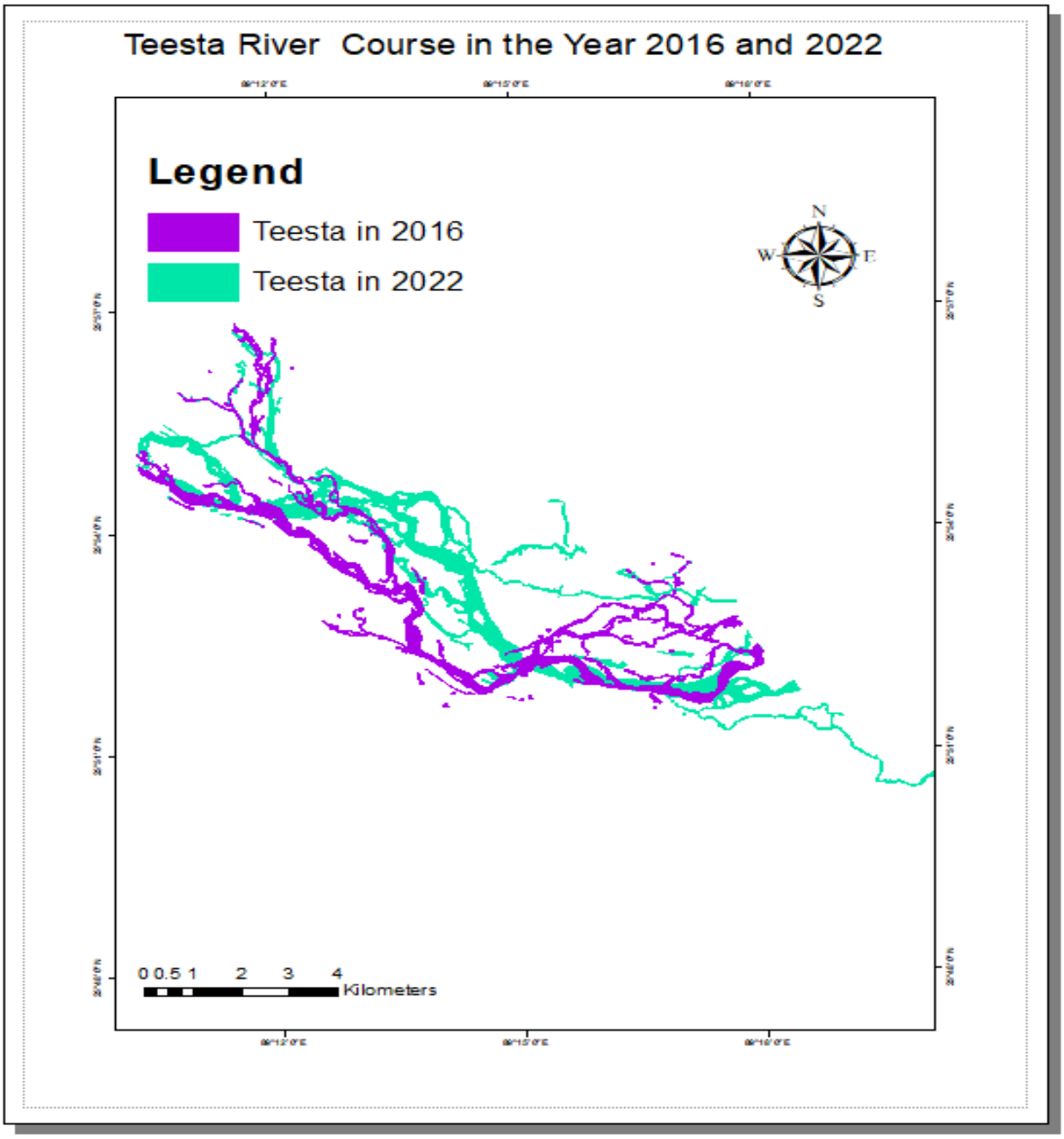


Figure 2.19 Teesta River course change in between the year 2016 to 2022 of Gangachara Upazila.

2.6 Fisheries Division

Title: Flash Flood Monitoring in Tanguar Haor: A Hydro-Meteorological Approach

Introduction

Meteorological hazards are responsible for 78% of the economic losses and 38% of the fatalities related to disasters worldwide, with a drastic increase in the number of events in the last 35 years attributed to global climate change. Hydrological events show the highest increase globally with a rise of a factor of 4, while meteorological catastrophes have increased by a factor of 3. Although these events affect the entire globe, exposure to hydrological events and vulnerability of those affected are not uniformly distributed, and climate risk disproportionately affects the world. For example, the impact floods have is greater in developing countries. It is estimated that nearly one billion people live in flood-prone areas, and this number is predicted to double by 2050 due to erratic precipitation events and rapid population growth. Floods caused the loss of 6.8 million human lives in the 20th century globally, and a recent study showed that floods affected 2.3 billion people between 1995 and 2015, marking flood as the deadliest natural disaster. In the context of climate change, the frequency and severity of flooding are increasing at an alarming rate, with a notable four-fold increase in Asia between 1982 and 2006.

Flash floods generally occur in the north-eastern haor and southeast (Chittagong) regions of Bangladesh. However, the northeast region of Bangladesh is highly vulnerable to flash floods due to surrounding hilly areas and presence of numerous large, deeply flooded depressions. When heavy rainfall occurs in the Assam and Meghalaya hilly region of India, flood water quickly moves towards the haor area of Bangladesh through the trans-boundary rivers and eventually enters the haor. In most cases, farmers don't get enough time to harvest their standing Boro crop. Thus, flash floods before harvesting of Boro crops not only create negative impact on the food security of the northeast region but also damage the national economy to some extent. Remote sensing (RS) and geographic information system (GIS) are now providing cost and time-effective tools for disaster management. Collection of multi-temporal remotely sensed data facilitates the synoptic analyses of earth- system function, patterning, and change at local, regional and global scale over time. The present study takes the advantage of RS and GIS techniques and information collected from field observation for monitoring the flash flood in Tanguar haor.

Being located in the piedmont of Meghalayan hill ranges, the water catchment area of Tanguar haor is huge. Since the haor is bowl shaped it works as a primary reservoir of water that mostly flows from the northern hilly areas along with inland precipitation. Usually, the haor starts to receive the water from late May to early June. But sometimes it receives the water very early from the regular time that causes flash flood which has serious impact on the agriculture, livelihood and ecosystem. Tanguar haor is an ecologically critical area because of its geographical location. The condition of the agriculture, livelihood and ecosystem of the haor is dependent on the outer area with water catchment rather than its own. So, the hydro-meteorology of the Meghalayan hill ranges and the haor regions along with its geomorphometrics is very crucial to monitor.

Aim and Objectives

The present study aims to monitor the flash flood in Tanguar haor. The specific objectives are:

- To identify the flash flood events in Tanguar haor using Sentinel-1 SAR data during 2015 to 2022.
- To identify the hydro-meteorological pattern in Meghalayan hill ranges and haor regions.
- To identify the linkage between flash flood and hydro-meteorological pattern.

Methods and Materials

The haor plays an important role in fish production of the country as well as providing livelihood for over 40,000 people. More than 140 species of freshwater fish are available here. The more predominant among them are: ayir, gang magur, baim, tara, gutum, gulsha, tengra, titna, garia, beti, kakia, etc. The freshwater wetland trees of this haor include hijal, karach, gulli, balua, ban tulsi, nalkhagra etc. The haor is a sanctuary for the migratory birds. Every winter about 200 types of migratory birds visit this haor and make their temporary habitat here (Banglapedia, 2021).

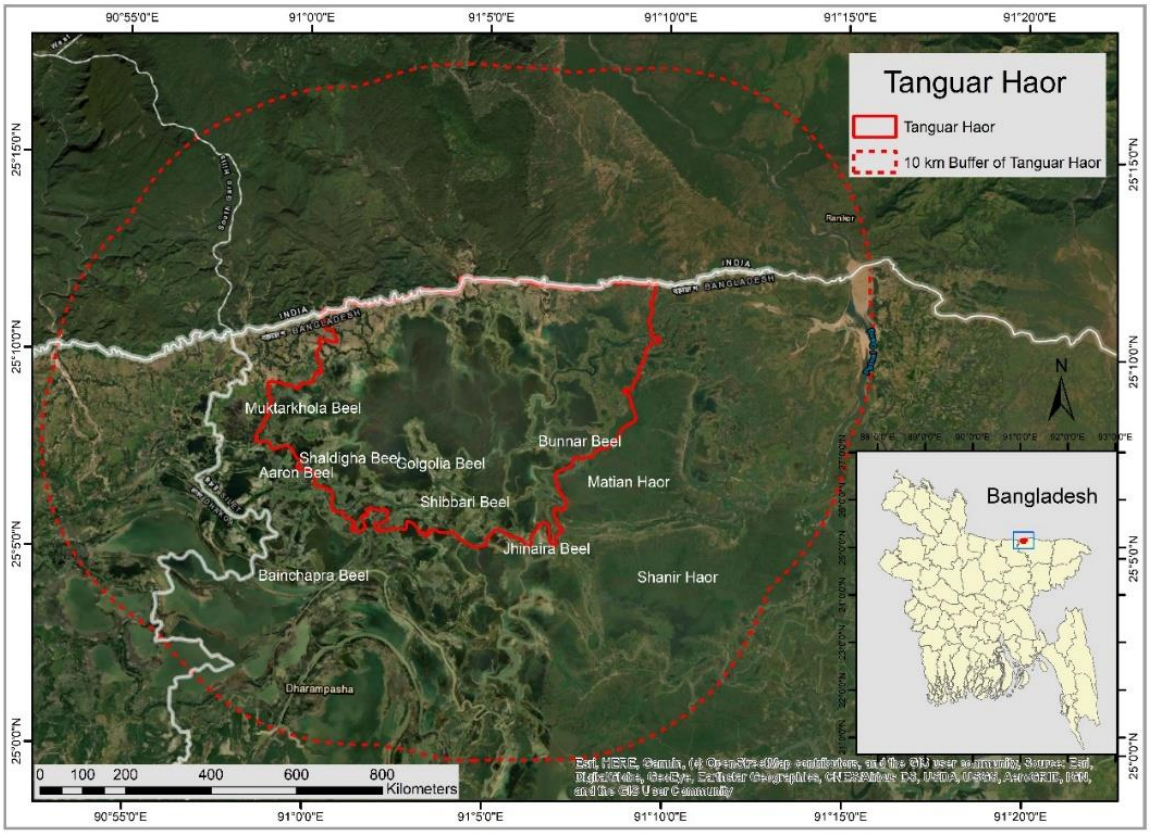


Figure 2.20 Study area.

Methods

To attain the aim and objectives of this study integrated RS-GIS technology will be implemented. The study will focus on identifying the events of flash floods in Tanguar Haor using Synthetic Aperture Radar (SAR) data. Flash flood events identification comprises the utilization of multitemporal Sentinel-1 satellite data of European Space Agency (ESA). To identify the hydro-meteorological pattern in Meghalayan hill ranges and haor regions, this study will mainly use the Global Precipitation Measurement (GPM) data. After identifying the flash flood events and the hydro-meteorological pattern, the study aims to find the connection between these two.

Materials

Satellite data	Other data
Sentinlel-1 SAR Data, Global Precipitation Measurement (GPM), Sentinel-2 MSI, Shuttle Radar Topography Mission (SRTM)	Field observation

Results

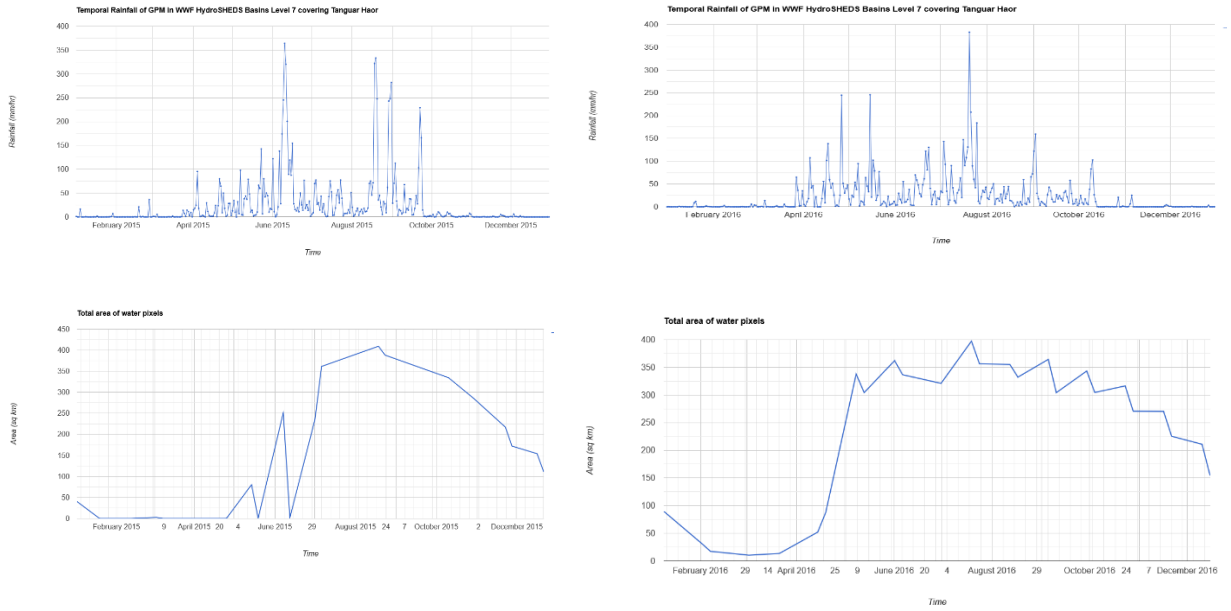


Figure 2.21 Rainfall and inundated area in Tanguar haor and its adjacent area during 2015 and 2016.

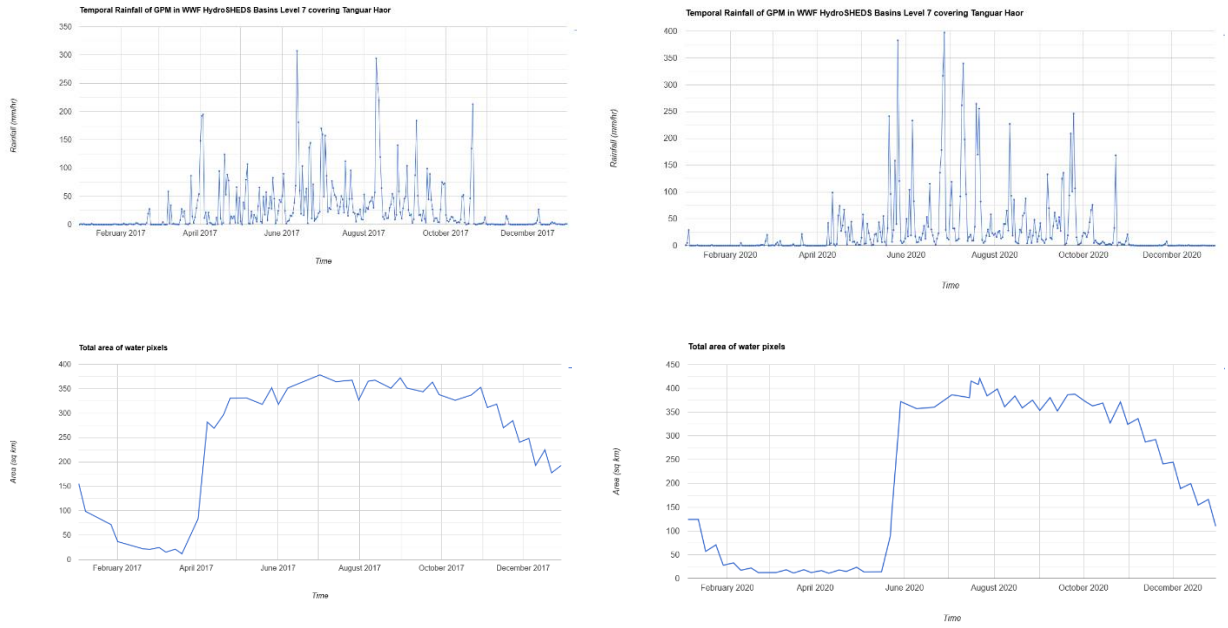


Figure 2.22 Rainfall and inundated area in Tanguar haor and its adjacent area during 2017 and 2020.

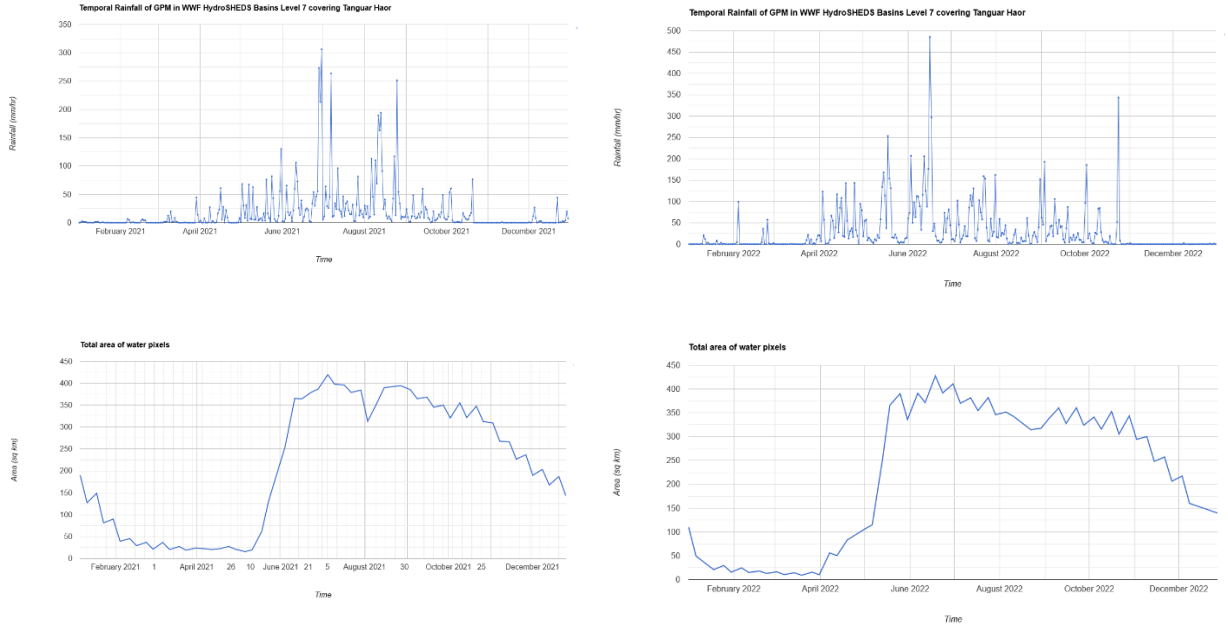


Figure 2.23 Rainfall and inundated area in Tanguar haor and its adjacent area during 2021 and 2022.

