ANNUAL REPORT

July 2019-June 2020

SPARRSO

Bangladesh Space Research and Remote Sensing Organization

(SPARRSO)

Agargaon, Sher-e-Bangla Nagar

Dhaka 1207, Bangladesh

ANNUAL REPORT

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SPARRSO

Editorial Committee

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Dream of Self-Reliance

"We are a hopeful nation. We achieved independence with the sacrifice of three million martyrs in the war of liberation. To make that independence meaningful, it is necessary now to achieve economic emancipation. We want to live keeping our heads high. We want to be the builders of our own future."

-Sheikh Hasina, Honourable Prime Minister
The People's Republic of Bangladesh

Dhaka, 28 February 2016

Rememembrance

In everlasting memory of

Abdullah Al Mohsin Chowdhury
Former Senior Secretary, Ministry of Defence

(1 January 1963 – 29 June 2020)

A fountainhead of knowledge and
a source of inspiration;
he has left behind a rich harvest of memories
to cherish, honor and emulate

Bangladesh Space Research and Remote Sensing Organization (SPARRSO)

Foreword

It is my great pleasure to present the Annual Report on the development activities, research work and achievements of Bangladesh Space Research and Remote Sensing Organization (SPARRSO) carried out by the authority and thematic Research divisions for the financial year of 2019-2020.

At first, I would like to pay deep tribute to the father of Nation Bangabandhu Sheikh Mujibur Rahman in whose tenure the space application related activities was started in Bangladesh on 1972 by initiating Earth Resources Technology (ERTS) program and Space and Atmospheric Research Centre (SARC). Later, SPARRSO has been formed merging those two entities. With the passage of time, SPARRSO is now being turned into the national space agency of Bangladesh.

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 to advance its capabilities in the fields of Agriculture, Fisheries, Water Resources, Oceanography, Atmospheric Research, Climate change and allied fields.

We are committed to fulfill the requirement of space research and remote sensing technology through Sustainable Development Goals (SDG) related research. By using and applying the most advanced satellite-based application of Remote Sensing, Geographical Information System (GIS) and Global Navigation Satellite System (GNSS) and other space research techniques, tools and methodologies. 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.

I would particularly like to acknowledge the continued support of the Ministry of Defence and we are also looking forward enthusiastically, the same to the years to come.

The Board of Directors and I continue to be inspired by the scientists, engineers and support-staff of SPARRSO, who work tirelessly for the progressively development of this organization maintaining a high global standard for space science.

During this time, SPARRSO continues to improve a broad array of programs on space technology research, blue economy, climate change, disaster mitigation and other fields of space science researches to achieve national goals, desired outcomes and economic development of the country.

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

Mizanur Rahman
Chairman (Additional Secretary)
SPARRSO

Editorial Note

I am delighted 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 2019 to June 2020. This 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. 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 Chairman of SPARRSO and the Members of its Board for their advice and cordial cooperation. Thanks to 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.

Md. Zafar Ullah Khan
Member, SPARRSO
&
Convenor, Editorial Committee

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CHAPTER 1

INTRODUCTION

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

The organization performs under the supervision of the Ministry of Defence and is governed by the direct instructions and guidelines of SPARRSO Board. In Bangladesh, SPARRSO is the focal organization of Asia Pacific Space Cooperation Organization (APSCO). By utilizing APSCO platform, 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 database, information and map which are supplied to different Ministries, i.e., Agriculture, Food & Disasters Management, Environment & Forest, Land, Fisheries & Livestock, Defence and others. It also disseminates information to different departments and organizations, such as Bangladesh Meteorological Department, Bangladesh Bureau of Statistics (BBS), Forest Department, Department of Disaster Management (DDM) etc. If there is specific requirement from any government organization to provide necessary information by applying space technology, it will do so for ensuring human safety and security and finally contributing towards national development.

This annual report for the fiscal year of 2019- 2020 briefly describes the research, study and operational activities implemented during the reporting period. In addition, it also includes the participations of the officials in trainings, conferences and meetings organized both in home and abroad. The list of publications of the officials for the reporting period is also included in this report.

1.1 Functions of SPARRSO

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

1.2 SPARRSO Board

SPARRSO is governed by a Board consists of Chairman and four Members. As of 30 June, 2020, the members of SPARRSO Board were as follows:

Name	Position in Board
Mr. Mizanur Rahman	Chairman
Mr. Md. Zafar Ullah Khan	Member (Application)
Mr. Md. Zafar Ullah Khan	Member (Research) (Additional Charge)
Mr. A. Z. Md. Zahedul Islam	Member (Technology-2)
Mr. A. Z. Md. Zahedul Islam	Member (Technology-1) (Additional Charge)

1.3 Manpower

List of existing officer of SPARRSO is enumerated below: (As of 30 June 2020)

Sl No	Name	Designation	Phone (Office)	Email
1	Mizanur Rahman	Chairman	+88-02-48117692	chairman@sparrso.gov.bd
2	Md. Zafar Ullah Khan	Member (Application) (Joint Secretary)	+88-02-48113998	khanmzu@yahoo.com
3	Md. Zafar Ullah Khan	Member (Research) (Joint Secretary) (Additional Charge)	+88-02-48113401	khanmzu@yahoo.com
4	A. Z. Md. Zahedul Islam	Member (Technology 2)	+88-02-48118572	azmd_zahed@yahoo.com
5	A. Z. Md. Zahedul Islam	Member (Technology 1) (Additional Charge)	+88-02-48114038	azmd_zahed@yahoo.com
6	Mohammad Sanaul Huq	Secretary (Deputy Secretary)(Acting)	+88-02-48118581	admin@sparrso.gov.bd
7	Mohammad Sanaul Huq	Financial Adviser (Deputy Secretary)	+88-02-48113308	huqsanaul@gmail.com
8	S.M. Humayun Kabir	Principle Scientific Officer (on Lien)		smhkabir1962@gmail.com
9	Dr. Md. Mahmudur Rahman	Chief Scientific Officer	+88-02-48120373	mahmud@sparrso.gov.bd
10	Dr. Md. Abdus Salam	Chief Scientific Officer	+88-02-48118564	salam@sparrso.gov.bd
11	Md. Nur Hossain Sharifee	Chief Scientific Officer	+88-02-48117688	nhsharifee@yahoo.com
12	Abu Mohammad	Principal Scientific Officer	+88-02-48118584	abumd2@yahoo.com
13	Md. Monirul Islam Khondoker	Finance Officer (Acting)	+88-02-9134006	kmi.salim1965@gmail.com
14	Md. Shahjahan Ali	Senior Scientific Officer	+88-02-58155951	shopan65@yahoo.com
15	Abdullah Yousuf Imam	Senior Scientific Officer (on Study Leave)		ayimam92@gmail.com
16	Md. Abdul Kader	Senior Scientific Officer	+88-02-48113700	imuimsf@gmail.com
17	B.M. Refat Faisal	Senior Scientific Officer		refatfaisal@yahoo.com
18	Sumangal Chakma	Senior Engineer	+88-02-58154829	schakma@hotmail.com
19	Md. Mahmudul Haque	Chief Administrative Officer (Acting)	+88-02-48110814	mahmud.du20@gmail.com