Photographs 2.1 Field data collection in Tanguar haor.

Conclusion

The present research has been conducting for two years from 2022-23 to 2023-24. This study aims to monitor the flash flood during 2015 to 2022. So, it consists of huge datasets of eight (08) years. The inundation and rainfall data for 2015, 2016, 2017, 2020, 2021, 2022 has been processed in the first phase of the research. The data processing of inundation and rainfall for 2018 and 2019 has been going on. This research will also use the station data from Bangladesh Meteorological Department (BMD). The current study will also utilize other types of hydro-meteorological data if available and necessary with a view to fulfilling the aim and objectives.

2.7 Geology Division

Title: Geospatial Techniques in Landslide Susceptibility Mapping

Research statement and objective

In order to develop scientifically informed ecosystem management, land use planning, and disaster mitigation methods, it is crucial to empirically observe the most vulnerable areas of a region using landslide susceptibility modeling and terrain mapping (Shofiqul Islam et al., 2015). In mountain topography, landslides are the most frequent natural hazard (Pham et al., 2020; Pourghasemi & Kerle, 2016; Shano et al., 2020). In Bangladesh, sustainable hill management & development are in great challenge because of changing precipitation patterns and increase in extreme rain events, short-term heavy rainfall, a small amount of rainfall for a longer period, the intensity of rainfall, and antecedent rainfall during the summer monsoon (Hossain et al., 2020).

Landslide susceptibility modeling focuses on the assessment of triggering events and causal factors to predict the spatial distribution of landslides in a region such that it predicts where landslides are likely to occur. In this study, assessing causal factors and landslide inventory, a landslide susceptibility mapping and associated terrain zonation has been developed. The objective of this research is to develop a landslide susceptibility map.

Research Methodology

Field survey, visual analysis of satellite images, GIS-based information value method was applied during this research. For this an intensive field survey and interpretation from Google Earth images were used to create the landslide inventory map. This study considers the following triggering factors for Landslide Susceptibility such as slope, aspect, curvature, relative relief, distance to streams, geology, geomorphology, Landcover, Distance to road and Soil Texture. Landcover maps were created from satellite images with the aid of the image processing software ERDAS Imagine, and settlement areas were digitalized from Google Earth images because they provided a more accurate result due to their high spatial resolution and ease of manual classification. Additionally, related information has been gathered, including topographic maps, DEM (30m x30 m resolution), geology reports and maps. Sentinel-2 multispectral satellite images of 2023 along with Google Earth images of have been utilized to study the Landslide susceptibility in the study area. From a 30m x 30m resolution DEM, slope, aspect, curvature, relative relief, and streams have been extracted. Landslide inventory and landslide factors are contained in the information value. After the information values were computed, information raster maps were created and then landslide susceptibility index (LSI) was calculated from these maps using the raster calculator in ArcGIS Pro environment. To obtain the landslide susceptibility maps, the landslide susceptibility index map was further classified using the reclassify tool from the spatial analyst toolbox. Finally, using the natural breaks classification approach, the landslide susceptibility index maps were classified into very low, low, moderate, high and very high landslide susceptibility classes.

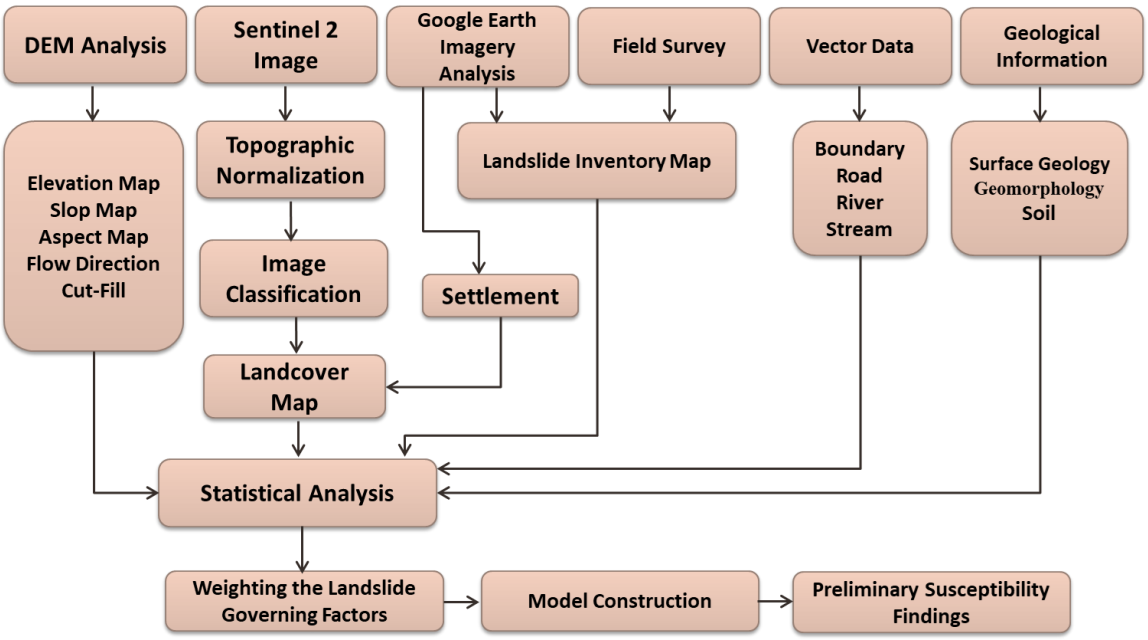


Figure 2.24 Methodology of the research.

Result and Discussion

The landslide susceptibility map of the research area has been generated in the current work using the information value method. However, it is important to note that this analysis is based on the information value method and should be considered in conjunction with other approaches and field observations for a comprehensive understanding of landslide susceptibility.

The landslide susceptibility map from the information value method reveals that 31.93% and 34.91% of the area of the Rangamati Sadar Upazila fall into high and very high susceptibility classes. The analysis revealed that a significant portion of the study area fell into high and very high susceptibility classes, primarily characterized by specific soil texture, slope angles, aspect classes, curvature patterns, landcover types, and proximity to geological formations or specific landforms. The information value of each factor class shows the contribution of each factor class on landslide occurrence when its value is greater than 0.1. The area with higher slope, high relative relief, close proximity to roads and stream, Sandy and Silty Loam soil, exposed Tipam Sandstone and Bolabil Formation indicated a significant influence on landslide occurrence.

Balukhali union is the most susceptible to landslide occurrence among the seven unions in Rangamati Sadar Upazila in terms of the high and very high susceptibility classes. The most frequent landslide type in the research area is a rotational, translational slide with an accompanying debris flow that is isolated and relatively small in size is the most common form of landslide in the study region. The remaining 20.24% and 5.68% area are classified as very low and low susceptibility classes, respectively.

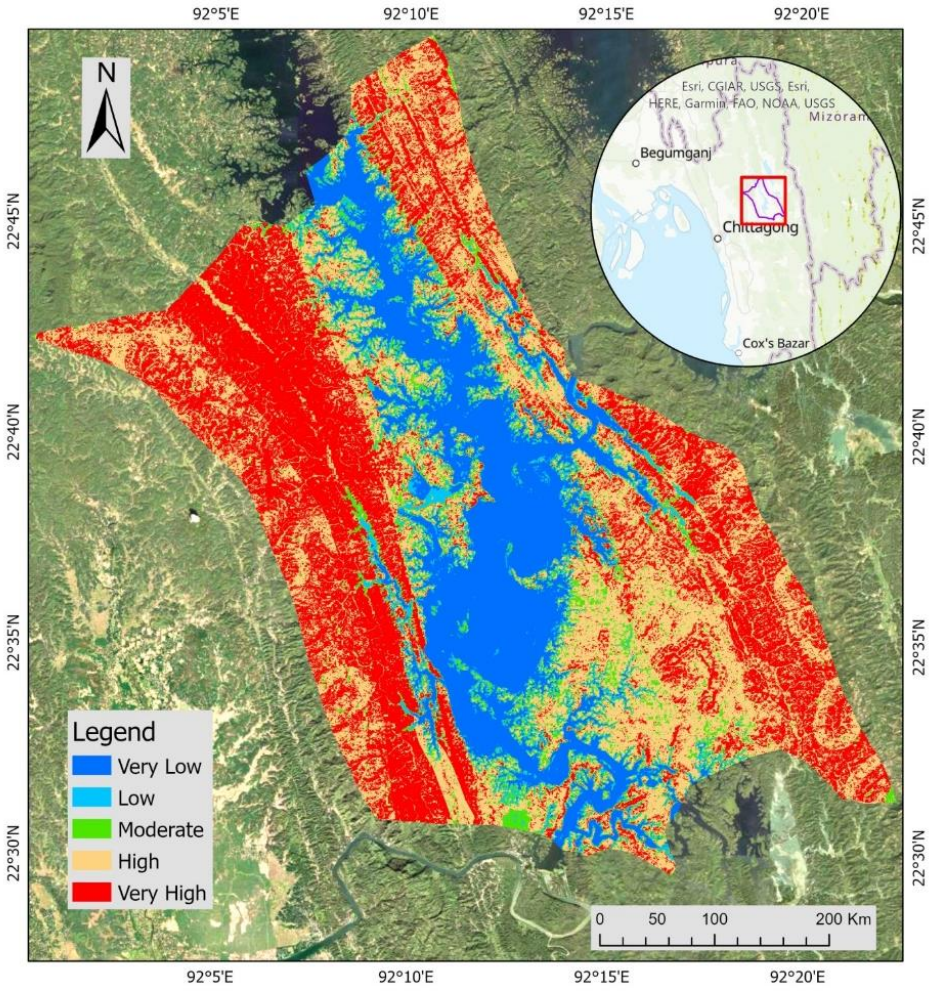


Figure 2.25 Landslide susceptibility index map of Rangamati Sadar Area.

Table 2.2 Landslide susceptibility index map summary using information value method.

Landslide Susceptibility Pixels	Landslide Susceptibility Index	Landslide Susceptibility Map Class	Landslide Susceptibility Map Area (km^2)	Landslide Susceptibility Map Area (%)
29441885	-10.317 to -5.168	Very Low	117.77	20.24
8264845	-5.167 to -1.883	Low	33.06	5.68
10534275	-1.882 to 0.212	Moderate	42.14	7.24
46450768	0.213 to 1.548	High	185.8	31.93
50784605	1.549 to 3.643	Very High	203.14	34.91

2.8 Space Physics and Rocket Dynamics Division

Title: Satellite Space Mission Orbital Simulation

First satellite launch in 1957. Satellites rapidly grew in size and became available. Changing world politics and strategic emphasis in the last decade has brought about a quiet revolution in space. Aerospace engineering design and development depends on design software and simulation software. There are various kinds of design and simulation software available for aircraft and spacecraft or launch vehicles (such as rockets). But only a few designs and simulations software are available for satellite. Most of the software is in commercial version and very expensive. Moreover, different subsystems use different designs and simulation software. Simulation and visualization are powerful decision-making tools that are time-saving and cost-effective. Space missions pose testing and evaluation challenges that can be overcome through modeling, simulation, and visualization of mission parameters.

The space mission parameter which are considered for the satellite mission planning are as follows in Figure 2.26:

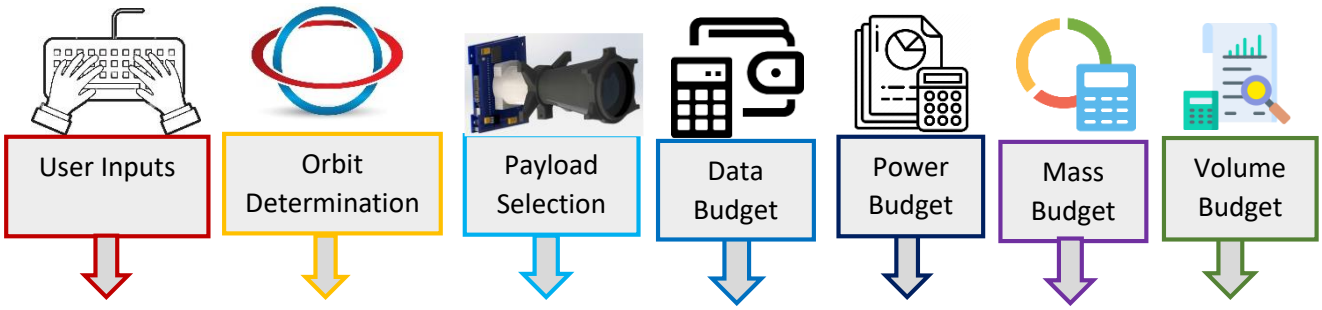


Figure 2.26 Satellite space mission parameter for mission planning.

This research work considered only user inputs and orbit determination. These two sections of the satellite space mission parameter as in Figure 2.29 are the orbital space mission simulation parameter. The whole software for orbital space mission simulation was demonstrated in MATLAB programming language. The programming flowchart is shown in Fig 2.27 and 2.28.

Methodology:

The whole research works is divided into two parts (i) Study and analysis (ii) computer coding. Study and analysis part includes- internet, relevant books, journals, papers, documents based review and analysis. Computer coding part includes the development of coding for space mission analysis which was done first using common platform such as C/C++/MATLAB. After that it will be converted to other coding platform such as Java/J2/Python or Rational Rose for the development of virtual space mission.

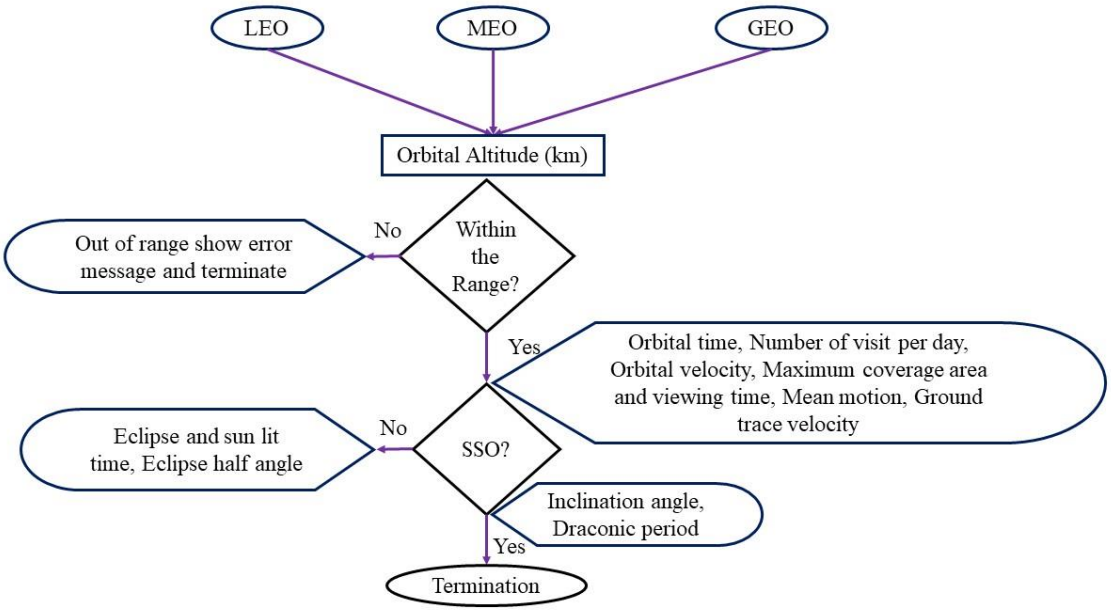


Figure 2.27 Programming language workflow for orbit.

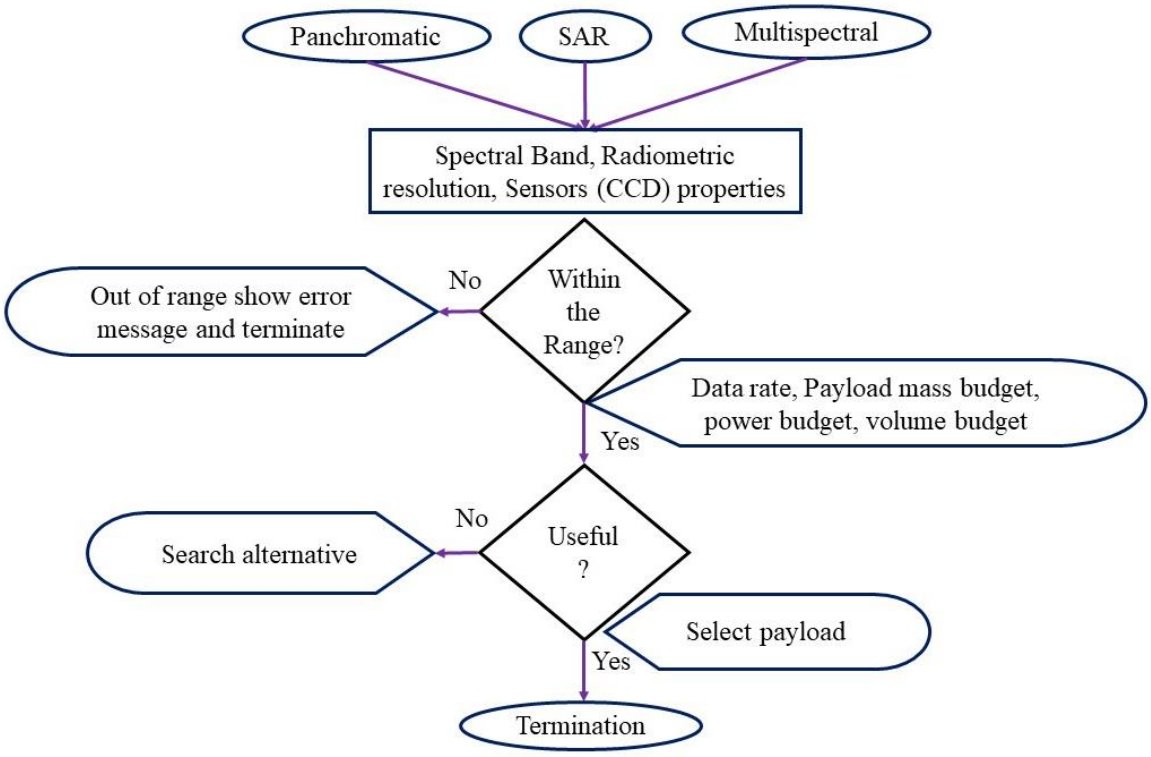


Figure 2.28 Programming language workflow for payload.

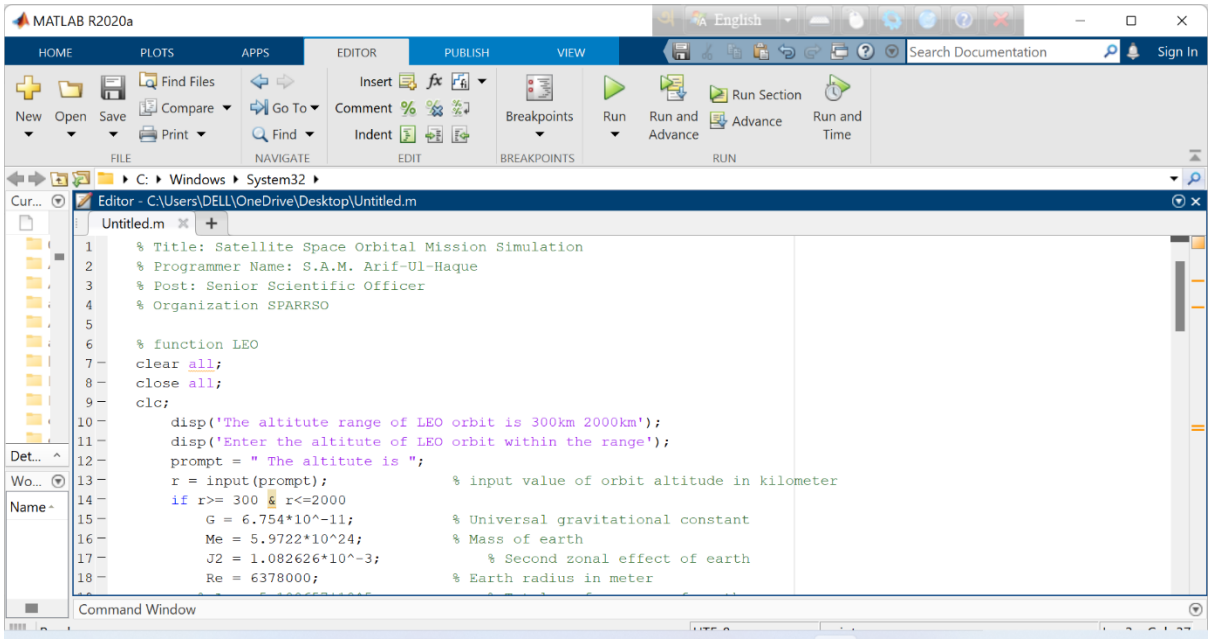


Figure 2.29 MATLAB Coding for the satellite space orbital mission.

Research Outcome

Code was developed using this MATLAB software. Orbital time, Number of visits per day, Orbital velocity, Maximum coverage area and viewing time, Mean motion, Ground trace velocity can be calculated accurately using the developed code (Figure 2.29). Moreover, if the orbit is sun-synchronous then the Inclination angle, Draconic period also can be calculated and if it is not sun-synchronous orbit then Eclipse and sun lit time, Eclipse half angle can be calculated accurately.

Conclusion

Space mission analysis is very much important to develop/manufacture satellite because of many reasons: such as payload configuration, orbit selection, space environment analysis, image location accuracy analysis, data transmission system (DTS) capability analysis, platform ability analysis, design life analysis, heritage analysis. Further improvement of this research work requires using neural network Kalman filter. Space catalogs can be used to compare in-orbit spacecraft with planned spacecraft. Developing interactive software requires subject-specific hands-on training.

2.9 Ground Station Division

Title: Design, Analysis and Simulation of an ML-based Remote Sensing Device and Antenna System

Research Statement

Bangladesh Space Research and Remote Sensing Organization (SPARRSO) is the focal space organization of the Government of Bangladesh. It has extensive experience with satellite data applications in several fields such as agriculture, water resources, forestry, geology, oceanography, etc. using Remote Sensing (RS) technology by utilizing data from earth observation satellites.

This project will assist us to become acquainted with Remote Sensing (RS) Sensors, Data Acquisition using sensors, Antenna Systems for Data Transmission, Signal Processing, Image Processing, Data Management, Machine Learning, and so on. This knowledge may be useful for the further development of the Space Technology of SPARRSO in the near future.

Objectives

The key objectives of the research work are-

1. To Design a Remotely Operable Device (UAV & Rover) for Acquiring RS Data.
2. To Store RS Data in the Network Attached Server (NAS).
3. To Process the Data Using Machine Learning (ML) and Software.
4. To Design, Analysis and Simulate Antennas for TT&C.
5. To Demonstrate RS Data Acquisition, Transmission and Processing System.

Methodology

The research work is divided into two phases. In the first phase (FY 2022-23), an Unmanned Aerial Vehicle (UAV) was planned to be designed as a data acquisition platform. Data will be sent to a Server (NAS) and further ML-based image interpretation will be done using software. The drone will be operated remotely using Flight Controller and Antenna. GPS along with a flight camera will help to track its flight path. While another camera will capture images.

In the second phase (FY 2023-24), a Rover unit will be designed. It will be equipped with RS sensors and Camera for Data acquisition, GPS for tracking, Robotic Arm for sample collection, Antenna and Remote-Control unit, Battery as power source, and so on.

Finally, the stored data will be processed using Machine Learning for Data interpretation. For this purpose, separate Software platforms will also be developed for Remote Control of the units and visualization of the final output.

Basic Mechanism of the UAV

Unmanned Aerial Vehicles or UAVs are aircraft that are guided autonomously, by remote control, or by both means and that carry some combination of sensors, electronic receivers and transmitters,

and cameras, etc. Drones have two basic functions: flight mode and navigation. To fly, drones must have a power source, such as a battery or fuel. They also have rotors, propellers, and a frame. The frame of a drone is typically made of a lightweight, composite material to reduce weight and increase maneuverability. A drone controller works by sending a radio signal from the remote control to the drone, which tells the drone what to do.

UAV with four propellers is called Quadcopter. Propellers are attached to battery-driven BLDC Motors. As can be seen in the above images, two of its propellers rotate in the CW direction while the other two rotate in the CCW direction for stability and avoid twisting on air.

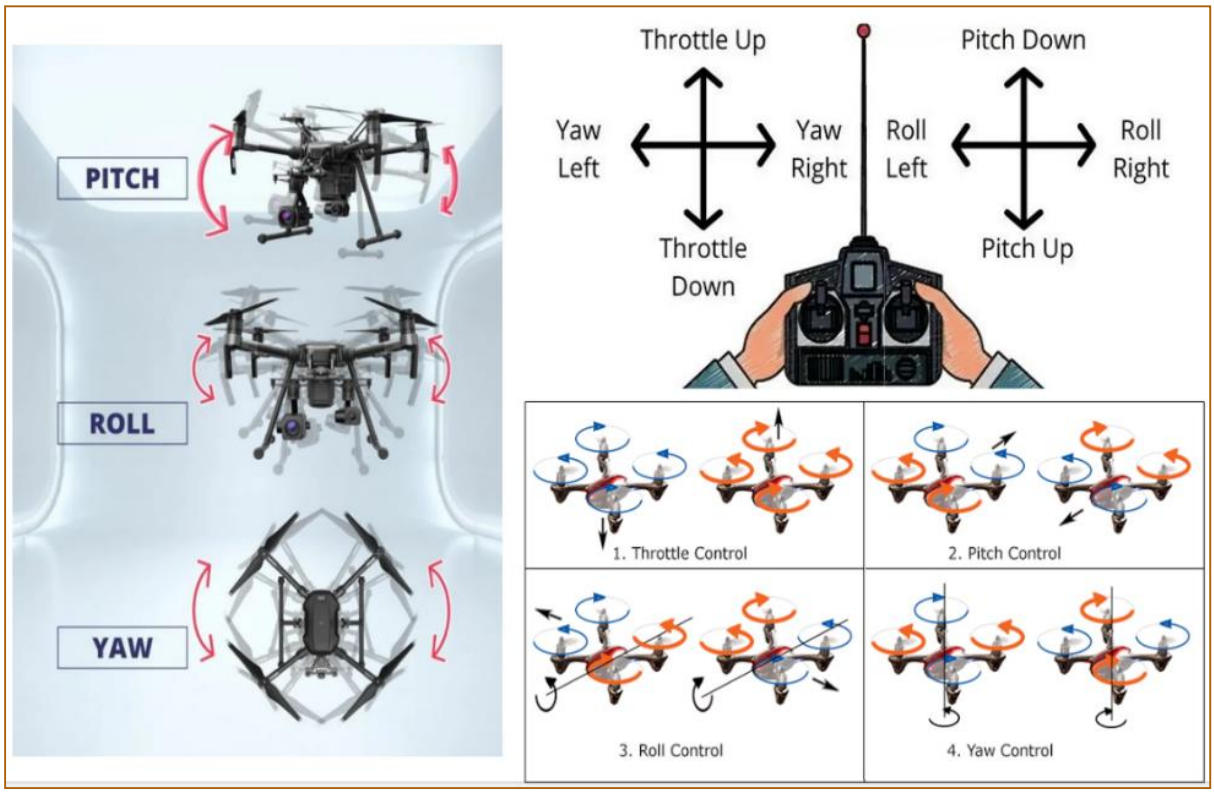


Figure 2.30 Basic mechanism for UAV control.

Motion and Direction of the UAV are controlled by controlling the combination of speed of the propellers which is a tough task and requires great effort. The stability of the UAV is a must for required data acquisition. UAV with six propellers is called Hexacopter which is aerodynamically better for stability but requires sophisticated design.

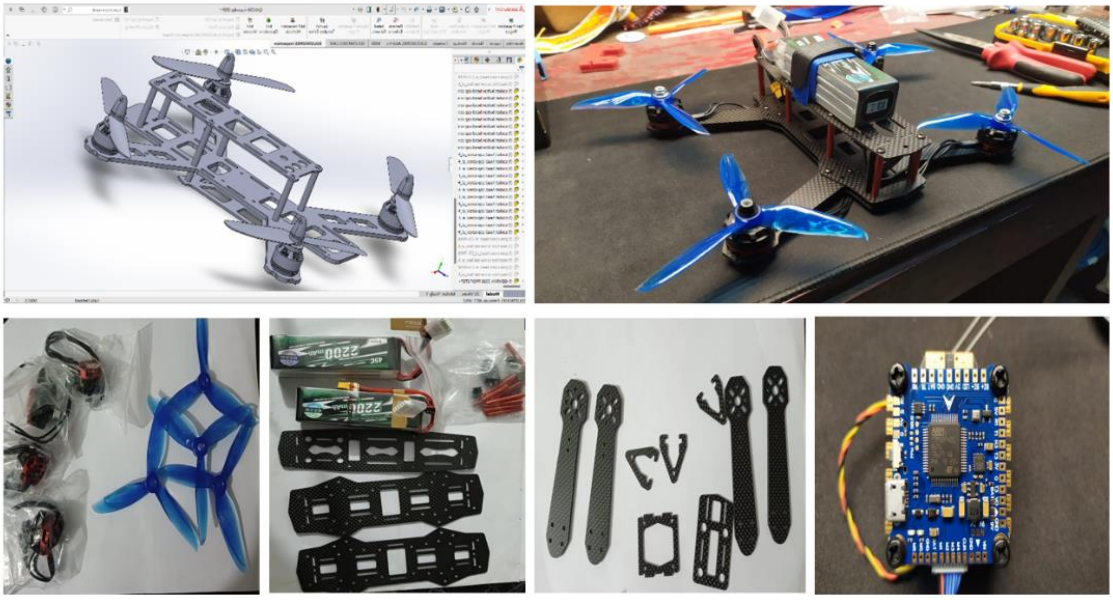


Figure 2.31 CAD Model, 3D printed mountings and components for UAV.

Figure 2.32 Final setup of the UAV and the Flight controller.

Sensors, Microcontroller and Other Components

A sensor is a device that produces an output signal for the purpose of sensing a physical phenomenon. In the broadest definition, a sensor is a device, module, machine, or subsystem that detects events or changes in its environment and sends the information to other electronics, frequently a processor. MOS technology is the basis for modern image sensors, including the charge-coupled device (CCD) and the CMOS active-pixel sensor (CMOS sensor), used in digital imaging and digital cameras. A data logger (also a datalogger or data recorder) is an electronic device that records data over time or about location with sensors. Microcontrollers are the brain of an embedded system which controls the activities of sensors, power supply, antenna, and other components of the system. Few components of this system are shown below.

Infrared Sensor | GPS | Altitude Sensor | Gyroscope

Accelerometer | Magnetometer | FPV Camera | Temperature, Humidity, Air Pressure Sensor

Figure 2.33 Sensors used with Microcontrollers.

Antenna Simulation using COMSOL Multiphysics

Antenna is an important part for any wireless communication. Different antennas serve different purposes. *COMSOL Multiphysics* Simulation Software and its *RF Module* has been used to design, analyze, and simulate various antenna types and their output pattern. Further study in this section will pave the way for advanced antenna designing and manufacturing at SPARRSO.

Dipole Antenna

A dipole antenna is an antenna with a center-fed driven element for transmitting or receiving radio frequency energy. From a physics viewpoint, this type of antenna is the simplest practical antenna. is a type of RF antenna that includes two conductive elements like wires or rods where the metal wire length is half of the highest wavelength approximately in free space at the operation of frequency. At the center of the antenna, the conductive materials are separated through an insulator which is called an antenna section. The RF voltage source is given to the middle of the antenna then the voltage & current supply throughout the two conductive elements generate an electromagnetic or radio signal and this signal is radiated outside of the antenna.

Helical Antenna

Helical antenna or helix antenna is the antenna in which the conducting wire is wound in helical shape and connected to the ground plate with a feeder line. It is the simplest antenna, which provides circularly polarized waves. It is commonly used for satellite communications. It consists of a helix of thick copper wire or tubing wound in the shape of a screw thread used as an antenna in conjunction with a flat metal plate called a ground plate. One end of the helix is connected to the center conductor of the cable and the outer conductor is connected to the ground plate. The radiation of helical antenna depends on the diameter of helix, the turn spacing and the pitch angle.

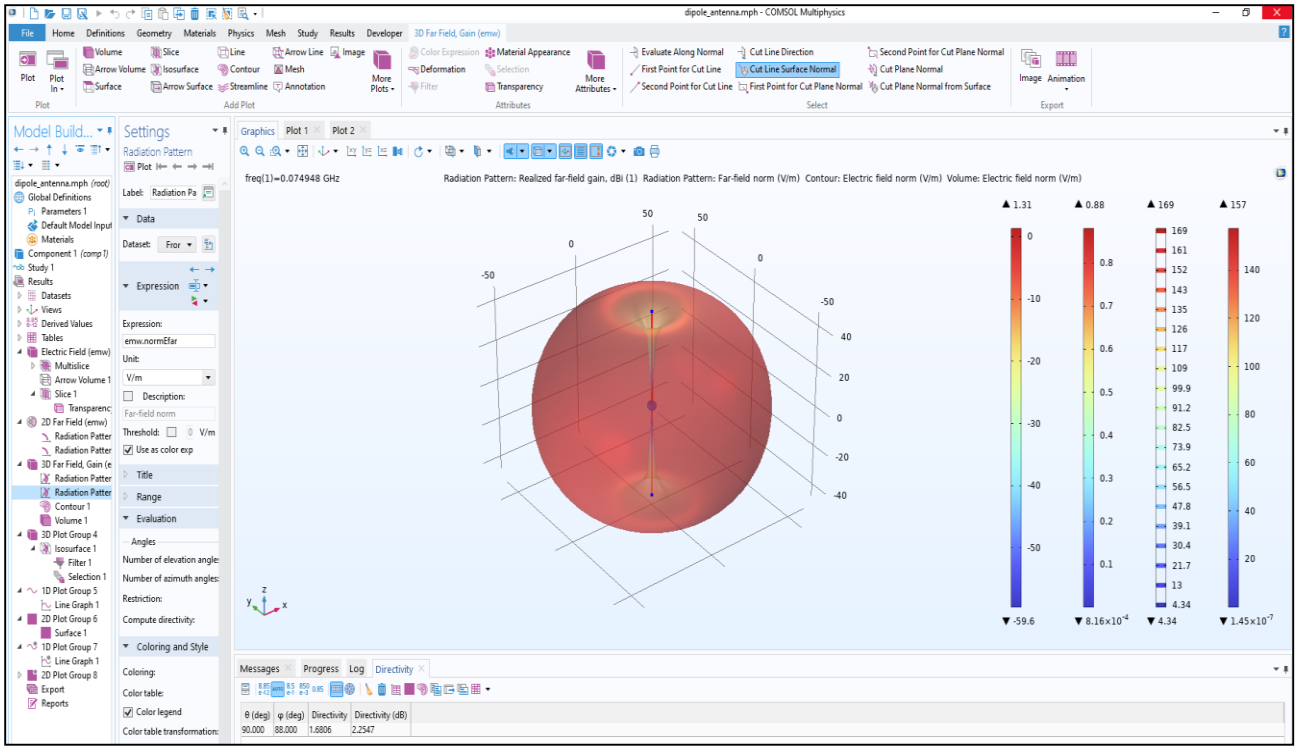


Figure 2.34 3D Radiation Pattern of Dipole Antenna.