20	Md. Firoz Molla	Assistant Engineer		firoz_62@yahoo.com
21	Nasrin Sultana	Scientific Officer		nasrin@sparrso.gov.bd
22	Mohammad Imrul Islam	Scientific Officer		imrul_islam@sparrso.gov.bd
23	Farhana Tazneen	Scientific Officer		farhana@sparrso.gov.bd
24	S M Ahsan Habib	Librarian (Additional Charge)		ahsan@sparrso.gov.bd
25	S.A.M. Arif-Ul-Haque	Scientific Officer		sam_arif@sparrso.gov.bd
26	S M Ahsan Habib	Scientific Officer	-	ahsan@sparrso.gov.bd
27	Rubel Kanti Dey	Information Officer (on Study Leave)	+88-02-58154816	rubelkanti@sparrso.gov.bd
28	Md. Mahmudul Haque	Administrative Officer	+88-02-48117503	mahmud.du20@gmail.com
29	Md. Manirul Islam Khandaker	Accounts Officer	+88-02-48117401	kmi.salim1965@gmail.com
30	Md. Manirul Islam Khandaker	Store and Procurement Officer (Additional Charge)	+88-02-48117384	kmi.salim1965@gmail.com
31	Mohammad Mahdi Hasan	Scientific Officer		mahdi.sparrso@gmail.com
32	Jagobandhu Some	Assistant Engineer	+88-02-48118583	jagobandhusome@gmail.com

CHAPTER 2

RESEARCH AND APPLICATION ACTIVITIES

The research and application activities of SPARRSO have been providing valuable inputs for planning in different sectors and finally contributing in the sustainable development in the country. Under the Annual Research Program of SPARRSO, fifteen research projects were approved for implementation in the financial year of 2019-2020. Due to world-wide pandemic situation, all the projects could not be completed within the stipulated time. Few of these projects have been continued in current financial year or will be carried out in near future after pandemic situation becomes normal in the country.

Among the projects implemented by in the last financial year, three are led by Water Resources Division of Bangladesh Space Research and Remote Sensing Organization (SPARRSO). These projects are the part of five-year plan of the Division and are related to the establishment of operational flood monitoring system, establishment of integrated river monitoring system and establishment of drought monitoring system. Bangladesh is a low-lying country, which is often affected by floods. In the flood monitoring system, satellite images are used to prepare flood map in the country. The objective of the project is to configure a GIS framework for the estimation of flood affected population and for crop damage assessment.

Bangladesh has one of the largest river networks in the world. Many rivers of the country are often shifting by the process of erosion and accretion. The objectives of the project are to generate river morphological datasets, analyze the changes in river network and establish an integrated river monitoring system in the country. Drought is one of the disasters faced by the country almost every year. The objectives of the project are to apply drought index for preparing drought map, select clusters based on drought map and validate on the field and finally, establish a national drought monitoring system.

A case study was completed on remote sensing based Boro Rice production forecasting using MODIS-NDVI. Normalized Difference Vegetation Index (NDVI) values obtained from MODIS data were used for forecasting Boro Rice production in Bangladesh. Investigation on the applicability of the microwave and optical images for mapping coastal configuration was

completed. In the study, microwave image and optical images were examined for the identification of coastline and mapping of coastal configuration.

The research projects implemented in the last financial year have been briefly described in the subsequent sections.

2.1 Atmospheric Research Division

Change Detection of Surface Water Bodies in the Selected Areas of Khulna City Using Remote Sensing & GIS Techniques (Phase- 1)

The Khulna City is situated in the South-Western Part of the Country. The area of Khulna City Corporation is around 46 sq. km. It is bounded by Khulna Sadar Upazila on the south, Daulatpur upazila on the north, Khulna Sadar Upazila on the east. The climate of Khulna is tropical monsoon with a predominantly hot and humid summer and a relatively cool winter. Khulna Municipality was established in 1984.

During the colonial period, Khulna city was experienced with a rapid growth and expansion. Khulna City is located on the banks of the Rupsha River and is surrounded by the Pushur, Bhairab and Atai. Khulna was changed to a city corporation from a municipal board in 1990, and currently the city is administrated by the Khulna City Corporation. Khulna consists of 31 Wards and 184 Mahallas and has a total area of 45.65 km². The city has a high population density; nearly 15,00,000 people are living in the city. It is one of the largest cities in Bangladesh. Khulna City Corporation consists of 31 wards.

Within the framework of current study, mapping of 12 wards out of 31 has been completed. From this figure, the extent of the study area of current investigation is calculated as 1,334 hectors (Figure 1). In this study, aerial photograph of 2000 and Very High Spatial Resolution (VHSR) satellite image of Google Earth had been used in the study (Figure 2). Images of Google Earth was analyzed in 2019.

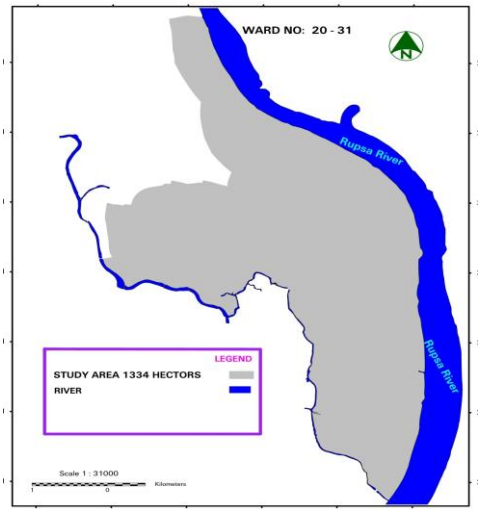
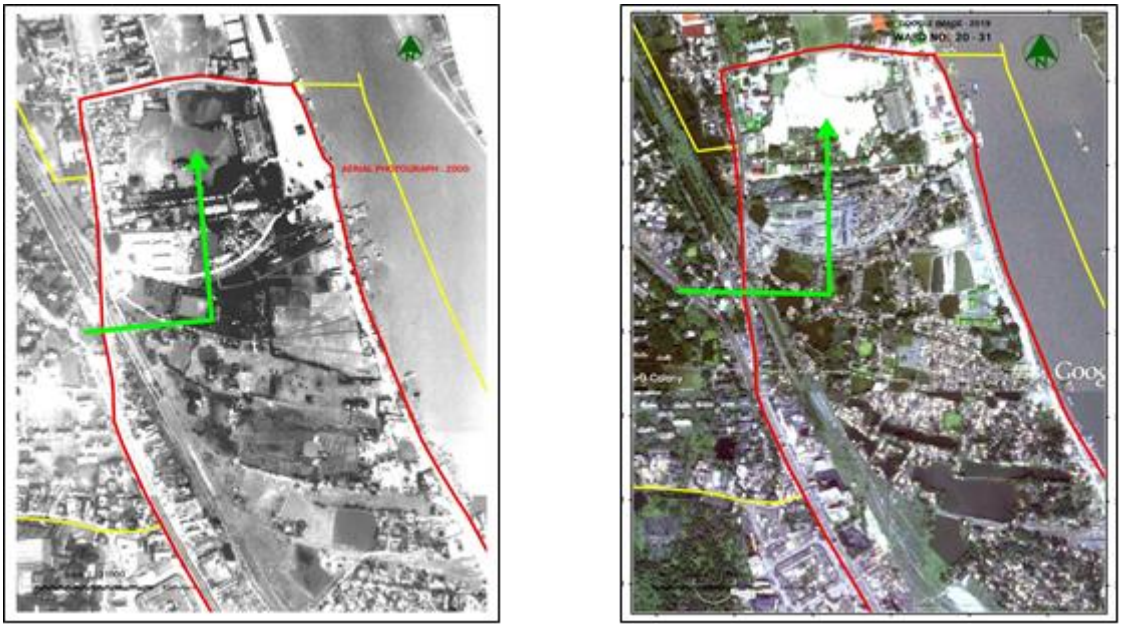
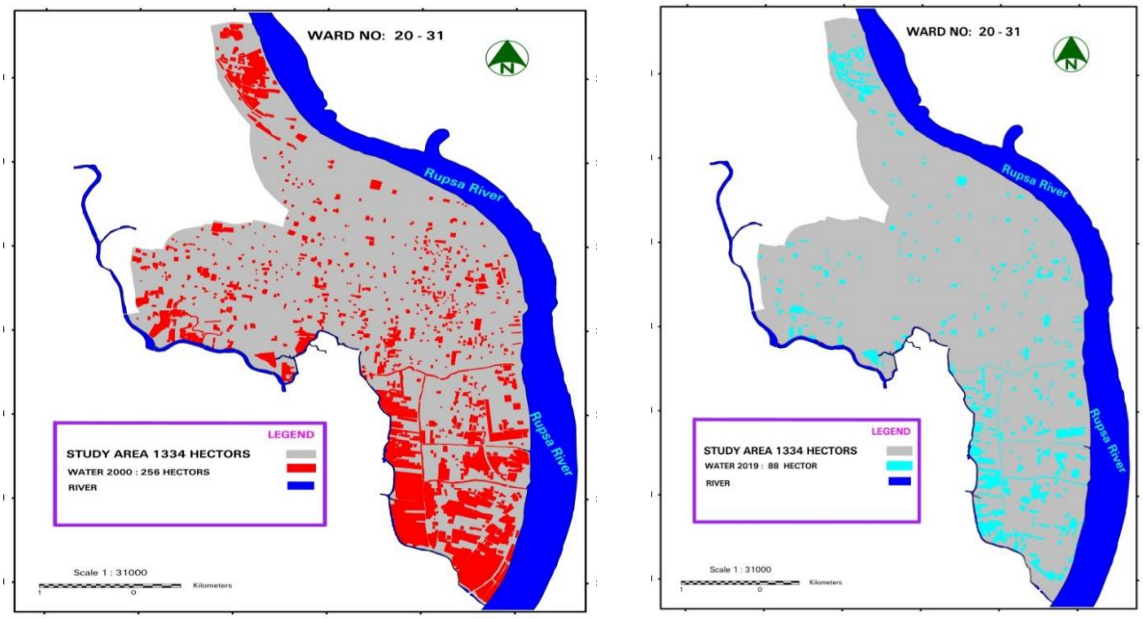