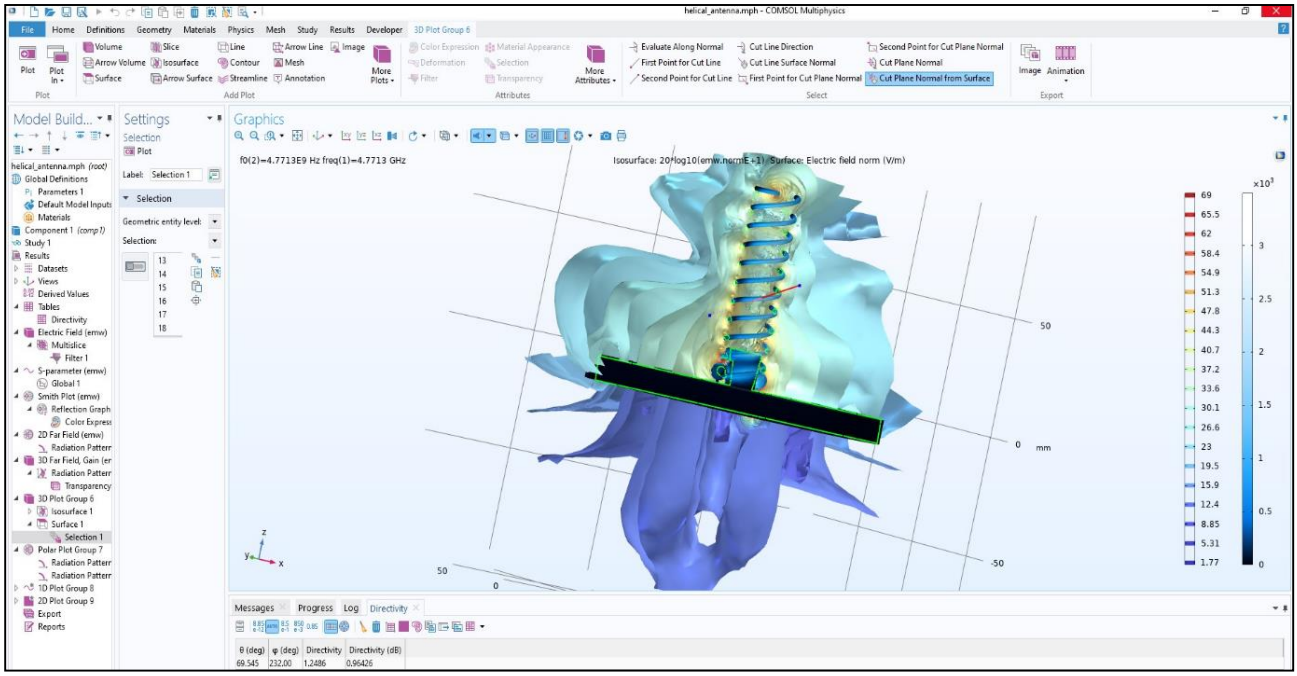


Figure 2.35 3D Normalized Electric Field Pattern of Helical Antenna.

Result and Discussion

Advances in computing technology have compiled the progression of modern and potent machine learning techniques, which have demonstrated plighting results in a wide range of applications. With the limitless amounts of remote sensing (RS) data availability, it is challenging to manually classify or detect specific land covers. Intelligent interpretation of RS images aims to use advanced machine learning techniques coupled with geological knowledge to focus on fusing massive remote sensing data, improving remote sensing application depth. Intelligent interpretation methods such as machine learning and deep learning have recently shown the potential to overcome the challenges of remote sensing signal, image, and data processing.

This Research focuses on the designing of the payload platform for UAV comprised of several sensors such as temperature, humidity, light intensity, air quality, air pressure, GNSS, etc. We developed a quadcopter UAV along with the payload. This quadcopter tested fine in RS data acquisition.

Conclusion

Design of a more developed and stable version of the UAV (Hexacopter) is underway. Implementation of machine learning algorithms and image processing techniques in order to enhance AI-based remote sensing applications will be applicable for the analysis of acquired data by this UAV. Design of the RS data acquisition platform (ROVER) and preparation of storage for RS Data in the Network Attached Server (NAS) will be done under this research work (phase 2) in the upcoming fiscal year 2023-24.

2.10 Information Section

Title: Formulation of Draft National Space Legislation in Bangladesh

Research problem/statement and objectives

Space law is a modern public international law discipline involving numerous conventions and treaties. Space law is a set of principles established under five international treaties by the United Nations during the 1960s and 1970s. In 1986, Bangladesh became a state party of the Outer Space Treaty 1967 through accession. Except for this treaty, Bangladesh has not ratified any other international space law treaties, nor has it established any primary national legal framework in this area. The only federal legislation that deals with space research activities in Bangladesh is the Bangladesh Space Research and Remote Sensing Institution Act, 1991, which only deals with establishing and functioning the Bangladesh Space Research and Remote Sensing Organization (SPARRSO). Without the legislation mentioned above, no legislation deals with more comprehensive issues relating to space law. So national legislation is required to deal with all the activities and issues relating to space law and space affairs from the country's perspective. On 11 May 2018, Bangladesh became the 57th space-faring nation by launching the satellite "Bangabandhu 1", which has opened enormous opportunities to explore and discover many space-related issues and extra-terrestrial activity. But launching the satellite was not an easy task due to many legal and technological drawbacks. It was tough, expensive, and time-consuming because there stand many issues relating to space law, and Bangladesh does not have any legal framework that would guide any authority to act according to a specified, formal procedure. Bangladesh has no proper rules, regulations or acts 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.

Forming a draft national space legislation for Bangladesh presents a critical challenge in the current era of rapid advancements in space technology and the growing importance of space activities. Despite Bangladesh's increasing involvement in space-related initiatives and its successful launch of the "Bangabandhu 1" satellite, the absence of a comprehensive legal framework poses significant obstacles to the country's ability to effectively regulate and exploit the potential benefits of space exploration and utilization. The absence of dedicated national space legislation in Bangladesh raises concerns regarding various space activities legal and regulatory aspects. The lack of specific guidelines and regulations governing satellite launches, authorization, supervision, registration of space objects, space debris mitigation, commercial space operations, and international collaborations creates ambiguity and leaves room for potential conflicts, unregulated activities, and missed development opportunities.

As space technology and its applications continue to evolve, Bangladesh needs to establish a legal framework that is adaptable and aligned with international standards and best practices. With comprehensive national space legislation, Bangladesh may be able to effectively engage in multinational space cooperation, negotiate agreements, and protect its national interests in space-

related matters. Furthermore, the absence of explicit legal provisions may hinder the growth of the domestic space industry, deter private-sector investment, and impede the development of local expertise in space-related activities. Therefore, the formulation of a draft national space legislation of Bangladesh is crucial to address the gaps and challenges in the existing legal framework and to provide a comprehensive and robust set of regulations that will foster the growth of the country's space sector, ensure national security, protect national interests, and enable effective international collaborations.

Research Objectives

i. To explore the scopes and challenges of developing space law in Bangladesh.
ii. To find out the essential steps, reformations, and amendments needed to develop space legislation in Bangladesh.
iii. To create a draft of 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 at investigating 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.

Result and Discussion

Review of International Space Law Treaties

The United Nations Committee primarily negotiates international space treaties on the Peaceful Uses of Outer Space (UNCOPUOS), a United Nations General Assembly subsidiary. Five major international treaties: The Outer Space Treaty 1967, The Rescue Agreement 1968, The Liability Convention 1972, The Registration Convention 1975 and the Moon Agreement 1979 deal with matters related to space law. Despite not having signed any of the aforementioned five international space treaties, Bangladesh has however joined the Outer Space Treaty as a state party through accession in 1986. The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies of 1967 serves as the foundation for international space law. All space operations, including those of individual member states, their residents, cooperation, and those of international organizations, of which a state party may be a member, are subject to the Outer Space Treaty (O.S.T.). The O.S.T. upholds the fundamental principles of international law which are applicable in space. The freedom of all states to explore and use celestial bodies and outer space is another basic principle.

Status of International Space Treaties in Various Countries

The status of international space treaties varies among countries, reflecting the complexities of regulating activities beyond Earth's boundaries. This overview provides a snapshot of each country's stance on key space treaties, shedding light on the global efforts to navigate the challenges and opportunities in space exploration.

Country	United Nations Space Treaties				
	Outer Space Treaty 1967	Rescue Agreement 1968	Liability Convention 1972	Registration Convention 1975	Moon Agreement 1979
Denmark	Ratification	Ratification	Ratification	Ratification	Non Party
Finland	Ratification	Ratification	Ratification	Ratification	Non Party
India	Ratification	Accession	Ratification	Ratification	Signature
Philippines	Signature	Signature	Signature	Non Party	Ratification
Korean Republic	Ratification	Ratification	Ratification	Ratification	Non Party
Malaysia	Signature	Signature	Non Party	Non Party	Non Party
United Kingdom	Ratification	Ratification	Ratification	Ratification	Non Party
New Zealand	Ratification	Ratification	Ratification	Ratification	Non Party
Kenya	Accession	Non Party	Ratification	Non Party	Non Party
Japan	Ratification	Ratification	Ratification	Ratification	Non Party

Summary of Various Country's National Space Law

In an era where space exploration and activities are rapidly expanding, nations around the world have responded with their own distinct set of laws and regulations to govern these endeavors. This segment presents an in-depth analysis of how different countries address the complex legal and regulatory challenges in space. From major spacefaring nations like the United Kingdom, India to emerging players and space enthusiasts, each country's approach to space law reflects their unique priorities, technological capabilities, and aspirations in the space. This compilation offers a glimpse into the diverse legal landscapes that guide space missions, satellite operations, commercial ventures, and resource utilization, providing valuable insights into the global governance of outer space activities.

Country	Key Features					
	Authorization	Registration	Supervision	Environment Protection	Liability	Penalty
Denmark	Y	Y	Y	Y	Y	Y
Finland	Y	Y	Y	Y	Y	Y
India	Y	Y	Y	Y	Y	Y
Philippines	Y	Y	Y	N	Y	Y
Korean Republic	Y	Y	Y	Y	Y	Y
Malaysia	Y	Y	Y	Y	Y	Y
United Kingdom	Y	Y	Y	Y	Y	Y
New Zealand	Y	N	Y	N	Y	Y
Kenya	N	N	Y	Y	N	N
Japan	Y	Y	Y	Y	Y	Y

Y = Has the provision regarding the subject matter in the act.
N = Does not have the provision regarding the subject matter of the act.

Benefits of Adopting a National Space Law in Bangladesh

- Collaboration between Institutions working for Space Technology
- Establishment of a Rocket Launching Station in Bangladesh
- Economic Development
- Opening the Doors of Foreign Investment in the Space Industry of Bangladesh:
- Private Company Investment and Commercial Use of Space
- Enhanced International Cooperation and Support
- Recognition in International Space Industry Sector
- Establishment of a Dedicated Space Studies Institution:
- Spacecraft and Aerospace Manufacturing

Major Challenges in Developing a National Space Law in Bangladesh

- Lacking Current National Space Law
- Absence of any Autonomous Space Agency
- Technological Backwardness
- Lack of Expertise and Manpower
- Absence of Space Studies Institution
- Environment Protection

Draft of National Space Legislation

By considering all challenges and benefits for space activities in Bangladesh, a draft space act has been formulated. The draft act will be verified and further scrutinized through arranging seminar/stakeholder meetings for taking inputs from researcher, institutions/ministries, legal personnel/entity in the next phase.

Conclusive Remarks

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. However, the country faces significant challenges in this endeavor, including the need for technical expertise, funding, collaboration between institutions and regulatory alignment with international space laws. 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. This study examines the prospects and challenges of developing national space legislation in Bangladesh. The research aims to review the existing 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.

Chapter 3

ADMINISTRATIVE AND FINANCIAL ACTIVITIES

4.1 Administration

4.1.1. New Chairman of SPARRSO

Mr. Md Abdus Samad, Additional Secretary to the Government of the People's Republic of Bangladesh, took charge as Chairman of Bangladesh Space Research and Remote Sensing Organization (SPARRSO) on 26 July 2022. Prior to joining this organization as Chairman, Mr. Samad served as Director in Bangladesh Parjatan Corporation (Government Tourism Organization).

He is an official of BCS (Administration) 15th Batch. Upon joining in the Civil Service in 1995, Mr. Samad serves in various important positions of the government's central and field administration at his various capacities. For professional up-skilling, he obtained training from different countries such as China, Malaysia, India, Singapore, Australia, South Africa, and Japan. The key areas of the training he obtained are Human Resource Development, Policy-Identifications, Development Administration, Environmental Development etc.

Mr. Md Abdus Samad obtained his Bachelor Degree in Agriculture from the Bangladesh Agricultural University, Mymensingh and Masters in Development Studies from the Peking University of China.

He was born on 04 May in 1967 in Chuadanga District. He is married and father of a son.

4.1.2. New Member of SPARRSO

Mr. Manash Mitra joined Bangladesh Space Research and Remote Sensing Organization (SPARRSO) as a Member (Joint Secretary) on 08 November 2022. He joined Bangladesh Civil Service in 2001. During his career, he worked in the Economic Relations Division (ERD), Finance Division, and Planning Division. Before joining SPARRSO, he served in the Bangladesh Embassy, Rome, Italy as Economic Counsellor and Alternate Permanent Representative to Rome-based UN Agencies. He also worked on lien with USAID and UKAID as Parliament Component Director at the Bangladesh National Parliament.

He holds Master Degree in Development Economics from Williams College, Massachusetts, USA before which he completed his MBA Degree from Institute of Business Administration (IBA), Dhaka University. He was basically a student of Physics from Dhaka University where he pursued his Bachelors and Master Degree.

4.1.3. New Director of SPARRSO

Mr. Mohammad Masudur Rahman Mollah, Deputy Secretary to the Government, joined as Director in Bangladesh Space Research and Remote Sensing Organization (SPARRSO on 11 October 2022. He joined the Bangladesh Civil Service in 2008 as a member of BCS Administration Cadre (27 Batch). He started his job as an Assistant Commissioner at office of the Deputy Commissioner, Lalmonirhat. He was an Assistant Commissioner (Land) in Gobindaganj, Gaibandha and Daudkandhi, Cumilla District. He was Upazila Nirbahi Officer (UNO) in Fulchari, Gaibandha, Kamalnagar, Lakshmipur and Banshkhali, Chattogram. He worked as Additional Deputy Commissioner (ADC), Additional District Magistrate (ADM) & Deputy Director Local Government (DDLG) in Coxsbazar. He worked as Deputy Secretary in Health Services Division (HSD) under the Ministry of Health and Family Welfare. He also worked as Deputy Secretary in the Ministry of Social Welfare.

Mr. Rahman graduated in Applied Chemistry & Chemical Technology from the University of Dhaka. He did Master's in Governance and Development (MAGD) from BRAC University. He obtained the highest distinction in that course and got VC's gold medal. He has got opportunities for foreign exposure to Australia, Malaysia, India, Singapore, South Korea, Switzerland, and France in various workshops, seminars and training that enhanced his knowledge of performing job activities properly.

4.1.4 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

4.1.5. Retirement and Post Retirement Leave (PRL)

The names of Officers and Staffs according to the effective date are written in chronologically

Ms. Rowshon Ara Begum, Receptionist has gone to retirement with effect from 30 September 2022. She joined SPARRSO on 18 October 1986 and served the organization for more than 36 years.

Mr. Md Altab Hossain, Driver, has gone to retirement with effect from 14 August 2022. He joined SPARRSO on 15 September 1988 and served the organization for more than 34 years.

Mr. Md. Ilias Ali, Gardener, has gone to retirement on 09 January 2022. He Joined at SPARRSO on 01 February 1993 and served the organization more than 29 years.

Mr. Dewan Md. Mehedi Hasan, Scientific Assistant has willingly retired from SPARRSO on 01 November 2022.

4.1.6 Obituary

Mr. Sumangal Chakma (53), Senior Engineer, SPARRSO, passed away on 27 November 2022 at approximately 10:25 PM at Square Hospital, Dhaka. He left behind a wife and a child at the time of his death. He joined SPARSO on 28 July 1993 as a Junior Engineer and performed his duties efficiently and diligently for 29 years.

4.1.6 New Officer and Staffs

In order to meet up different level of employees' vacancy, Bangladesh Space Research and Remote Sensing Organization (SPARRSO) has successfully accomplished the different level other recruitment process for the officers and staffs during the 2022-2023 financial years. Under some following some regular process like as police verification, medical examination. Bangladesh Space Research and Remote Sensing Organization (SPARRSO) got 4 new Officers. Their name, post and date of joining are listed below:

Sl No.	Name	Designation	Joining Date
01	Mr. Mostafizur Rahman	Scientific Officer	05/02/2023
02	Mr. Mehedi Hasan Peas	Scientific Officer	12/02/2023
03	Mr. Md. Jahidul Ashik	Scientific Officer	26/01/2023
04	Mr. Md. Rassal Mollik	Librarian	01/02/2023

Bangladesh Space Research and Remote Sensing Organization (SPARRSO) got 4 new Staffs. Their name, post and date of joining are listed below:

Sl No.	Name	Post	Joining Date
01	Mr. Abu Zafar Mohammad Zulfikar Nayem Mukti	Security Guard	21/08/2022
02	Mr. Ferdous Hasan	Mechanic/Plumber	21/08/2022
03	Mr. Zual Mondol	Driver	25/08/2022
04	Mr. Md. Toslim Ahmed	Mechanic/Plumber	20/12/2022

4.2 BUDGET AND EXPENDITURE

SPARRSO meets its recurring expenditure from the revenue budget of the Government. It also earns revenues through selling of products like maps, photographic prints, providing services and project works on payment basis. The revenue budget and the expenditure for the financial year July 2022 to June 2023 are given below:

Organization and Code	Financial Year	Allocated Budget (BDT)	Revised Budget (BDT)	Expenditure (BDT)	Remarks
SPARRSO & 131003300	2022-2023	203700000.0	17957000.0	163485370.0	Unspent (BDT) 16371630.0*

*has been deposited to the government treasury.

4.3 Store and Procurement Section

In the Light of the demand for the financial year 2022-2023 obtained from various departments/divisions/branches of SPARRSO. The HOPE (Chairman, SPARRSO) approved Annual Procurement Plan (APP) including 28 (Twenty-Eight) Package. SPARRSO spent TK. 3,76.17,702 (Three Crore Seventy-Six Lac Seventeen Thousand Seven Hundred Two Taka) by following PPR rules and regulations in the financial year 2022-2023. 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. 10,89,184/- (Ten Lac Eighty-Nine Thousand One Hundred Eighty-Four).

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 Computer, Laptop, Printer & Scanner	OTM
GR2	Repair and Maintenance of IT Accessories for SPARRSO ETC Room	OTM
GR3	Procurement of LED Display (60 -85 inch) & CCTV Monitor	e-GP (OTM)
GR4	Procurement of Stationary and Hygiene Materials	e-GP (OTM) (Frame Work Agreement)
GR5	Procurement of Equipment/ Materials for Research works	OTM
GR6	Lot 1: Procurement of ArcGIS Desktop Software Licenses (Add-on Modules/Extensions	OTM
	Lot 2: Procurement of IMAGINE ATCOR Software Licenses (Add-on Modules/Extensions	
GR7	Procurement of COMSOL Multiphysics Software with RF Module Licenses	OTM

Package No	Description of procurement packages Goods/Works/Services	Procurement method and Type
GR8	Procurement of raw Materials for Space Technology Research Lab (STRL)	RFQ
GR9	Procurement of Instrument for STRL	OTM
GR10	Publication of Annual Report , Research Report, Brochure and Latter Head Pad Printing	RFQ
GR11	Supply and Fitting Acrylic Sheet, ACP and LED Backlight Sign Board for SPARRSO	RFQ
GR12	Procurement of GIS Data and Satellite Data (VHSR) for Research Project	DPM
GR13	Procurement of souvenirs, Crest and Printing Items	RFQ
GR14	Lot:1 Procurement of Electrical Materials	Framework Agreement (Call of Order)
	Lot:2 Procurement of AC, AC Repair and Servicing	
	Lot:3 Procurement of Computer Accessories	
	Lot:4 Procurement of sanitation and hygiene related materials	
GR15	Procurement of Liveries	OTM (Framework Agreement)
GR16	Procurement of Books for Research & Library	RFQ
GR17	Procurement of Furniture	OTM
GR18	Procurement of Online UPS	OTM
GR19	Procurement of Computer & Printers for GIS Lab	OTM
GR20	Procurement of Engineering Equipments for Office management Software	OTM
WR1	Establishment of Two Labs for SPARRSO (Lot 1 Civil Works and Lot 2 Interior Works)	OTM
WR2	Renovation of Substation	RFQ
WR3	Repair and Maintenance of Furniture	RFQ
WR4	Supplying, fitting and fixing of Rolling Shutter with Enamel painting of Car Garage	RFQ
WR5	Repair and Maintenance of SPARRSO Main gate Electric Line , IP Camera and Electric water pump basement	RFQ
WR6	Renovation of Wash Block for SPARRSO Conference Room	RFQ
SR1	Appoint of 1 (one) Research Associate for ongoing Research Work	SIC

Chapter 4

LIBRARY AND USER SERVICES

4.1 User Services

Delivery of Satellite Data Product

SPARRSO Photographic Division provides different types of remote sensing data products to different government, non-government organizations and universities for conducting their study and project works. The image products of different aspect supplied to the different organizations in the financial year of 2022-2023 are mentioned below:

Product Description	Date (July '22-June'23)	Supplied to the Concerning Authority
Provide permission for use as Reference: Cyclone Affected Area Map of Bangladesh.	07-12-2022	Professor Dr. Md. Rafiqul Islam, University of Dhaka.
Sentinel-2 Satellite Image of Pirgang , Shivalaya, Bandar and Daudkandi Upazila has been provided for the Year 2015.	08-02-2023	Professor Dr. Ishrat Islam, Dean , Faculty of Architecture and Planning, BUET
Sentinel-2 Satellite Image of Thakurgaon & Dinajpur district has been provided for the year 2016 and 2022.	08-06-2023	Md. Manik Ali, Assistant Professor, Agriculture, Forestry and Environment Division, Hajee Danesh Science and Technology University, Dinajpur.

4.2 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 16,309 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. The library has books on the Liberation War and the autobiography of the Father of the Nation Bangabandhu Sheikh Mujibur Rahman. Besides, the library has religious and other reference books, government and non-government publications and other departmental collections.

During the reporting period of July 2022 to June 2023, the following books were procured. The category-wise numbers are listed below:

List of procured books

Sl. No.	Description	Number
1	Scientific Related Books	103
2	Accounting Related Books	5
3	General Books	28
	Total	**136**

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.

Photograph 4.1: Readers are at SPARRSO Library

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.

Contacts: Phone: +88-02-9113957,
Cell: +88-01515696838
Email: rassalm.duis@gmail.com

Address: Bangladesh Space Research and Remote Sensing Organization (SPARRSO)
Agargaon, Sher-e-Bangla Nagar, Dhaka-1207. Bangladesh.

Chapter 5

INTERNATIONAL EVENTS

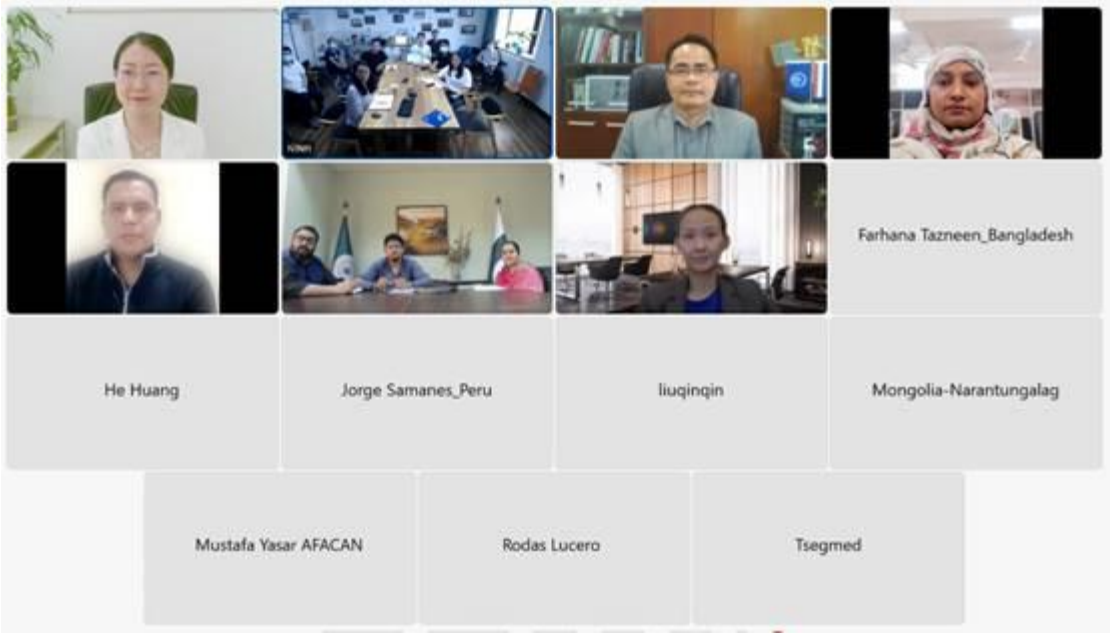
5.1 Asia-Pacific Space Cooperation Organization (APSCO)

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 5.1: APSCO Headquarters in Beijing
(Source: 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.

5.2 Expert Group Meeting (EGM) on the Feasibility Study Report (FSR).



Photograph 5.2: Group Photo of Expert Group Meeting (EGM)

The Expert Group Meeting (EGM) on the Feasibility Study Report (FSR) of "Research on Remote Sensing Models for Monitoring Earthquake Precursors and Application Demonstration in APSCO Member States" Project was successfully organized through a teleconference during 4-5 July 2022. Experts from Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand, Türkiye and the project management team from APSCO Secretariat participated in this meeting. The Review Report of Expert Group Meeting on FSR of the project based on the evaluation results, comments and suggestions of Member States experts was discussed and consolidated. The experts recommended to submit updated version of FSR of "Monitoring Earthquake Precursors and Application Demonstration in APSCO Member States Project" to submit the upcoming Administrative Heads Meeting, for review and recommendation of the Council Meeting. Farhana Tazneen, Senior Scientific Officer, attended the meeting as an expert from SPARRSO.

5.3 Twenty Sixth Session of the Intergovernmental Consultative Committee (ICC) Meeting

The twenty-sixth Session of the Intergovernmental Consultative Committee (ICC) on the Regional Space Applications Programme for Sustainable Development (RESAP) was held on 18-19 August 2022, at the National Research and Innovation Agency (BRIN) Headquarters, Jakarta, and also at the virtual platform. The ICC was attended by representatives from the following 14 members, namely Bangladesh; China; Fiji; India; Indonesia; Japan; Kazakhstan; Pakistan; Philippines; Singapore; Sri Lanka; Tajikistan; Thailand; and Uzbekistan; and one associate member: Hong Kong, China.

Under the theme 'Progress in implementing the Asia-Pacific Plan of Action on Space Applications for Sustainable Development (2018-2030), Dr. Md. Mahmudur Rahman, Chief Scientific Officer of SPARRSO on behalf of the Bangladesh delegation reported on its progress in carrying out the Plan of Action, in three thematic areas: disaster risk reduction and resilience, natural resource management and social development. The present activities and future plans of SPARRSO were highlighted in the presentation. These include the development of an integrated river monitoring system based on space applications; mapping changes in mangrove species composition in the northern part of the Sundarbans; estimating crop water requirement using remote sensing data and SEBAL algorithm; and identification of potential land reclamation in the Meghna estuary.

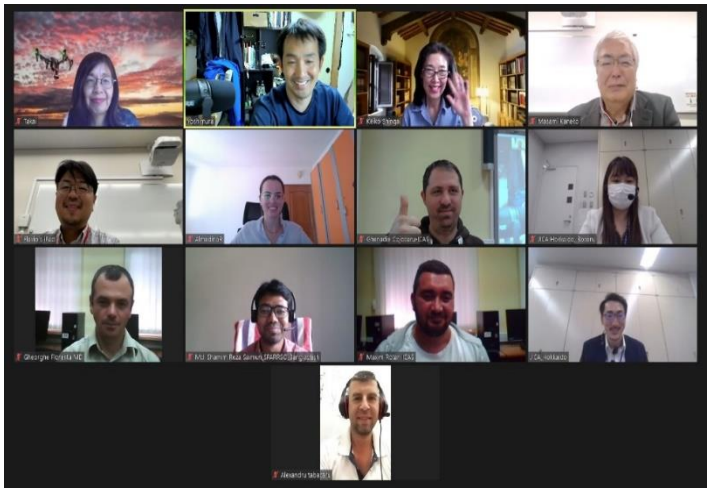
The delegation also emphasized a few spaces application-based best practices that may be shared with the other nations in the area, including the national flood monitoring system to support disaster preparedness, and annual estimates of rice crop areas to assist food security planning. The development of an agricultural drought monitoring model and monitoring thunderstorms, floods and flash floods, erosion, and mapping tree cover, etc. were highlighted as some ongoing activities under various thematic areas of the Plan of Action.

There was an update on the preparation for the Geospatial Practices for Sustainable Development in South-East Asia 2022: A Compendium. The second edition of the compendium on geospatial practices was currently under preparation as reported by the secretariat. As it was decided at the previous session of the Committee, the sub-regional focus of the forthcoming edition (2022) was on South-East Asia.

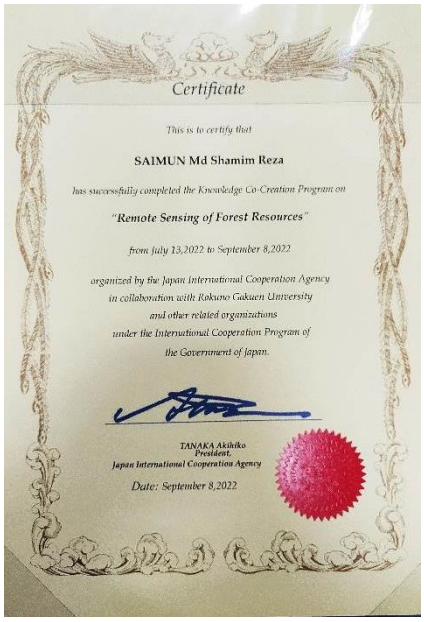
The conclusions and recommendations of the meeting were presented by the Chair before adoption. The Committee adopted the proceedings, conclusions, and recommendations of the meeting.

5.4 Training Course on Remote Sensing of Forest Resources (Online)

In order to acquire the basic skills and knowledge for using remote sensing with the aim of understanding forest resources in their own countries based on international discussion of REDD+, JICA arranged this training course from 11 July 2022 to 8 September 2022. Mr. Md. Shamim Reza Saimun, Scientific Officer, participated in this course and received a certificate for successful completion of the training. In this course, he learned about various topics such as the theory of remote sensing, types of remote sensing data, how to preprocess those data, classification concepts and types, change detection techniques, and accuracy assessment using QGIS software. This training course also provided the basic knowledge of Google Earth Engine and its usage such as cloud-free mosaicking, data exporting, classification, change detection etc. Furthermore, there was a practice and consultation session, where the participant presented the application of remote sensing in his respective field based on the learning from this course.



Photograph 5.4: Participants and trainers of the course titled Remote Sensing of Forest Resources



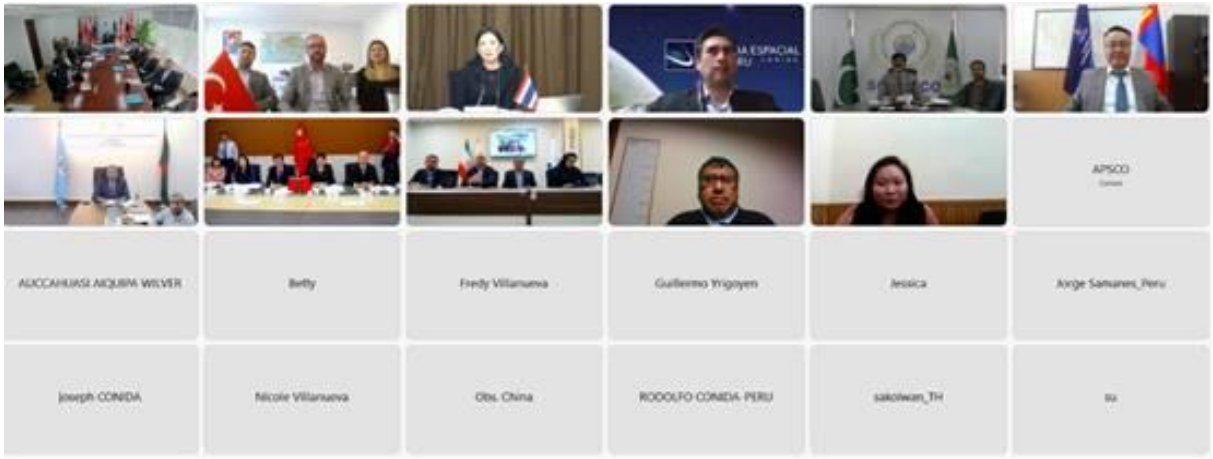
Photograph 5.5: Certificate of the training course arranged by JICA.

5.5 Bangladesh Delegate attended in the 15th Administrative Heads Meeting of APSCO

The 15th Administrative Heads Meeting of APSCO was held from 14 to 16 September 2022 in Beijing, China through Virtual Platform. After the APSCO Council, it is the second highest decision-making forum of APSCO. Administrative Heads and accompanied delegates from Member States: Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand and Turkiye, attended in the Meeting.

Photograph 5.6: Delegates of the 15th Administrative Heads Meeting of APSCO at SPARRSO Board Room

Mr. Md Abdus Samad, Chairman SPARRSO (Additional Secretary) led the Bangladesh Delegation. He also chaired the 1st session of the meeting. Dr. Fahmida Khanom, Joint Secretary, Ministry of Defence and Dr. Md. Abdus Salam, Chief Scientific Officer & Focal Point of APSCO from Bangladesh also attended in the meeting. The Administrative Heads and the delegates from Member States made detailed deliberations and discussions on each agenda item.

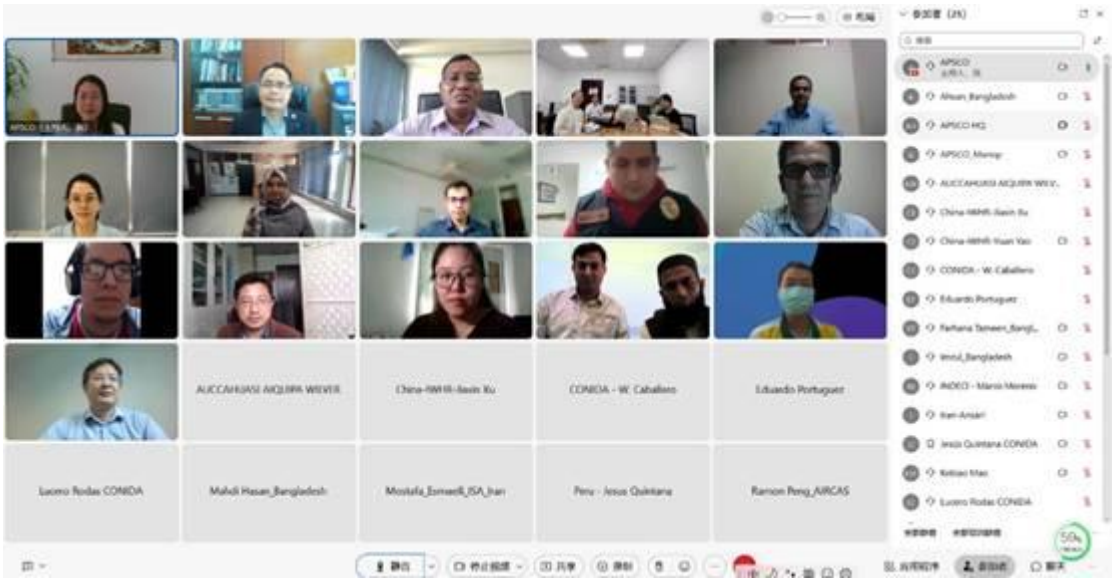


Photograph 5.7: Member States delegates of 15th Administrative Heads Meeting (online)

The Administrative Heads finalized the recommendation on each agenda item for the confirmation/approval of the APSCO 16th Council Meeting.