Figure 1: Location of the study area



(a) (b)

Figure 2. Presentation of (a) aerial photograph and (b) VHSR satellite images of Google Earth. Aerial photograph was acquired in 2000 and VHSR image of Google Earth was analyzed in 2019.



(a) (b)

Figure 3. Satellite image map of (a) 2000 and (b) 2019 of the study area in Khulna City Corporation. The map shows the expansion of surface water body in the study area.

Satellite image interpretation and analysis revealed that 256 hectors of water body mapped in 2000 have been reduced to 88 hectares in 2019 in the study area. The total contraction of water area is 168 hector. The shrinkage of surface water area is 65.6 percent. This result obtained from this study provided valuable information on the change in the surface water body of Khulna City Corporation.

2.2 Agriculture Division

Remotely Sensed Boro Rice Production Forecasting Using MODIS-NDVI: A Bangladesh Perspective

This research work deals with the development of an operational methodology with appropriate technical components for the monitoring and forecasting of Boro rice production in Bangladesh. Terra MODIS 16-day Normalized Difference Vegetation Index (NDVI) Maximum Value Composite (MVC) image products MOD13A1 of 500 m spatial resolution covering Bangladesh have been used for the period of 2011-2017. Hence, the district-wise sum of NDVI on pixel-by-pixel has been calculated from Jan-April during 2011-2017.

Regression analysis between district-based pixel-wise summation of MODIS-NDVI and district-wise BBS (Bangladesh Bureau of Statistics) estimated Boro production shows a strong correlation. Therefore, the highest regression co-efficient value derived from the analysis has been used to obtain year-wise rice production for the years (2011-2017). The results demonstrate a good agreement between the estimated and predicted yearly Boro production during the period of 2011-2017. Therefore, MODIS-NDVI based regression model seems to be effective for Boro production forecasting.

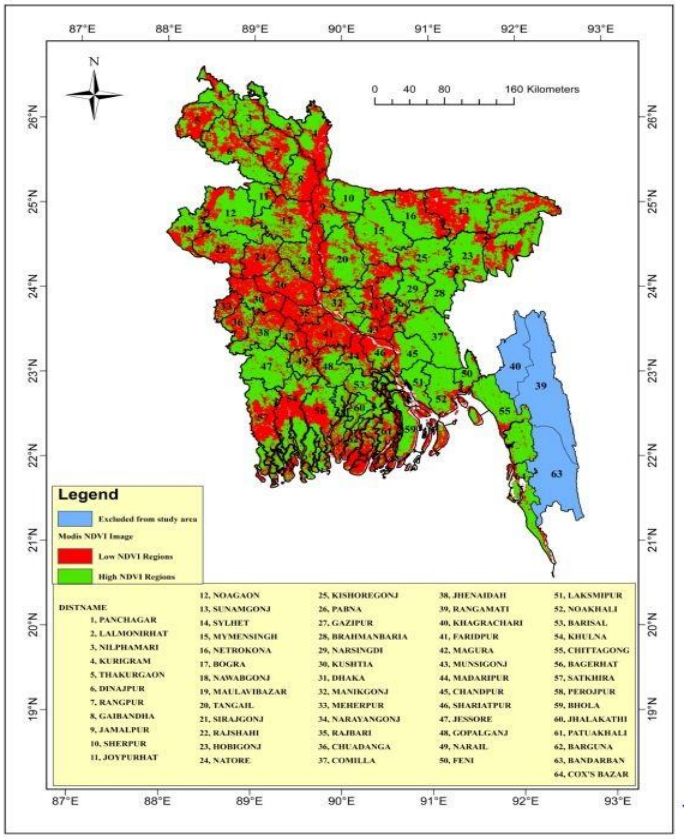


Figure 4: Map showing the sample MODIS imagery over the study area.

2.3 Oceanography Division

Investigation of the Applicability of the Microwave Image to Complement the Optical Image for Preparation of Map of Coastal Configuration

This research work was carried out by the Oceanography Division under the Annual Research Projects of SPARRSO in the FY 2019-2020.

The study area geographically belongs to 91º 03' 20" E, 22º 52' 45.51" N and 91º 10' 28.29" E, 22º 46' 18.52" N and occupies an area of 764,265 hectares.

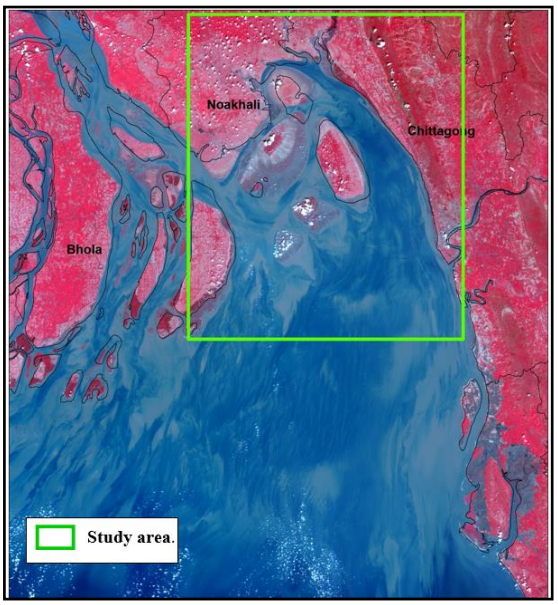


Figure 5: Study area

The study area is shown in Figure 5. It belongs to the eastern part of the Meghna Estuary. In respect of the geo-morphological changes, the area is highly active (Ahmed *et al.* 2018). Both the erosion and accretion are casual occurrences in this area. Landsat OLI, Landsat ETM+ and Landsat TM satellite images have been used for this work. The microwave images used for the study were acquired in high-tide condition. Therefore, the analysis was carried by superimposing the high-tide coastline obtained from the optical image in previous years.