5.6 1st Intermediate Progress Review Meeting of the Joint Research Projects (JRP)

The 1st Intermediate Progress Review (IPR) Meeting of the Joint Research Projects (JRP) under the "Establishment of a Framework for Researches on Application of Space Technology for Disaster Monitoring in the APSCO Member States-Phase II" Project was successfully conducted in virtual format, during 19-20 September, 2022. Delegates of the joint research teams from Bangladesh, China, Iran, Mongolia, Pakistan, Peru and Thailand, as well as the Project Management Team from APSCO Secretariat attended the meeting. The research team leaders of 13 JRPs under four disaster research themes of Theme-1: 'Flood', Theme-2: 'Landslide/Avalanche', Theme-3: 'Drought' and Theme-4:'Multi-Hazard', presented their respective JRP progress report. Knowledge, information and best practices have been actively shared among the experts of participating Member States during the session. The implementation of all JRPs were in good progress. Collaboration among the research teams shall continue under the leadership of each JRP initiator, for effective implementation of the project, and improving capacity in the field of disaster monitoring using space technology among APSCO Member States. M. Nur Hossain Sharifee, Chief Scientific Officer, Farhana Tazneen, Senior Scientific Officer and S M Ahsan Habib, Senior Scientific Officer attended the meeting from SPARRSO.



Photograph 5.8: Group Photo of 1st Intermediate Progress Review Meeting of the Joint Research Projects (JRP)

5.7 Bangladesh Delegate attended in the 1st APSCO Leadership Development Forum

The 1st APSCO Leadership Development Forum was held from 13-14 November 2022 in Islamabad Pakistan, just before the 16th Council Meeting of APSCO, on 13 November 2022, Opening Ceremony was held in which the Secretary-General of APSCO, Ms. Yu Qi, Acting Chairman of SUPARCO, Mr. Zafar Iqbal and Chairman APSCO Mr. Jose Antonio Garcia Morgan made opening remarks.

Speakers from United Nations - Office for Outer Space Affairs (UNOOSA), Secure World Foundation, Western Sydney University, Australia, Wuhan University, China, University of Hong Kong, and Hong Kong Aerospace Technology Group,Hong Kong-China, shared their views and insight on critical space law and policy related issues, contemporary dialogues in space governance, and new emerging aspects in space, such as: space commercialization, space commerce, local industry development, and space economy.

More than 60 participants from Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand, and Turkiye, Mexico, Malaysia and Philippines attended the forum. On behalf of Mr. Golam Md Hashibul Alam, Senior Secretary, Ministry of Defence (APSCO Council Member), Dr. Md. Abdus Salam, Chief Scientific Officer, SPARRSO & Focal Point of APSCO from Bangladesh participated in the forum.

The event provided an opportunity for the higher leadership to meet the renowned experts from the world and have a dialogue on latest issues, challenges and opportunities for government, private sector, academia and society related to space. In the afternoon of 14 November, a round

table discussion was held on “Post-Pandemic Regional Space Cooperation” among representatives from Member States, partner countries and speakers.

The participants emphasized that the rule of law in space can help ensure the sustainable, secure, and peaceful utilization of outer space that can benefit all humanity. The participants strongly supported developing new rules, regulations, policies, and practices aligned with peaceful purposes and existing international laws.


Photograph 5.9: Delegates of the 1st APSCO Leadership Development Forum

5.8 Bangladesh Delegate attended in the 16th Council Meeting of APSCO

The 16th Council Meeting of APSCO was held from 15-17 November 2022 in Islamabad, Pakistan. APSCO Council is the highest decision-making forum of APSCO. Council Members/Representatives and accompanied delegates from the Member States: Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand, and Turkiye, attended the Meeting.


Photograph 5.10: Delegates of the 16th APSCO Council Meeting

On behalf of Mr. Golam Md Hashibul Alam, Senior Secretary, Ministry of Defence (APSCO Council Member), Dr. Md. Abdus Salam, Chief Scientific Officer, SPARRSO & Focal Point of APSCO from Bangladesh attended the meeting.

The Council Members/Representatives and the delegates from the Member States made discussions on the reports and proposals of APSCO cooperative activities as presented by APSCO Secretariat in different agenda items. The Council reviewed/ revised /confirmed /approved the recommendations on different agenda items earlier recommended in the 15th Administrative Heads Meeting of APSCO.

5.9 Short Course on "Application of Space Technology for Disaster Risk Management with Emphasis on Floods and Landslides for Asia Pacific Region"

Photograph 5.11: Group Presentation on Flood Mapping.

The CSSTEAP organized a Short Course on "Application of Space Technology for Disaster Risk Management with Emphasis on Floods and Landslides for Asia Pacific Region" which was conducted by Indian Institute of Remote Sensing (IIRS) at Dehradun, India during November 21-December 03, 2022. Bangladesh, Myanmar, Mongolia, Nepal, Kazakhstan, Sri Lanka, Tajikistan, and Uzbekistan were the eight countries from the Asia-Pacific region that took part in the training course. The overall objective of this two weeks training programme was to generate awareness among users, researchers, professionals, decision-makers or academicians on Space technology and its applications for disaster management and in the line of implementing Sendai Framework for Disaster Risk Reduction. Utilizing hardware, software, and instrumentation facilities, the course curriculum was carried out through a combination of theory lectures and practical exercises. The instructors for the aforementioned course include specialists and experienced IIRS and ISRO faculty members, as well as skilled scientists and engineers employed at various ISRO centers and

Departments. For hands-on practice, a PC loaded with image processing and GIS applications was provided by the institute for each participant. The participants were taken to Irrigation Research Institute Roorkee to have some knowledge about the Hydraulic Modelling of structures. The Hydraulic Modeling is generally carried out by various means such as physical hydraulic modeling, electronic/electrical, numerical or mathematical modeling. The participants have been familiarized with the disaster management concepts, conceptual frameworks and institutional mechanisms, application of space and geospatial technologies for pre- and post-disaster monitoring and mitigation such as early warning, hazard, vulnerability and risk assessment, damage assessment, data repositories and web portals for addressing flood and landslide hazards during this training. Farhana Tazneen, Senior Scientific Officer, attended the training as a participant from SPARRSO, Bangladesh.

5.10 Workshop on "Tackling Extreme Precipitation Events".

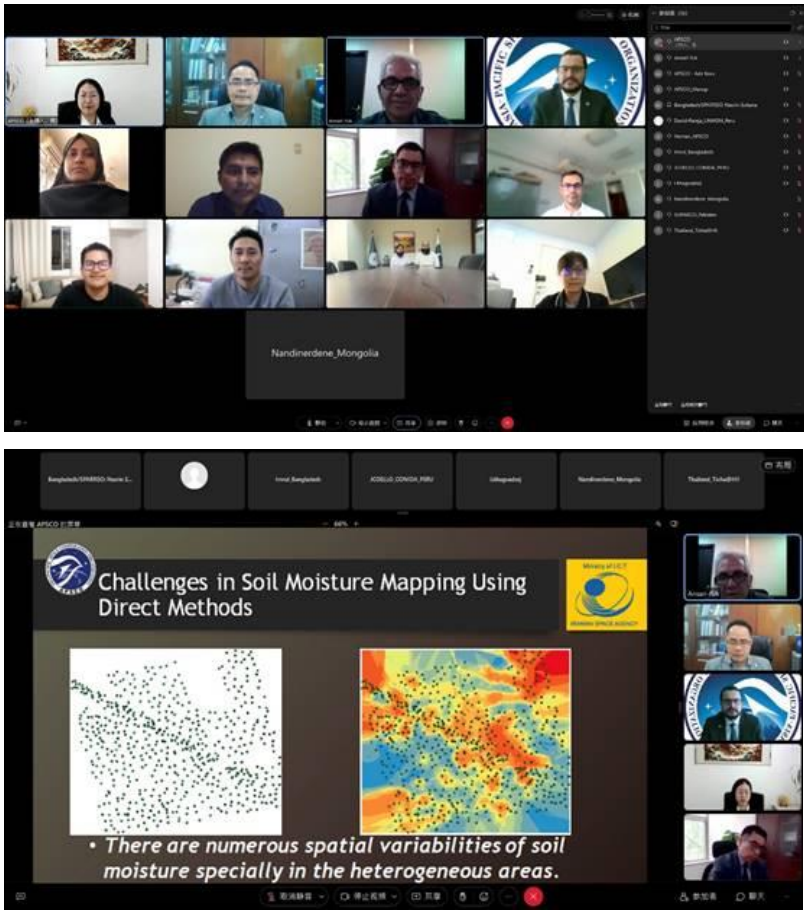
Mrs. Nasrin Sultana, Senior Scientific Officer and S M Ahsan Habib, Senior Scientific Officer participated in workshop on "Tackling Extreme Precipitation Events" was organized by Japan Aerospace Exploration Agency (JAXA) and the Japan Meteorological Agency (JMA) through Teleconference during 01-03 March, 2023. This workshop showcased current applications and services based on space technology for preparation and mitigation of the impacts caused by extreme precipitation events, shared good practices, and discussed potential cooperation to support tackling the issues in the Indo-Pacific region. The workshop included training session for utilizing space-based information for managing extreme weather events such as drought and heavy rainfall.

5.11 1st Expert Group Meeting (EGM) on the Feasibility Study Report (FSR) of Industrial Minerals Prospection Using Satellite Remote Sensing

Photograph 5.12: Group Photo of 1st Expert Group Meeting (EGM)

The 1st Expert Group Meeting (EGM) on the Feasibility Study Report (FSR) of Industrial Minerals Prospection Using Satellite Remote Sensing Project was organized on virtual platform during 28-30 March, 2023. Experts from the Member States of Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand, Türkiye and the Project Management Team from APSCO Secretariat participated in the meeting. The main objectives of this project are to develop efficient and rapid mineral mapping methodology using satellite remote sensing and ancillary data, and to strengthen capacity building of Member States of APSCO in space technology applications, especially satellite remote sensing. The FSR was thoroughly reviewed and actively discussed by the experts. Comments and suggestions from the Member States' experts were clarified and taken into account for updating of the FSR which will be discussed in the 2nd EGM. Farhana Tazneen, Senior Scientific Officer, attended the meeting as an expert from SPARRSO.

5.12 Kick-off Meeting on "Spatial Downscaling of Retrieved Soil Moisture Using Synergistic Multi-Satellite Remote Sensing



Photograph 5.13: Kick-off Meeting on "Spatial Downscaling of Retrieved Soil Moisture Using Synergistic Multi-Satellite Remote Sensing

Mrs. Nasrin Sultana, Senior Scientific Officer participated in the Kick-off Meeting on "Spatial Downscaling of Retrieved Soil Moisture Using Synergistic Multi-Satellite Remote Sensing" Project which was organized by APSCO through Teleconference during 17-17 April, 2023. Delegates from Bangladesh, China, Iran, Mongolia, Pakistan, Peru and Turkey participated in the meeting. Mr. Abdolreza Ansari Amoli, Project Manager, from ISA, presented the Project Implementation and Management Plan (PMP) in details during the meeting. Discussion on the PMP was carried out based on the recommendation, comments proposed by experts from Member States. The corresponding clarifications and action items were agreed among all participants. It was recognized by all delegates that the Spatial Downscaling of Retrieved Soil Moisture Using Synergistic Multi-Satellite Remote Sensing Project has been successfully kicked-off, and transferred to the implementation phase according to the PMP.

5.13 Bangladesh Delegate attended in the 1st Focal Point Networking Meeting of APSCO

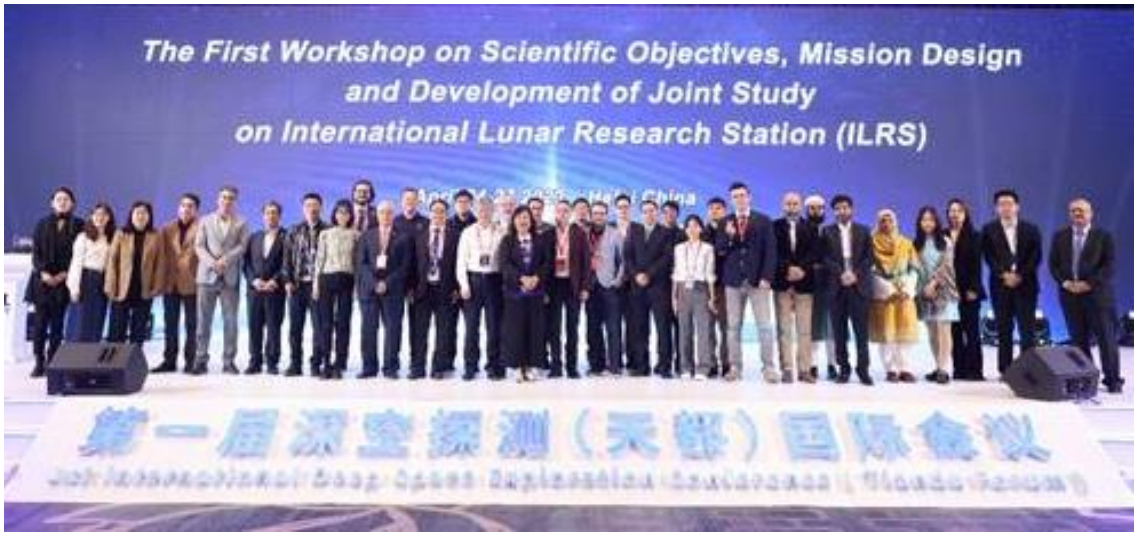
The 1st Focal Points Networking Meeting of APSCO was held on 27 April, 2023 in Hefei, China. The meeting was organized back-to back with the China National Space Day. Focal Points from the agencies and respective embassy in Beijing of the Member States: Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand, and Turkiye, attended the Meeting. Dr. Md. Abdus Salam, Chief Scientific Officer, SPARRSO & Focal Point of APSCO from Bangladesh and Dr. Mohammad Nazrul Islam, Chief of Mission & Minister, Embassy of the Republic of Bangladesh attended the meeting.


Photograph 5.14 Delegates of the 1st APSCO Focal Point Networking Meeting

Upon receiving the membership status of APSCO, each Member State nominates a Focal Organization which becomes the coordinating and communicating organization with APSCO. The Focal Organization further nominates official/s (focal Point/s) which becomes the main communication channel with APSCO. Focal Points plays a crucial role in the execution of APSCO activities by fostering efficient and effective communication between APSCO Secretariat and the respective Member State. The Secretariat organized the meeting with the aim to introduce the Focal Points to each other, build strong network among Focal Points and the APSCO Secretariat.

Focal Point from each Member States made an introduction about its Focal Organization and working mechanism towards APSCO affairs. It helped Secretariat Staff to understand the domestic procedures of Member States. The Director Generals of the five Departments of APSCO Secretariat introduced their own staff and respective responsibilities. In the afternoon session, APSCO new initiatives and activities of year 2023 were presented by the Secretariat. The Focal Points highly appreciated the initiative of organizing such meeting and strongly supported to continue it.

5.14 First Workshop on Scientific Objectives, Mission Design and Development of Joint Study on International Lunar Research Station (ILRS)



Photograph 5.15: Group photo of the workshop

The Asia-Pacific Space Cooperation Organization (APSCO), in collaboration with the Lunar Exploration and Space Engineering Centre of the China National Space Administration (CNSA), and Belt and Road Aerospace Innovation Alliance (BRAIA) co-organized the First Workshop on Scientific Objectives, Mission Design and Development of Joint Study on International Lunar Research Station (ILRS) during 24-27 April, 2023 in Hefei, Anhui Province, China. Invited experts and scholars from space agencies and organizations worldwide, space industries, research institutes and universities participated in the workshop to discuss the Scientific Objectives of Joint Study on ILRS. The workshop was organized back-to-back with International Conference on Deep Space Science, Sub-forum 1: Engineering & Technology of Deep Space Exploration and Sub-Forum 2: Deep Space Science. The participants actively exchanged their experiences on cutting-edge technologies, research achievements, contemporary hot topics, international major projects, and international cooperation in deep space exploration field. During the event, APSCO and CNSA also celebrated the signing ceremony of the Joint Declaration Concerning Cooperation on the ILRS on International Conference of Deep Space Science, on 25 April, 2023. The workshop focused on the APSCO-CNSA Joint Study on ILRS project which was held on 26 April. There are currently

more than 50 experts and scholars from APSCO Member States, and Arab Union for Astronomy & Space Sciences (AUASS) who have joined the Working Group. Mrs. Farhana Tazneen, Senior Scientific Officer, and Mr. Muhammad Sharif, Assistant Engineer, attended the workshop as a participant from SPARRSO.

5.15 Distance Training Course on Mars Geology

Photograph 5.16: Group Photo of Distance Training Course on Mars Geology

APSCO Secretariat organized the Distance Training Course on Mars Geology on virtual format during 8-12 May and 15-19 May, 2023. Deep space exploration is an essential component of modern science, and APSCO has been organizing training programs under this hot topic and received widespread attention. In the past two years, Short Training Course on "Lunar Data Analysis", and Short Training Course on "Analysis and Interpretation of Data from China's Lunar Missions" were successfully held. Distance Training Course on Mars Geology was the third course in this regard. The lecturers, from the highest academic institution and first-class universities, presented a 21-hour courses focused on the subjects including Aqueous Processes on Mars, Volcanism on Mars, Subsurface Structure of Mars, Aeolian Processes on Mars, Magnetic Field of Mars, Introduction to Astrobiology of Mars, and Experimental Constraints on the Surficial Processes of Mars. Around 50 participants from APSCO Member States and the rest of the world to register for the courses. Exchanges on theory and application in the fields were carried on among participants and lecturers. Nasrin Sultana, Senior Scientific Officer, Farhana Tazneen, Senior Scientific Officer, Md Farid uddin, Md. Shamim Reza Saimun and Mehedi Hasan Peas, Scientific Officer attended the training as a participant from SPARRSO.

5.16 Expert Group Meeting (EGP) on Feasibility Study Report (FSR) on Universe Adventure Project

Photograph 5.17: Participants of the First Expert Group Meeting (EGM) on the Feasibility Study of the Universe Adventure Project

Universe Adventure Project is a training project that proposed by National space science center (NSSC), Chinese Academy of Sciences (CAS) and Asia Pacific Space Cooperation Organization (APSCO) is going to approve the project. The First Expert Group Meeting (EGP) on Feasibility Study Report (FSR) on the project is organized on 8-9 June 2023, through teleconference and experts from 08 member states of APSCO have participated. Dr. Mohammad Shohidul Islam, Principal Scientific Officer, SPARRSO has participated in the meeting behalf of Bangladesh. In this meeting, the Feasibility Study Report (FSR) of the project is reviewed, and the final Report on the FSR is consolidated. It is a 02 years training program on China space science missions' data analysis, study and application. It includes two terms of training, each last for 60 days, and one term per year. The training program will be open to the college students, doctoral students, or postdoctoral researchers, young researchers of APSCO member states.

5.17 Second Expert Group Meeting (EGM) on the Feasibility Study Report (FSR) of Minerals Prospection Using Satellite Remote Sensing Project

APSCO organized the Second Expert Group Meeting (EGM) on the Feasibility Study Report (FSR) of Minerals Prospection Using Satellite Remote Sensing Project on virtual format during 19-20 June, 2023. The project aims to develop efficient and rapid mineral mapping methodology using satellite remote sensing and ancillary data and to strengthen capacity building of Member States in space technology applications, especially satellite remote sensing. As a follow up of the 1st EGM organized in April 2023, Mr. Hafiz Uzair Ahmad Khan, the project team leader from

SUPARCO (Space & Upper Atmosphere Research Commission) presented the updated FSR, based on the comments and suggestions of the experts provided during 1st EGM. The updated FSR was thoroughly reviewed and discussed by the experts. Farhana Tazneen, Senior Scientific Officer, attended the meeting as an expert from SPARRSO.

Photograph 5.18: Group Photo of Second Expert Group Meeting (EGM) on the Feasibility Study Report (FSR) of Minerals Prospection Using Satellite Remote Sensing Project

5.18 Online training on Space Application for Weather and Climate Studies

Dr. Mohammad Shohidul Islam, Principal Scientific Officer along with other Scientific Officers named Md. Ariful Islam, Md Farid Uddin, Mehedi Hasan Peas and Md. Jahidul Ashik participated in the online training on "Space Application for Weather and Climate Studies" organized by Indian Institute of Remote Sensing (IIRS) from 22 May- 2 June 2023. It was an intensive summary training course on satellite-based climate studies followed by some practical sessions as well. An overview of satellite-based rainfall, humidity, surface temperature etc. estimation was provided by experts from IIRS and Indian Meteorological Departments (IMD) and several other experts.

5.19 APSCO Training on "Urban Remote Sensing Information Processing and Air Pollution Monitoring"

Distance Training Course on "Urban Remote Sensing Information Processing and Air Pollution Monitoring" under Advanced Training Course on Remote Sensing and Urban Application Project, was held on 26-30 June 2023. Dr. Md. Mahmudur Rahman, Chief Scientific Officer, and Mr. Md. Jahidul Ashik, Scientific Officer of SPARRSO attended this program. This online training course primarily targeting satellite-based air quality monitoring in different urban issues like land surface temperature (LST), urban greenness index, urban street canopy measurement, accessibility,

aerosol monitoring, air pollution monitoring, etc. The themes were presented from the perspective of applying recent LiDAR data, drone images, and satellite-based remote sensing imagery.

Mostly, significance was given to satellite-based air quality monitoring using Chinese satellites like DQ-1, Polder satellite, GF-5 satellite which can measure CO2 and Aerosols, Particulate Matter (PM) 6.5, PM 6.10 using roughly 410 nm to 2250 nm wavelength of light. Several studies on the relationship between air quality change and human mortality, the relationship between LST and population increase, or agriculture production increase with temperature increase were discussed in terms of a global perspective. One of the insights was the recent development in the air quality index in Chinese cities and the rapid pollution increase in India and Africa. These methods have also been used in dense fire activity monitoring, volcanic activity monitoring, dust storm monitoring, etc. These types of models were developed using the integration of satellite data and in situ data and later calibrated. Different new methods like machine learning and its conveniences in terms of accuracy and better classification of images were also discussed.

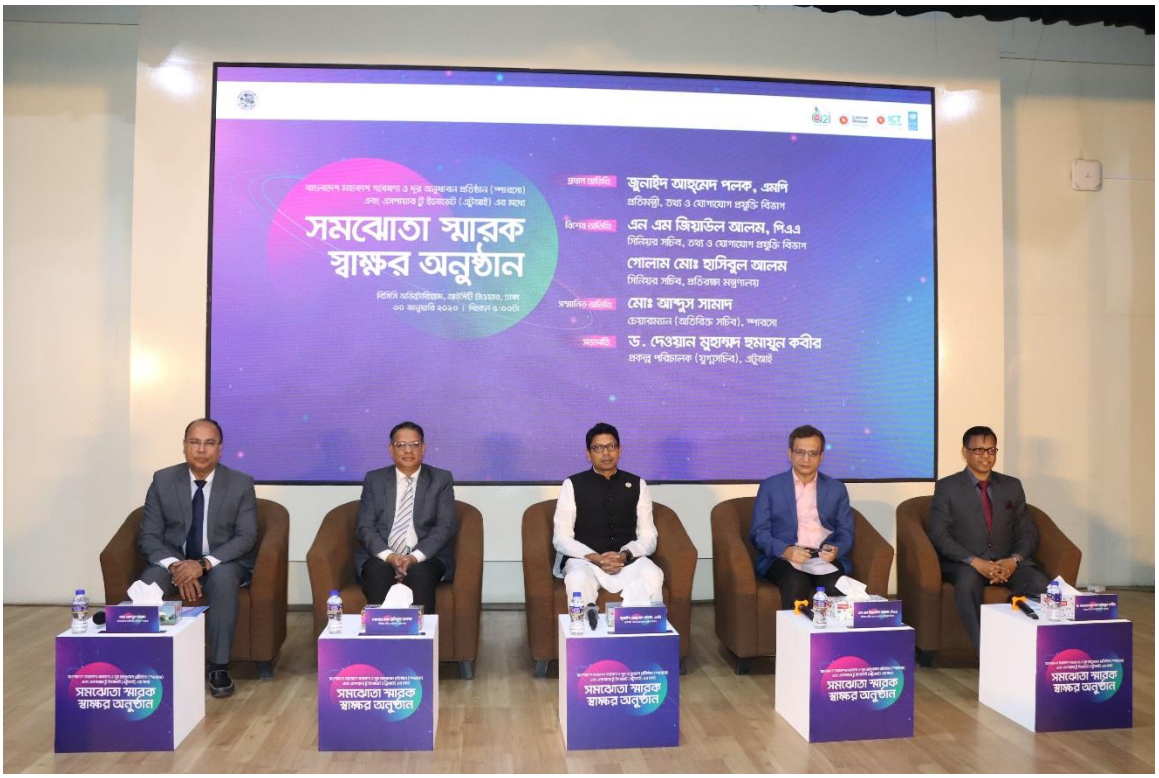
Considering the lower livability ranking among cities of the world in Bangladesh, these types of cutting-edge technology and method can be adopted here as well. For near real-time air quality monitoring integration of satellite-based data along with the in-situ data can enable Bangladesh in large-scale air quality monitoring and eventually identify spatiotemporal sources and sink of this hazard. Also, different analyses of urban livability can produce better insight for the city authorities and policymakers.

Chapter 6

IN-HOUSE AND LOCAL EVENTS

6.1 Memorandum of Understanding (MoU) Signing with Aspire to Innovate (a2i)

A Memorandum of Understanding (MoU) was signed between Bangladesh Space Research and Remote Sensing Organization (SPARRSO) and Aspire to Innovate (a2i) at BCC Auditorium, ICT Tower in Dhaka. Mr. Zunaid Ahmed Palak, MP, Hon'ble State Minister, Information and Communication Technology Division was the Chief Guest of the program. Mr. N M Zeaul Alam, PAA, Senior Secretary, Information and Communication Technology Division and Mr. Golam Md Hasibul Alam, Senior Secretary, Ministry of Defence were the Special Guests of the MoU Signing Program. Mr. Md Abdus Samad, Chairman (Additional Secretary), SPARRSO was also the Honored Guests and Mr. Dr. Dewan Muhammad Humayun Kabir, Project Director (Joint Secretary), Aspire to Innovate (a2i) was the Moderator of the Program. Officers of SPARRSO, Ministry of Defence and a2i were also attended in the MoU Signing program. This signing has expanded the level of co-operation between SPARRSO and a2i.



Photograph 6.1: MoU Signing Ceremony between SPARRSO and a2i.

Photograph 6.2: Chairman, SPARRSO and Project Director, a2i were signing the MoU.

Photograph 6.3: Participants of MoU Signing Ceremony.

6.2 In-House Events

6.2.1 First Workshop on Fourth Industrial Revolution and Space Technology

A workshop was organized on 28th December 2022 by Bangladesh Space Research and Remote Sensing Organization (SPARRSO) based on Fourth Industrial Revolution and Space Technology at SPARRSO auditorium. The workshop centered around the fusion of the Fourth Industrial Revolution and Space Technology. Mr. Md Abdus Samad, Chairman (Additional Secretary) of SPARRSO, graced the event as the chief guest. Two distinguished speakers, namely, Dr. Soebur Razzaque, Professor at the Department of Physics, University of Johannesburg, and Mr. Mustafa Hasan, Chairman of the Department of Computer Science and Engineering at Primeasia University, shared their insights during the workshop.Top of Form Integral to the workshop was a group activity that aimed to foster collaboration and learning. To attain the workshop's objectives, all participants were allocated to four distinct groups. Each group was tasked with delving into a specific topic. The workshop's primary focus was on the advancement of technologies associated with the Fourth Industrial Revolution such as the Internet of Things (IoT), artificial intelligence (AI), 3D printing, cloud computing and big data analytics. With the requirements of the latest industrial revolution increasing the pace of technological innovation, the future of space exploration is very bright and will be able to play a key role in the responsible use of disruptive technologies that will help transform the way we live.

Photograph 6.4: Workshop on Fourth Industrial Revolution and Space Technology.

Photograph 6.5: Participants of the Workshop on Fourth Industrial Revolution and Space Technology.

6.2.2 Workshop on Demand Analysis for the Ongoing and Future Research Works of SPARRSO

SPARRSO organized a workshop focusing on Demand Analysis for the Ongoing and Future Research works of SPARRSO on 29th January and 20th February 2023 with an aim to enhance the quality of ongoing research and identify potential research works for the upcoming financial year 2023-24.

First workshop: First workshop on Demand Analysis for the Ongoing and Future Research works of SPARRSO was held on 29th January 2023. Mr. Md Abdus Samad, Chairman (Additional Secretary), SPARRSO was the chief guest and Dr. Dewan M Humayun Kabir, Project Director (Joint Secretary), Aspire to Innovate (a2i) was the special guest of the workshop. Also, a number of Govt. Officials of Ministries/ Organizations/ Departments including Defence ministry, a2i program, Professors/ Associate professors of renowned Universities were present in the workshop. Officers of different department of SPARRSO had presented their ongoing research works while professors and officials provided valuable insights and feedback on these research works. This collaborative approach aimed to foster an environment of knowledge sharing and constructive critique, ultimately driving improvements in the ongoing research endeavors and influencing the selection of future research works.

Photograph 6.6: Workshop on Demand Analysis for the Ongoing and Future Research Works.

Photograph 6.7: Participants of the Workshop on Demand Analysis for the Ongoing and Future Research Works of SPARRSO.

Second workshop: Second workshop on Demand Analysis for the Ongoing and Future Research works of SPARRSO was held on 20th February 2023. Mr. Md Abdus Samad, Chairman (Additional Secretary), SPARRSO graced the event as the chief guest and Nahid Sultana Mallik, Joint Project Director (Joint Secretary), Aspire to Innovate (a2i) as the special guest of the workshop. Professors from Bangladesh University of Engineering (BUET), BRAC University and Bangabandhu Sheikh Mujibur Rahman Aviation and Aerospace University, Scientists and representatives of various Ministries/ Organization/ Departments including Defence Ministry, a2i program were present in the workshop. The morning session of the workshop was dedicated to demand analysis within the Agriculture and Forestry sector. In the afternoon session, the primary focus shifted to outlining potential projects for SPARRSO in the field of space technology for the upcoming financial years. Esteemed researchers and experienced professors provided their invaluable insights and feedback on these matters, contributing to the productive discourse of the workshop.

Photograph 6.8: Dr. Md. Mahmudur Rahman, Chief Scientific Officer, SPARRSO Presented His Research Work.

Photograph 6.9: Participants of the Workshop on Demand Analysis for the Ongoing and Future Research Works of SPARRSO

Photograph 6.10: Mr. Md Abdus Samad, Chairman (Additional Secretary), SPARRSO Gave His Closing Remarks.

6.2.3 Workshop on Finalization of Draft Annual Performance Agreement

A workshop was organized on 12th April 2023 by Bangladesh Space Research and Remote Sensing Organization (SPARRSO) based on Finalization of Draft Annual Performance Agreement at SPARRSO auditorium. Mr. Md Abdus Samad, Chairman (Additional Secretary), SPARRSO was the chief guest of the workshop. All the Officers of SPARRSO attended in the workshop. The group activity was the important part of the workshop. To achieve the workshop's objectives, participants were divided into four groups, each tasked with working on a specific topic. The ultimate aim of the workshop was to develop a draft for the annual performance agreement and a comprehensive understanding of the intricacies involved in crafting an Annual Performance Agreement (APA).

Photograph 6.11: Workshop on Finalization of Draft Annual Performance Agreement.

Photograph 6.12: Participants of the Workshop on Finalization of Draft Annual Performance Agreement.

6.2.4 Workshop on Audit under Annual Performance Agreement

A valuable workshop took place on May 18, 2023, organized by the Bangladesh Space Research and Remote Sensing Organization (SPARRSO). The workshop focused on the subject of Audit as part of the Annual Performance Agreement for the year 2022-23. The event was hosted at the SPARRSO auditorium. Mr. Md Abdus Samad, Chairman (Additional Secretary) of SPARRSO, had the honor of being the chief guest. Mr. A K M Abdullah Faruque, Chief Accounts and Finance Officer (CAFO), Ministry of Defence was the trainer of the workshop. The workshop drew the participation of all officers and a substantial number of staff. The event aimed to enhance participants' understanding of the intricacies of successfully overseeing an audit committee, aligning with the organization's commitment to excellence in performance and accountability.

Photograph 6.13: Workshop on Audit under Annual Performance Agreement 2022-23.

Photograph 6.14: Participants of the Workshop on Audit under Annual Performance Agreement 2022-23.

6.2.5 Workshop on Research Works Selection for Financial Year 2022-23

SPARRSO organized a workshop on Research Works Selection for Financial Year 2022-23 on 22th May 2023 at SPARRSO conference room. Mr. Md Abdus Samad, Chairman (Additional Secretary), SPARRSO was the Moderator of the workshop. All the officers and some of the staffs of SPARRSO were attended in the workshop. The group activity was the important part of the workshop. To achieve the goal of the workshop, all participants were divided into four groups. Each group undertook the responsibility of delving into a particular topic. The culmination of their efforts resulted in each group delivering a presentation centered around their respective topics.

Photograph 6.15: Participants of the Workshop on Research Works Selection for Financial Year 2022-23.

6.2.6 Workshop on Financial Management System

A workshop was organized on 5th June 2023 by Bangladesh Space Research and Remote Sensing Organization (SPARRSO) based on Financial Management System at SPARRSO conference room. Mr. Md Abdus Samad, Chairman (Additional Secretary), SPARRSO presided the workshop. Mr. Muhammad Abul Kasem, Deputy Secretary, Finance Division, Ministry of Finance was the trainer of the workshop. All the officers of SPARRSO participated in this event. The focus of the workshop was budgeting and accounting classification system.

Photograph 6.16: Participants of the Workshop on Financial Management System.

Photograph 6.17: Workshop on Financial Management System.

6.2.7 Second Workshop on Fourth Industrial Revolution and Space Technology

A workshop was organized on 18th June 2023 by Bangladesh Space Research and Remote Sensing Organization (SPARRSO) based on Fourth Industrial Revolution and Space Technology at SPARRSO conference room. Mr. Md Abdus Samad, Chairman (Additional Secretary), SPARRSO was the chief guest of the workshop. All the officers of SPARRSO attended in the workshop.

Photograph 6.18: Participants of the Workshop on Fourth Industrial Revolution and Space Technology.

6.2.8 Workshop on Capacity Development of SPARRSO

A workshop was organized on 14th June 2023 by Bangladesh Space Research and Remote Sensing Organization (SPARRSO) on Capacity Development of SPARRSO. Mr. Golam Md Hasibul Alam, Senior Secretary, Ministry of Defence was the chief guest of the workshop. Mr. Md Shamsul Arefin, Secretary, Information and Communication Technology Division was the special guest and Mr. Md Abdus Samad, Chairman (Additional Secretary), SPARRSO was the Moderator of the workshop. Mr. Anir Chowdhury, Policy Adviser, a2i program was also an honorable guest of this workshop. Another inter-ministerial meeting was also held on 21st June 2023 at SPARRSO board meeting room.

Photograph 6.19: Workshop on Capacity Development of SPARRSO.

Photograph 6.20: Mr. Golam Md Hasibul Alam, Senior Secretary, Ministry of Defence was the chief guest for the Workshop on Capacity Development of SPARRSO.

Photograph 6.21: Inter-ministerial Meeting for Capacity Development of SPARRSO.

Photograph 6.22: Participants of the Inter-Ministerial Meeting for Capacity Development of SPARRSO.

6.3 In-house Training

6.3.1 Foundation Training for Newly Recruited Officers of SPARRSO

The foundation training for the newly appointed officers of SPARRSO was organized by SPARRSO under the National Integrity Strategy in the fiscal year 2022-23 from 9th September to 22th September that last for ten days in the first phase. Esteemed senior officers, including the Chairman of SPARRSO and the faculties from the reputed university assumed the roles of trainers for the program. The training cohort comprised six newly appointed officers. Certificates were awarded among the newly appointed officers at the end of the training to mark their successful completion of the program.

Photographs 6.23: Foundation Training for Newly Recruited Officers of SPARRSO in First Phase.