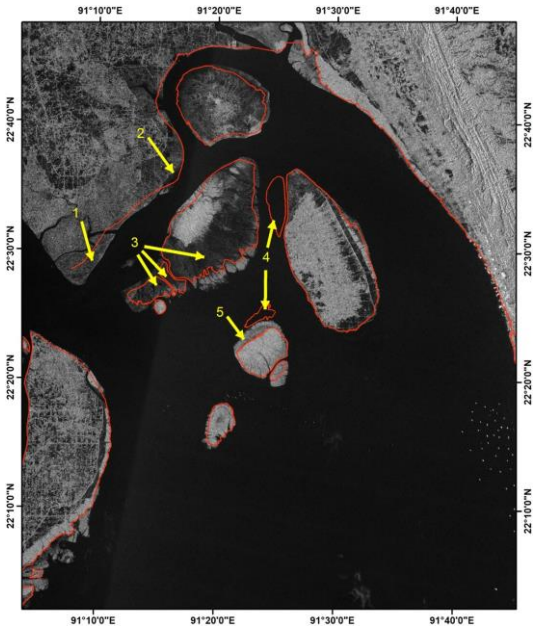


Figure 6: High-tide coastline derived from optical image superimposed on microwave image

In Figure 6 representative places are marked for comparative analysis. The islands that are identified using the optical images were not confirmed in the microwave images. Out of 15 identified islands on the optical image in the study area, two islands were not visible on microwave images. (marked as '4' in Figure 6). Thus, interpretation of microwave images having appropriate tidal condition along with optical image is necessary to identify the island.

It is seen, when compared with microwave image, interpretation of high-tide coastline using optical image is different in some places as marked as '1' '2' '3' and '5' in Figure 6.

In case of unavailability of optical image, microwave image may be used to identify the coastal geo-morphological features. However, the challenges of interpretation to identify the coastal geo-morphological features both in optical and microwave images need to be analyzed in future studies.

2.4 Forestry Division

2.4.1 Change Assessment in the Sundarbans Mangrove due to Cyclone Bulbul using Satellite Sensor Data

Sundarbans is the largest mangrove forest in the world occupies about 600 sq. km in a single tract (Blasco *et al.* 1998). It is distributed at the mouth of the Ganges River Delta. Approximately two-thirds of the forest is located in Bangladesh and the remaining one-third is in India. Because of the location of mangrove ecosystem at the interface between land and sea, mangroves are affected by tropical cyclones and storm surges, coastal erosion and other environmental or ecological factors.

In November 2019, very Severe Cyclonic Storm Bulbul hit West Bengal and Bangladesh and made storm surge, heavy rains, and flash floods across the areas. On 9 November Bulbul made landfall near Sagar Island in West Bengal and passed over the Sundarbans and subsequently to other parts of Bangladesh. After landfall, Cyclone Bulbul rapidly weakened into a deep depression. There are earlier reports on Sundarbans that Cyclone Sidr damaged Sundarbans severely in 2007 (Akhter *et al.* 2008, Bhowmik and Cabral 2013).

This report has been prepared with a view to assess quick damage in mangrove extent in the Bangladesh part of Sundarbans in 2019 caused by Cyclone Bulbul and any other natural or anthropogenic causes using Earth Observation (EO) data. The study used Sentinel-2 and Landsat-8 data listed in Table 1.

Table 1. Satellite images used in this study

Sensor	Frame	Date of acquisition
Sentinel-2	T45QYE	2 January 2019
		29 October 2019
		18 November 2019
Landsat-8	137-045	23 January 2019
		23 November 2019

The results are presented in figures using Sentinel-2 data, while Sentiel-2 has 10m spatial resolution. The map of Sundarbans with the demarcation of five sub-sections is presented in Figure 7. The change statistics are presented in Table 2. The estimated loss of mangrove forest in 2019 was around 26 ha in four different locations (site A, B, C and D; presented in Figure 8-11). The forest was primarily lost because of coastal erosion. Giri *et al.* (2007), Rahman *et al.* (2011) and Rahman (2013) also reported earlier on mangrove forest loss by coastal erosion in the Sundarbans. It has also been noticed form the satellite images of October and November 2019 that Cyclone Bulbul did not make any significant damage to the Bangladesh part of Sundarbans.

Table 2. Forest loss in the Bangladesh part during January-November 2019.

Sites	**Area (ha)**	**Approximate GPS Location* Latitude and Longitude (UTM Projection, WGS 84)**	**Approximate location in the map**
Site A	6.5	21° 39′ 24.4′′ N 89° 13′ 34.0′′ E	Southern part of Manderbaria Area
Site B	5.9	21° 40′ 57.7′′ N 89° 17′ 18.8′′ E	Eastern part of Manderbaria Area
Site C	9.5	21° 42′ 41.0′′ N 89° ′ 15.6′′ E	Southern part of Bahirer Char
Site D	4.4	21° 50′ 20.8′′ N 89° 51′ 23.3′′ E	South-western part of Pakhir Char
Total	26.4	-	-

* GPS location was recorded at the central part of polygon

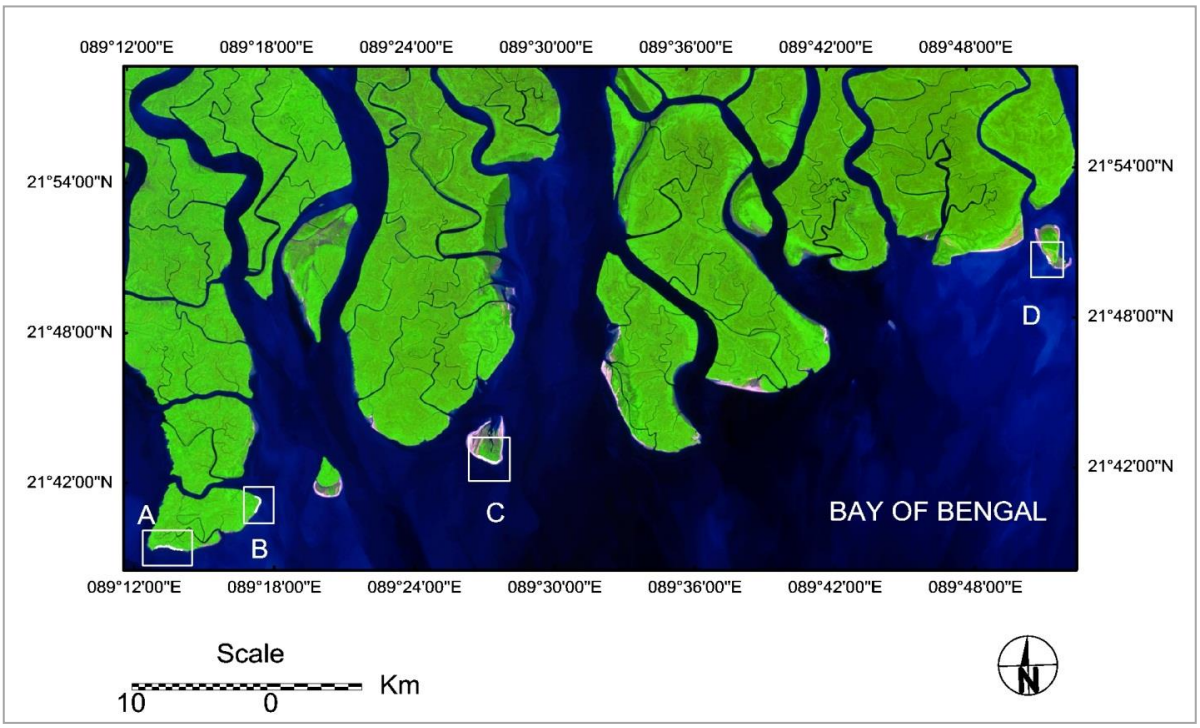


Figure 7: Satellite image map showing the locations of the areas where mangrove forest was lost during 2019 (Sentinel-2 image, 2 January 2019). Four sites where changes are detected are marked as A, B, C and D.