Photographs 6.24: Certificate Distribution among Newly Appointed Officer.

In second phase, the foundation training for the newly appointed officers of SPARRSO was organized by SPARRSO under the National Integrity Strategy in the fiscal year 2022-23 from 14th February to 1st March for ten days. There were four newly appointed officers in the second phase.


Photographs 6.25: Foundation Training for Newly Recruited Officers of SPARRSO in Second Phase.

6.3.2 Training for Staffs of SPARRSO

As part of the Annual Performance Agreement, a training session was conducted at the APSCO ETC (Education and Training Centre) room of SPARRSO on September 29, 2022. The training comprised four sessions. The participants of the training included all the staffs of SPARRSO.

Photograph 6.26: Participants of the Training for Staffs.

6.3.3 Training on Fourth Industrial Revolution Era

SPARRSO organized a day-long training program on Fourth Industrial Revolution Era under Innovation for the officers on 8th December 2022. The training was conducted by Mr. Abu Saleh Md. Mahfujul Alam, Consultant (Deputy Secretary), Department of Information and Communication Technology. During the training, Mr. Alam delivered an insightful speech, emphasizing the significant aspects of the fourth industrial revolution and its relevance to innovation.

Photographs 6.27: Participants of the Fourth Industrial Revolution Era Training.

6.3.4 Training on Research Methodology

SPARRSO arranged a day-long training program on Research Methodology as part of its commitment under the Annual Performance Agreement (APA) for its officers on 11th December 2022. The training featured Dr. Mohammed Shamsul Alam, Professor, Department of Geography and Environment at Jahangirnagar University, as the esteemed speaker and instructor for the session.

Photographs 6.28: Participants of the Research Methodology Training.

6.3.5 Training on Cyber Security

SPARRSO organized a day long training program focusing on Cyber Security under National Integrity Strategy (NIS) for the officers and staffs on 12th December 2022.

Photograph 6.29: Participants of the Cyber Security Training.

6.3.6 Training on Online Grievance Redress System

SPARRSO arranged day-long training program aimed at familiarizing its officers and staff members with the procedure to apply online under the Grievance Redress System (GRS) on 13th December 2022. The training was enriched by the expertise of Mr. Md. Abu Abdullah, Joint Secretary and Mr. Md. Aktaruzzaman, System Analyst, both from the Ministry of Defence. The training encompassed theoretical and practical aspects, focusing on clarifying the online application process.

Photograph 6.30: Participants of the Online Grievance Redress System Training.

6.3.7 Training on Project Management

SPARRSO organized a training course on Project Management under National Integrity Strategy (NIS) for the officers on 2nd February 2023. The training shared valuable insights and strategies on effective project management, offering guidance on the principles and practices of successful project execution.

Photograph 6.30: Participants of the Project Management Training.

6.3.8 Training on Hexagon Geospatial Software

To enhance the remote sensing application activities, SPARRSO arranged a training session on ERDAS Imagine software. This training was participated by the officers and scientific assistants and held on 30th April and 2nd -3rd May. The training encompassed a diverse range of techniques, including geo-referencing, data quality management, data creation, editing and modification and image processing. This comprehensive approach aimed to equip participants with the necessary skills to effectively utilize ERDAS Imagine software.

Photograph 6.31: Mr. Manash Mitra, Member, SPARRSO Inaugurated the Software Training.

6.4 Integrity Award in the Financial Year 2022-23

Mr. Jagobandhu Some, Assistant Engineer, Mr. Tofayel Ahammed, Assistant Scientific Officer, Mr. Md. Masud Parvez, Security guard of SPARRSO had been awarded Integrity Award in the financial year 2022-23. They had received one–month basic salary and a certificate which was handed over by the Chairman of SPARRSO.


Photographs 6.32: Integrity Award Ceremony in SPARRSO.

6.5 Annual Research Award 2021-22

Dr. Md. Mahmudur Rahman, Chief Scientific Officer, SPARRSO was awarded Annual Research Award 2021-22 by SPARRSO for his excellent research work on Mapping Changes in the Mangrove Forest Ecosystem Using Satellite Sensor Data. He had received a certificate which was handed over by the Chairman of SPARRSO.

Photograph 6.33: Annual Research Award Ceremony in SPARRSO.

6.6 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.	Organizations	Number of Visitors	Date
01	Bangladesh Satellite Company Limited (BSCL)	05	24 July 2022
02	Institute of Forestry & Environmental Science, Chittagong University.	31	27 July 2022
03	16th Basic Hydrographic (CAT-B) Course, Bangladesh Navy (BN)	17	07 August 2022
04	Bangladesh Agricultural University	20	28 August 2022
05	Navy Wing, DSCSC Course 2022	53	29 August 2022
06	No-121 Junior Command and Staff Course (JCSC) of Command and Staff Training Institute (CSTI), Bangladesh Air Force (BAF)	32	16 October 2022
07	Bangladesh Air Force	05	17 November 2022
08	Fighter Controller Training Unit (FCTU), BAF	33	29 November 2022
09	School of Security and Intelligence (SSI), BAF	16	15 December 2022
10	School of Air Traffic Services (SATS), BAF	17	05 January 2023
11	Japan International Cooperation Agency (JICA) team	06	17 February 2023
12	National Agriculture Training Academy	38	20 March 2023
13	Institute of Environmental Science, Chittagong University	38	05 June 2023
14	Institute of Forestry & Environmental Science, Chittagong University	43	19 June 2023


Photographs 6.34: Visitors from Bangladesh Satellite Company Limited (BSCL).

Photographs 6.35: Students and Teachers from Institute of Forestry & Environmental Science, Chittagong University Visited SPARRSO.

Photographs 6.36: SPARRSO Visit by 16th Basic Hydrographic (CAT-B) Course, Bangladesh Navy (BN).

Photographs 6.37: SPARRSO Visit by the Officers of Navy Wing, DSCSC Course 2022


Photographs 6.38: Students and Teachers from Bangladesh Agricultural University Visited SPARRSO.


Photographs 6.39: No-121 Junior Command and Staff Course (JCSC) of Command and Staff Training Institute (CSTI), Bangladesh Air Force (BAF) Visited SPARRSO.


Photographs 6.40: SPARRSO Visit by Japan International Cooperation Agency (JICA) Team.


Photographs 6.41: Bangladesh Air Force Visited SPARRSO.


Photographs 6.42: SPARRSO Visit by Fighter Controller Training Unit (FCTU), BAF.


Photographs 6.43: School of Security and Intelligence (SSI), BAF Visited SPARRSO.


Photographs 6.44: SPARRSO Visit by National Agriculture Training Academy

Chapter 7

PUBLICATIONS

List of Publications

Md. Shahjahan Ali, Mohammad Mahdi Hasan, Jagobandhu Some, Muhammad Sharif (2022). A GIS Approach to Land Use and Land Cover Change Assessment from 2016 to 2020 in Teknaf and Ukhiya Upazila of Cox's Bazar District of Bangladesh Due to Rohingya Intrusion. International Journal of Scientific and Research Publications, 12 (10), http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13018

S M Ahsan Habib, S.M. Quamrul Hassan, M. Nur Hossain Sharifee, Muhammad Abul Kalam Mallik and Fahmida Parvin (2023). Role of low level wind to the heavy rainfall on the east coast of the Bay of Bengal during low pressure system. Dynamics of Atmospheres and Oceans, 102, p.101362. https://doi.org/10.1016/j.dynatmoce.2023.101362

Chapter 8

OBSERVATION OF NATIONAL EVENTS

8.1 Discussion Meeting and Doa Mahfil on the 47th Martyrdom Anniversary and National Mourning Day of the Father of the Nation Held in SPARRSO

On the occasion of the 47th Martyrdom Anniversary and National Mourning Day of the Father of the Nation Bangabandhu Sheikh Mujibur Rahman, the Great Architect of Independence; several programs like holding the national flag at half-masted, wearing the black badge, laying a wreath at the portrait of the Father of the Nation installed at SPARRSO, various programs including screening of Bangabandhu's biographical documentaries, discussion meetings and prayer mahfils were held at SPARRSO Auditorium on August 15, 2022. Discussion meetings and doa mahfils were held by following proper hygiene rules. Honorable Chairman of SPARRSO, Mr. Md Abdus Samad, Additional Secretary to the Government of the People's Republic of Bangladesh presented as the chief guest in the discussion meeting and Mr. Md Mahmud Ali, Member (Research) (Joint Secretary to the Government) was the Chairperson. Mr. Mohammad Sanaul Haque, Financial Adviser of SPARRSO presented the main article in the discussion meeting. He gave a detailed presentation of Bangabandhu's 'Unfinished Autobiography' and the significance of the dreams cherished by the father of the nation in the formation of the country. Chairman of SPARRSO and

Photograph 8.1-8.4: Discussion meeting and Doa Mahfil held on the occasion of 47th Martyrdom Anniversary and National Mourning Day of Father of the Nation Bangabandhu Sheikh Mujibur Rahman.

chief guest of the discussion meeting, Mr. Md Abdus Samad, remembered Bangabandhu Sheikh Mujibur Rahman, Bangamata Sheikh Fazilatunnesa Mujib and other family members with deep respect on the 47th martyrdom anniversary of Father of the Nation Bangabandhu and prayed for their soul's repose. He recalled Bangabandhu's non-communal thinking and presented his visionary ideas about the passage of the Father of the Nation in the era of the Father of the Nation and called upon everyone to work with intelligence, wisdom and patriotism from their respective positions. At the end of the discussion, prayers were offered for the forgiveness of the souls of all the martyrs who were martyred on August 15, including the Father of the Nation, and for the continuation of the ongoing development of the country.

8.2 SPARRSO Celebrated Sheikh Russel Day with Wreath Laying and Discussion Meetings and Prayer

Photograph 8.5-8.10 Discussion Meeting and Doa Mahfil held at SPARRSO of Sheikh Russel Day on 18 October 2022.

Bangladesh Space Research and Remote Sensing Organization (SPARRSO) organized various programs on the occasion of Sheikh Russel Day on 18 October 2022. SPARRSO Chairman Mr. Md Abdus Samad was the chief guest in the discussion meeting held on Sheikh Russel Day. Mr. Mohammad Sanaul Huq, Financial Adviser (Deputy Secretary) of SPARRSO was the keynote speaker on understanding the importance and significance of this National Day. The original article on the theme of "Sheikh Russel is a symbol of serenity, fearless and inspiring" discussed Sheikh Russel's birth, growing up, childhood memories, and life memories before and after independence in an informative manner. The chief guest of the discussion meeting, Mr. Md Abdus Samad, Chairman of SPARRSO, remembered Father of the Nation Bangabandhu Sheikh Mujibur Rahman and his family members as well as Sheikh Russel with deep respect. At the end of the discussion meeting, a prayer ceremony seeking the forgiveness of Sheikh Russel's soul was held. All levels of officers/employees of SPARRSO attended the discussion meeting and prayer.

8.3 Discussion Meeting on the Occasion of the Victory Day Celebration at SPARRSO

On the occasion of the Great Victory Day celebration on 16 December 2022, Bangladesh Space Research and Remote Sensing Organization (SPARRSO) organized discussion programs. Mr. Md Abdus Samad, Chairman of SPARRSO and Additional Secretary to the Government, was present as the chief guest in the discussion meeting. Mr. Md. Nur Hossain Sharifee, Chief Scientific Officer of SPARRSO, was the main discussant on understanding the importance and significance of this National Day. Mr. Md Abdus Samad, Chairman of SPARRSO, remembered Father of the Nation Bangabandhu Sheikh Mujibur Rahman and his family members as well as all martyrs with deep respect. At the end of the discussion meeting, the program ended up with a prayer ceremony seeking the forgiveness of freedom fighters. All levels of officers/employees of SPARRSO attended the discussion meeting and prayer meeting

Photograph 8.11-8.14 Discussion Meeting and Prayer held at SPARRSO on the occasion of Victory Day Celebration.

8.4 Celebrating Martyr's Day International Mother Language Day at SPARRSO

In order to celebrate Martyr's Day and International Mother Language Day 2023 with due respect and dignity, various day-long programs were organized by Bangladesh Space Research and Remote Sensing organization (SPARRSO), on 21st February 2023. The Day's program began with the hoisting of the national flag at half-mast at sunrise. Then discussion and Doa Mahfil for Martyr's Day and International Mother Language Day 2023 was held at the auditorium of SPARRSO. The discussion was presided over by Mr. Md Abdus Samad, Chairman (Additional Secretary), SPARRSO. The program began with the recitation of the Holy Quran. Mr. Mohammad Sanaul Huq, Financial Adviser and other SPARRSO officials addressed the nations February 21, 1952 in an honor of the self-sacrificing language martyr's. All the officers/employees working in SPARRSO were present in the Doa Mahfil.

Photograph 8.15-8.18: Doa Mahfil held at SPARRSO on the occasion International Mother Language Day 2023.

8.5 SPARRSO celebrated Historical 7th March

A discussion meeting was held at Bangladesh Space Research and Remote Sensing Organization (SPARRSO) to mark the historical 7th March speech of Father of the Nation Bangabandhu Sheikh Mujibur Rahman. Mr. Md Abdus Samad, Chairman (Additional Secretary), SPARRSO, was present as the chairman of the discussion meeting. Mr. Manash Mitra, Member (Application) (Joint Secretary), SPARRSO was the keynote speaker on the importance and significance of the speech of Father of the Nation Bangabandhu Sheikh Mujibur Rahman. Mr. Mohammad Sanaul Huq, Financial Adviser (Joint Secretary), SPARRSO spoke on Bangabandhu's historic 7th March speech. Mr. Md Abdus Samad, Chairman of SPARRSO remembered Father of the Nation Bangabandhu Sheikh Mujibur Rahman, Bangamata Sheikh Fazilatunnessa Mujib and 30 lakh martyrs of the liberation war with deep respect. He appealed to develop the ideals and spirit of the liberation war and Bangabandhu from generation to generation by celebrating various programs announced by the government on the occasion of independence. He requested everyone to be diligent and work hard accordingly to make SPARRSO a centre of excellence in the future. All the officers/employees working in SPARRSO were present in the discussion meeting.

Photograph 8.19-8.22: Historical 7th March Celebration at SPARRSO.

8.6 Discussion Meeting on the Occasion of 103rd Birth Anniversary and Children's Day of the Father of the Nation Bangabandhu Sheikh Mujibur Rahman

On the occasion of Father of the Nation Bangabandhu Sheikh Mujibur Rahman's 103rd Birth Anniversary and National Children's Day, a discussion meeting, special prayers and other programs were held at Bangladesh Space Research and Remote Sensing Organization (SPARRSO) on 17 March 2023. Mr. Md Abdus Samad (Additional Secretary), Chairman of SPARRSO and chief guest of the discussion meeting, inaugurated the program by hoisting the national flag at sunrise and placing a wreath at the portrait of Bangabandhu. Dr. Md. Mahmudur Rahman, Chief Scientific Officer, SPARRSO, was the main speaker on the importance and significance of the birth centenary of Father of the Nation Bangabandhu Sheikh Mujibur Rahman. He gave a detailed outline of Bangabandhu's contribution to independent Bangladesh from his childhood. Besides, Mr. Manash Mitra, Member (Application) (Joint Secretary) SPARRSO and Mr. Md. Mahmud Ali, Member (Research) (Joint Secretary), SPARRSO spoke about Bangabandhu's political wisdom, diplomatic prudence and contribution of Bangabandhu in building a happy and prosperous Bangladesh. Mr. Md Abdus Samad (Additional Secretary), Chairman of SPARRSO remembered Father of the Nation Bangabandhu Sheikh Mujibur Rahman, Bangamata Sheikh Fazilatunnesa Mujib and 30 lakh martyrs of the Liberation War with deep respect on Bangabandhu's birth anniversary. All Officers/employees of SPARRSO were present in the discussion meeting. The

program was concluded with special prayers for the salvation of the souls of Father of the Nation Bangabandhu Sheikh Mujibur Rahman and his martyred family members and for the prosperity of Bangladesh.

Photograph 8.23-8.28: Discussion Meeting and doa mahfil on the occasion of 103rd Birth anniversary and Children's day of the father of the nation Bangabandhu Sheikh Mujibur Rahaman on 17 March 2023.

8.7 Discussion Meeting on the Occasion of 25 March "Genocide Day"

On the occasion of 25 March Genocide Day, a discussion meeting Doa Mahfil was held at Bangladesh Space Research and Remote Sensing Organization (SPARRSO) on 25 March 2023. Mr. Md Abdus Samad, Chairman (Additional Secretary), SPARRSO was present as the chief

guest in the discussion meeting. Mr. Md. Nur Hossain Sharifee, Chief Scientific Officer, SPARRSO was the keynote speaker on the importance and significance of Genocide Day. Also, Mr. Mohammad Sanaul Huq, Financial Adviser (Joint Secretary), SPARRSO was present as Chairperson and Mr. Md. Mahmud Ali, Member (Research) (Joint Secretary), SPARRSO was present as special guest. They gave an informative speech on the significance of Genocide Day and expressed hope for international recognition of Genocide Day. Finally, the end of the discussion program was announced by praying for the forgiveness of the souls of all the martyrs killed on Genocide Day. All the officers/employees working in SPARRSO were present in the discussion meeting.

Photograph 8.29-8.34: Discussion Meeting on the occasion of 25 March "Genocide Day".

8.8 Discussion Meeting on the Occasion of "Independence and National Day

On the occasion of 26 March Independence Day, a discussion meeting and Doa Mahfil were held at Bangladesh Space Research and Remote Sensing Organization (SPARRSO) on 26 March 2023. Mr. Md Abdus Samad, Chairman (Additional Secretary), SPARRSO was present as the chief guest in the discussion meeting. Mr. Manash Mitra Member (Application) (Joint Secretary), SPARRSO was the keynote speaker on the importance and significance of Independence Day. He gave an informative speech on the significance of Independence Day. Finally, the end of the discussion program was announced by praying for the forgiveness of the souls of all the martyrs. All the officers/employees working in SPARRSO were present in the discussion meeting.

Photograph 8.35-8.40: Discussion Meeting on the occasion of "Independence and National Day 2023" on March 26.

Bangladesh Space Research and Remote Sensing Organization (SPARRSO)

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