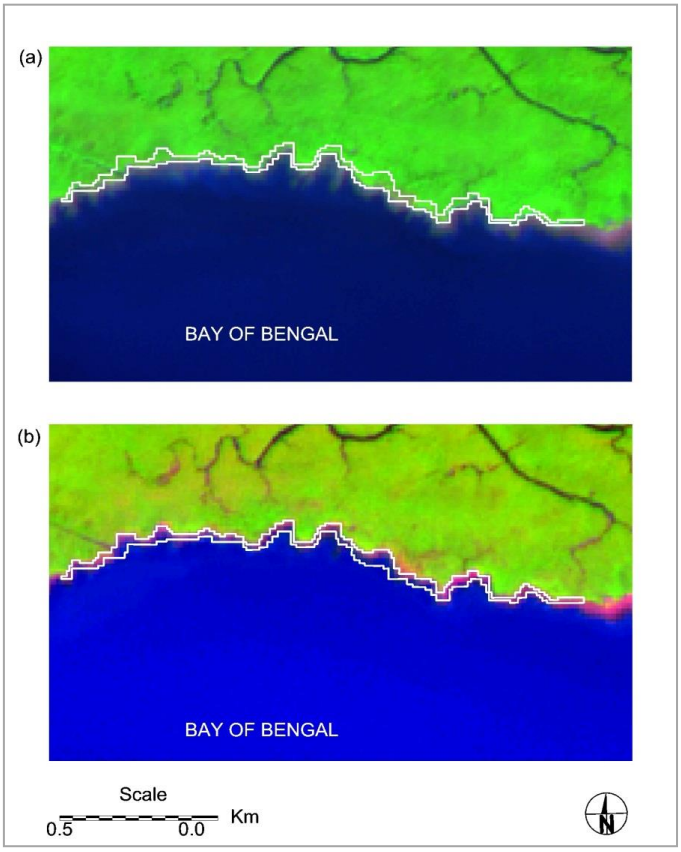


Figure 8. Forest lost at Manderbaria area of Sundarbans on Sentinel-2 satellite image (south part) in 2019 (a) 2 January 2019 and (b) 18 November 2019 (Site A)

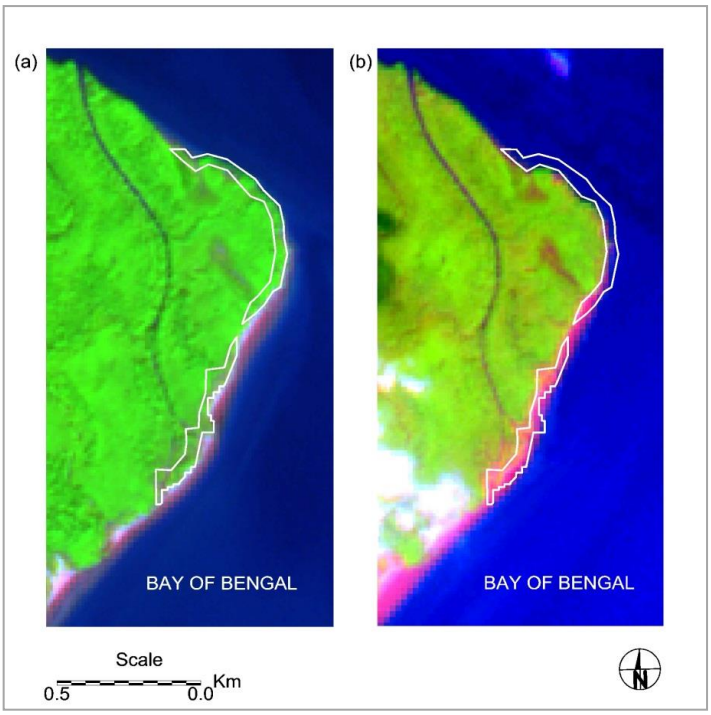


Figure 9. Forest lost at Manderbaria area on Sentinel-2 satellite image (east part) in 2019 (a) 2 January 2019 and (b) 18 November 2019 (Site B)

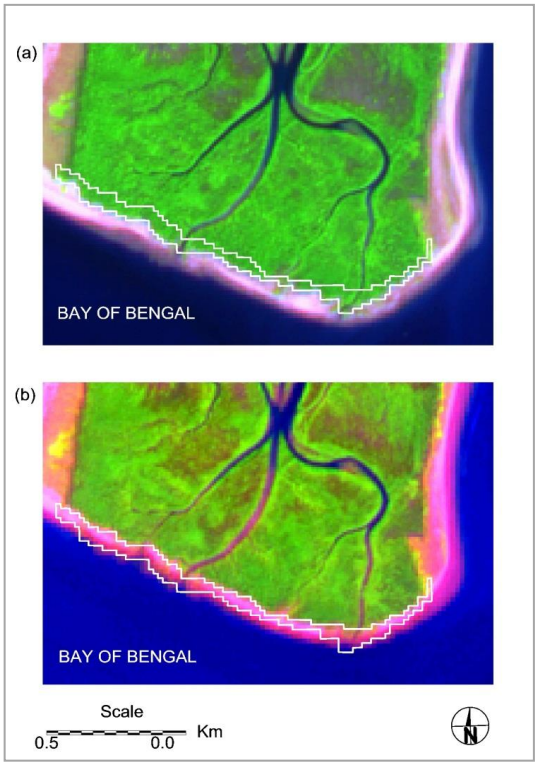


Figure 10. Mangrove forest loss at Bahirer Char on Sentinel-2 satellite image in 2019 (a) 2 January 2019 and (b) 18 November 2019 (Site C)

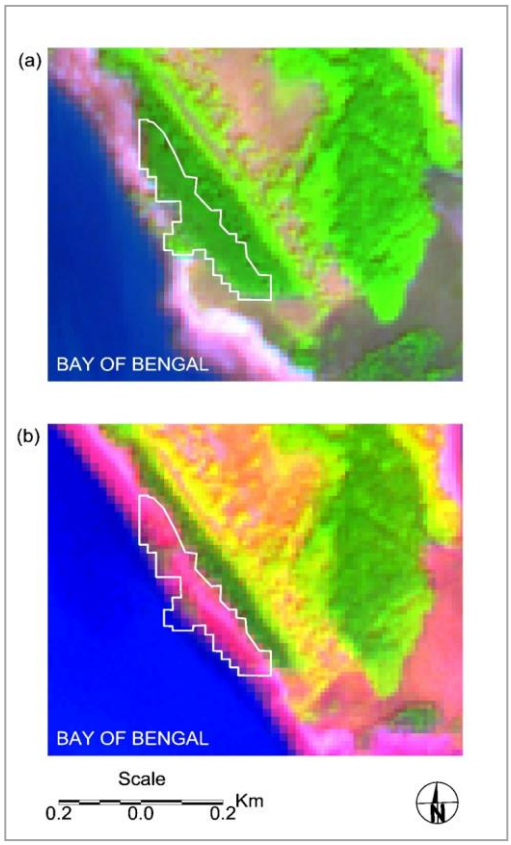


Figure 11. Mangrove forest loss at Pakhir Char on Sentinel-2 satellite image in 2019 (a) 2 January 2019 and (b) 18 November 2019 (Site D)

2.4.2 Assessment and Modeling of Carbon Flux in Forest Ecosystem using Satellite Sensor and Terrestrial Sample Based Forest Inventory Data (Phase I)

The area of global forest cover is just over 4 billion hectares, which is about 31% of total land area of the globe. The total carbon storage of global forest ecosystem is estimated to be 638 Gt for 2005, which is more than the amount of carbon in the entire atmosphere. This huge amount of carbon stocks will be declined by the process of deforestation and forest degradation, while it will be increased by afforestation, reforestation and forest amelioration activities.

The continuous process of deforestation and forest degradation at alarming rates, contributes significantly to the loss of forest carbon and biodiversity. It is estimated that some 420 million hectares of forest have been lost through the conversion of forest to other land uses since 1990, although the rate of deforestation has decreased over the past three decades.

The forest cover in Bangladesh is also changing at an alarming rate. In order to understand carbon flux by the process of deforestation and forest degradation in the country, methodology should be developed that can be effectively used for satellite detection and monitoring of forest carbon in country scale. The objectives of this study were (i) to develop model based forest carbon estimation based on satellite reflectance for the period of 2003 and 2019 (ii) to prepare digital database and GIS layers of forest cover maps and forest cover statistics for the study period and (iii) to prepare forest carbon change map for 2003-2019.

The study area was located at southern Chittagong, which belongs to the south-eastern region of Bangladesh. The size of the study area was approximately 300 sq. km (20km x 15km). The forests of the study area are classified as tropical wet evergreen forests and tropical semi-evergreen forest.

The research project could not be implemented since reliable estimation of forest carbon is highly dependent on the availability of ground sampling plots. This year field sampling could not be implemented because of Covid-19 outbreak. After situation becomes normal this type of research project can be implemented for developing satellite based forest and carbon monitoring system in the country.

2.5 Water Resources Division

2.5.1 Establishment of Remote Sensing based Drought Monitoring System in Bangladesh

Bangladesh is a disaster prone country. Drought is one of the disasters faced by the country almost every year. It is being considered as one of the main causes which hamper the estimated agricultural production in Bangladesh over the last few decades. Every five years, Bangladesh is affected by the major country-wide droughts. However, local droughts occur regularly and affect crop production. In the circumstances mentioned above it is necessary to establish an operational drought monitoring system in the country to keep vigilance over the drought condition and to provide drought relevant information on real time basis for better management of drought event.

Drought condition and its severity are estimated by drought indexes each of which have been developed to address particular types of drought (meteorological, hydrological and

agricultural). Many drought indexes are available, like Standardized Precipitation Index (SPI), Aridity Index, Vegetation Condition Index (VCI), Temperature Condition Index (TCI), Vegetation Health Index (VHI), Keetch Byram Dryness Index (KBDI), Land Surface Water Content (LSWC) etc. Each of these indexes has merits and demerits. Successful application of drought indexes depends on a no. of factors like field of application, boundary conditions, data availability, reliability/robustness, spatial/temporal resolution, resources availability, regional context, spatial validity etc. Nowadays remote sensing based drought monitoring becomes advantageous in some aspects. However, a country may have its particular context regarding the factors mentioned above and also regarding topography, hydro-meteorology and agricultural practices for which suitable drought indexes should be found out or developed. In this context, SPARRSO has been carrying out research works with the ultimate aim to develop a national drought monitoring system based on remote sensing technology. The fundamental aspect of the research works is to find out the most suitable index/indicator applicable in the context of Bangladesh for drought monitoring.

Investigation carried out so far directed towards development of a drought indicator, namely Environmental Thermal State Indicator (ETSI), which may be technologically promising in the context of the country. Figure 12 shows a map of one of the baseline products of ETSI. The higher value of ETSI indicates normalized higher thermal regions to be related with the drought intensities. Investigation is going on to finalize the methodology to be used in the national drought monitoring system.

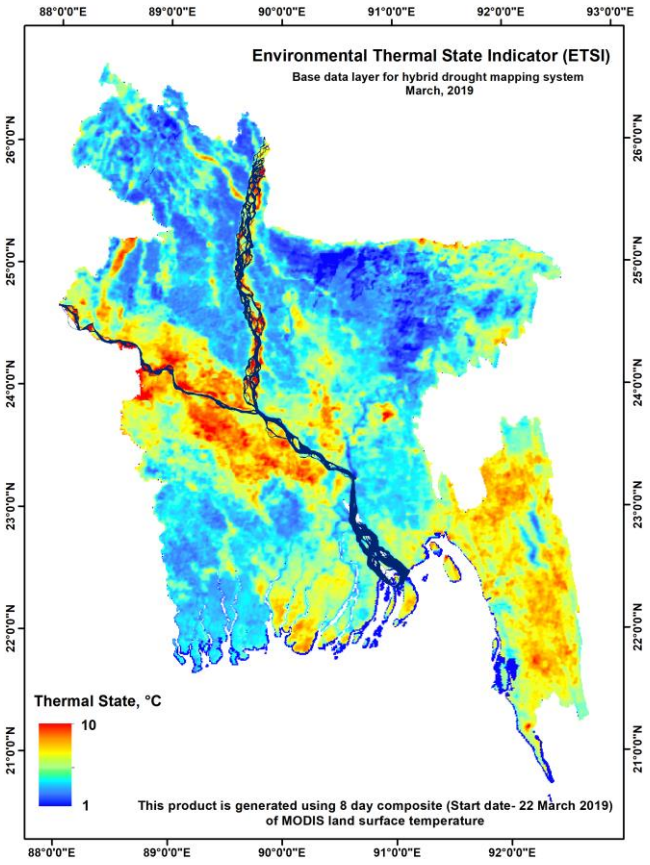


Figure 12: Map of baseline products of ETSI.

2.5.2 Establishment of Remote Sensing based Operational Flood Monitoring System

SPARRSO is underway to establish a "National Flood Monitoring System (NFMS)" based on remote sensing and GIS techniques. The NFMS has been being developed in phases based on its gradation mentioned in table 3 with the intension to address all the major aspects of flood monitoring in a single package.

Table 3. Gradation of National Flood Monitoring System

Output	Grade
Flood map showing only gross flood area	G-1
Flood map showing perennial and extended flood area	G-1A
G-1A + Population affected	G-2
G-2 + Flood damage	G-3
G-3 + Early warning	G-4

Research works for establishing the NFMS was started in 2012 and the 1st component of the system was established in 2015 having the capability of nation-wide extended flood area

mapping (grade G-1A). The system was operated the then for preparing extended flood area map of 2015 flood event (figure 13).

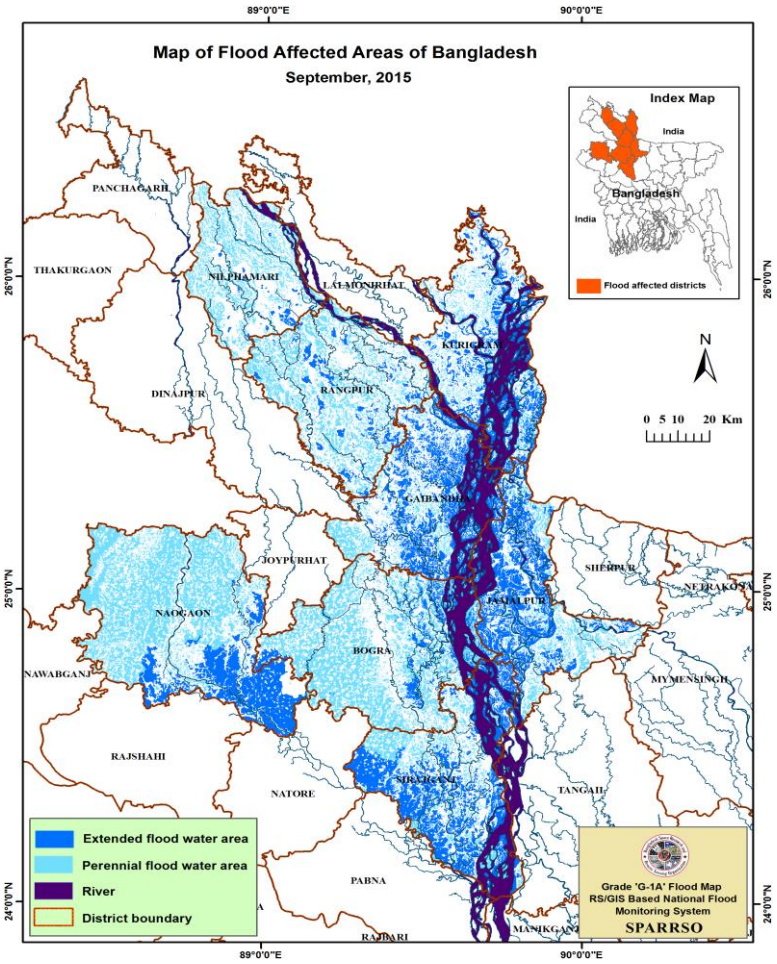


Figure 13. Extended flood area map of September, 2015.

Extended flood area mapping: Flood occurs in Bangladesh every year. When it remains in perennial level, it is welcome because it does not damage but does benefit in a number of ways-it helps to maintain balance in the aquifer systems, sustain agricultural fertility of the floodplain and sustain productivity of the inland fish catches etc. Bangladesh has considerable areas of perennial flood. When flood extent goes beyond the perennial level, it is called extended flood. This flood actually damages lives and properties and needed to be mapped. However, satellite data can provide only gross flood area (perennial + extended). Mapping gross flood area is not useful for flood managers because for effective relief and rehabilitation activities information on the area where actual flood damage occurs is needed. Even for prioritization of flood affected area in order to carry out post flood management

activities, gross flood area mapping is misleading. So, in the context of Bangladesh mapping of extended flood is important.

A flood area model was developed for estimation of extended flood area based on satellite images. The schematic presentation of the flood area model is shown in Figure 14. In terms of boundary of the water areas the flood area model can mathematically be expressed as,

$$W_{EF} = W_{GF} - (W_{PF} + W_D)$$

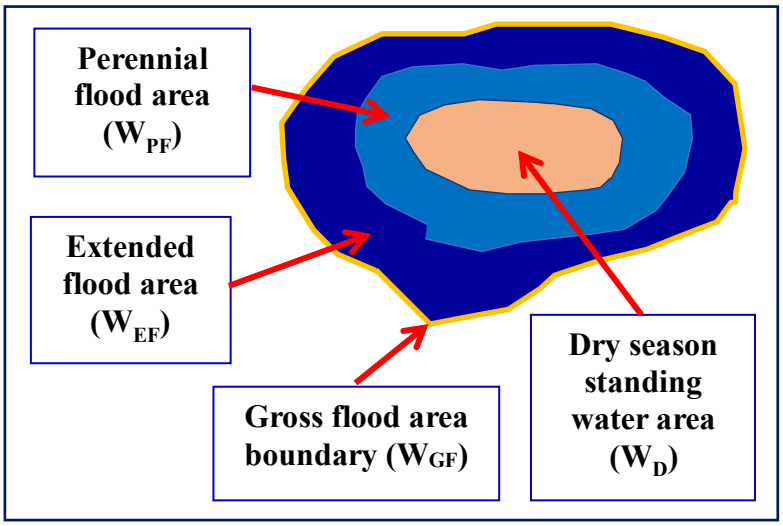


Figure 14. Schematic presentation flood area model.

The model introduces a critical perennial flood area data layer in a GIS framework to identify and map extended flood area of a particular flood event. Multi-temporal remotely sensed images of normal monsoon years were synthesized to generate the critical perennial flood

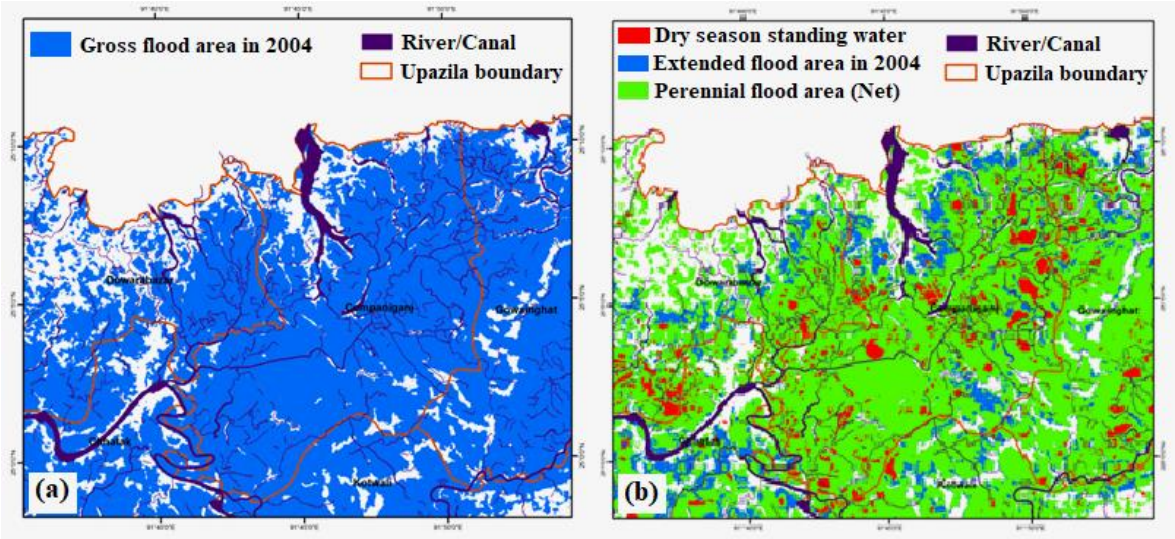


Figure 15. (a) Gross flood area map; identification of flood damage area is difficult (b) Extended flood area map, identification of flood damage area is easier.

area data layer beyond which damages occur if flood extends. During research period the flood area model mentioned above was applied in Sylhet division for the backward flood event of 2004 when nation-wide flood occurred in Bangladesh. Flood maps (partly shown in figure 15) were prepared which clearly conceived the improvement of the map and flood area statistics (Table 4). Table 4 shows changes of priority of the districts in respect of extend flood affected area.

Table 4. Improvement of flood area statistics in Sylhet division.

District	Gross flood			Extended flood			Change of priority
	Area	%	Priority	Area	%	Priority	
Sylhet	2,28,859	66.30	2	48,502	14.05	2	No Change
Sunamganj	3,26,515	87.14	1	27,255	7.27	4	1 to 4
Maulavibazar	92,404	33.01	4	24,575	8.78	3	4 to 3
Habiganj	1,74,746	66.28	3	45,169	17.13	1	3 to 1

Estimation of population affected by flood: Research work on another sub-system of the NFMS for estimation of population affected by flood has been completed. This sub-system is based on a population model developed by SPARRSO. The schematic presentation of the population model is shown in Figure 16. The population model is mathematically expressed as,

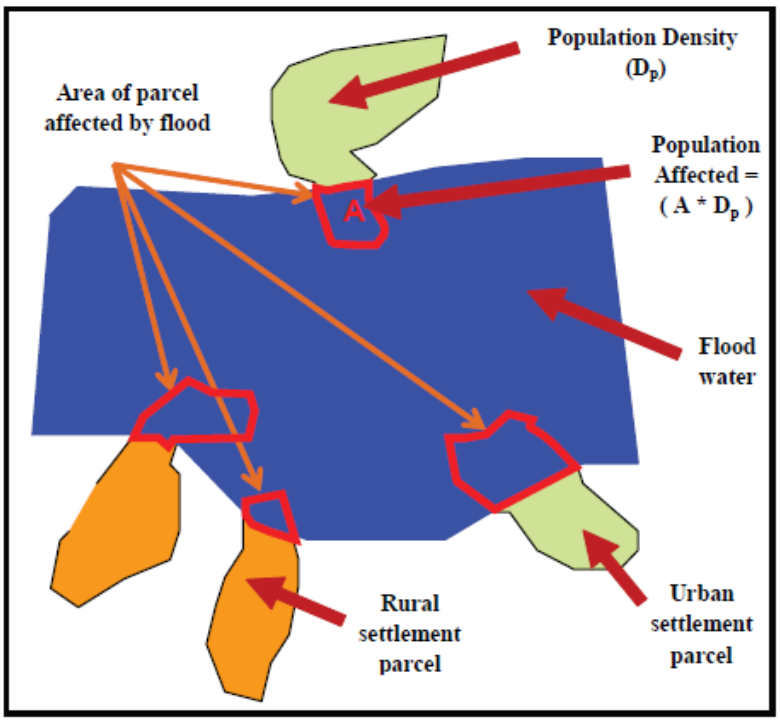


Figure 16. Schematic presentation population model.

Population affected

$= \Sigma (A_u * D_{pu}) + \Sigma (A_r * D_{pr})$

A_u: Area of a urban land parcel affected by flood.

D_{pu}: Urban population density.

A_r: Area of a rural land parcel affected by flood.

D_{pr}: Rural Population density.

The population model is executable in GIS and gives a first-hand estimation of population affected by flood. The inputs to the model are extended flood area, settlement area and administrative unit based population data. Configuration of a GIS framework for application of population model for estimation of flood affected population is going on.

Estimation of crop damaged by flood: A RS/GIS based sub-system for estimation of damage of crop by flood has been incorporated in the NFMS. The sub-system is based on a spatial model that rooted functionalities into a destination of generation of a spatial data layer of crop damage probability classes. The probability classes are translated to the actual crop damage classes based on field collected information. Configuration of a GIS framework for application of crop damage spatial model is going on.

2.5.3 Establishment of Remote Sensing based Integrated River Monitoring System

Bangladesh is a riverine country and has one of the largest river networks in the world. Being a delta which is still under formation stage, the river network of Bangladesh is characterized by ever changing morphological nature. Erosion, accretion, siltation in the river bed, change of courses etc. are the morphological aspects which the river network of the country has been facing. The economy of the country greatly depends on the rivers and this dependency sometimes embedded with the changes mentioned above. It is, therefore, very important to keep vigilance over the river network and to assess the trend of its changes. In Bangladesh there is no operation river monitoring system to carry out these tasks on regular basis. Remote sensing and GIS based system is a feasible option to carry out the tasks. However, to establish the river monitoring system some issues like identification of river bank lines, trend analysis and change prediction, remote sensing relevance to sediment transport etc. need to be addressed considering the specific context of Bangladesh. To address these issues it is necessary to carry out research works along with generation of the river morphology datasets in multi-temporal domain.

SPARRSO has undertaken research works to establish a remote sensing and GIS based operational river monitoring system in the country capable of providing information on the rivers of Bangladesh on near real time bases. As the backbone of this system, high feature resolution river network data layer has been generated using RapidEye satellite images of 2011. RapidEye images have 5 multi-spectral bands and 5 meter resolution. The generation of this backbone dataset was assisted by aerial photographs. This data layer contains all the rivers of Bangladesh along with large number of khals/canals. The river network data layer of 2011 has been forward projected to update the data layer for the year 2020. Figure 17 shows the updated map of 2020.

Generation of high feature resolution river network data layer of 1972 is in progress. Once generation of this data layer will be completed, the three data layers (1972, 2011 and 2020) will be analyzed to reveal complete picture of changes occurred in river network of the country since 1972. The river network data layer of the country will be updated on yearly basis to provide readily available geo-spatial datasets of the rivers/canals of the country for various applications and researches.

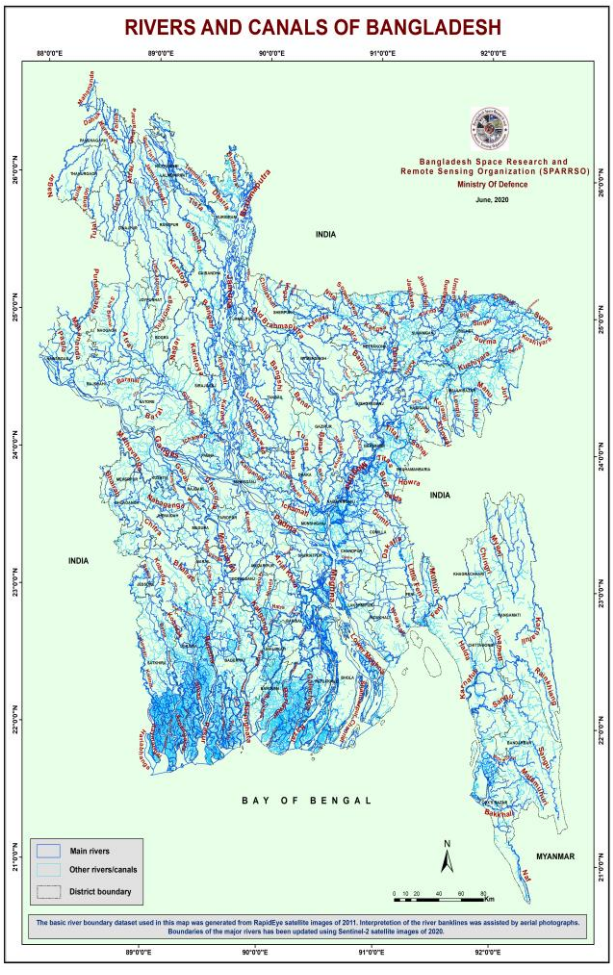


Figure 17. Rivers and canals of Bangladesh in 2020.

2.5.4 Remote sensing and GIS based water logging monitoring system

Water logging is involved in the livelihood of the people of Bangladesh since quite a long time. However, over the last three decades it has become gradually aggravated and has become a disaster in this country. Particularly, the south-western part of Bangladesh has increasingly been facing the water logging problem. Agricultural lands are being lost due to water logging which ultimately deteriorating the socio-economic condition of the relevant people. Reliable information on the extent/intensity of water logging and damages created by it are not available in the country. The country does not have an operational water logging monitoring system. Water logging is a silent disaster and because of absence of an operational water logging monitoring system, it is not possible to identify the occurrence of water logging at its initial stage. If water-logging could be identified at its earlier stage of occurrence, the remedial measures would be implemented easily within shorter period of time and in a cost-effective manner. Therefore, an operational water logging monitoring system is essential to be established in the country. On this background SPARRSO established an operational Water Logging Monitoring System (WLMS) having the ultimate objective of launching regular vigilance over the water logging situation in the country. The WLMS has been launched in 30 April, 2017 through a national seminar arranged at SPARRSO (Figure 18). Using 122 multi-temporal (1972-2016) satellite images (Landsat TM / ETM/ OLI and RADARSAT) covering the geographic area of Bangladesh, a baseline survey was carried out during 2014-2016 to identify locations of water logged area in Bangladesh. According to this survey, the gross water logged area in the south-west region of the country during 1972-2016 was about 77,300 hectares

Figure 18. National seminar on water logging in Bangladesh was arranged for launching the NWMS established at SPARRSO

After establishment of the WLMS, remote sensing based nation-wide survey has been being carried out each year to identify and estimate the changes of the extent/intensity of water logging occurred earlier and to identify the occurrence of water logging at new places. In 2019, gross water logged area in the south-west region reduced from 77,300 hectares to about 34,881 hectares which was also the water logged area in wet season. Water logged area in dry season was 16,270 in 2019. Figure 19 shows the wet and dry season water logged areas in 2019.

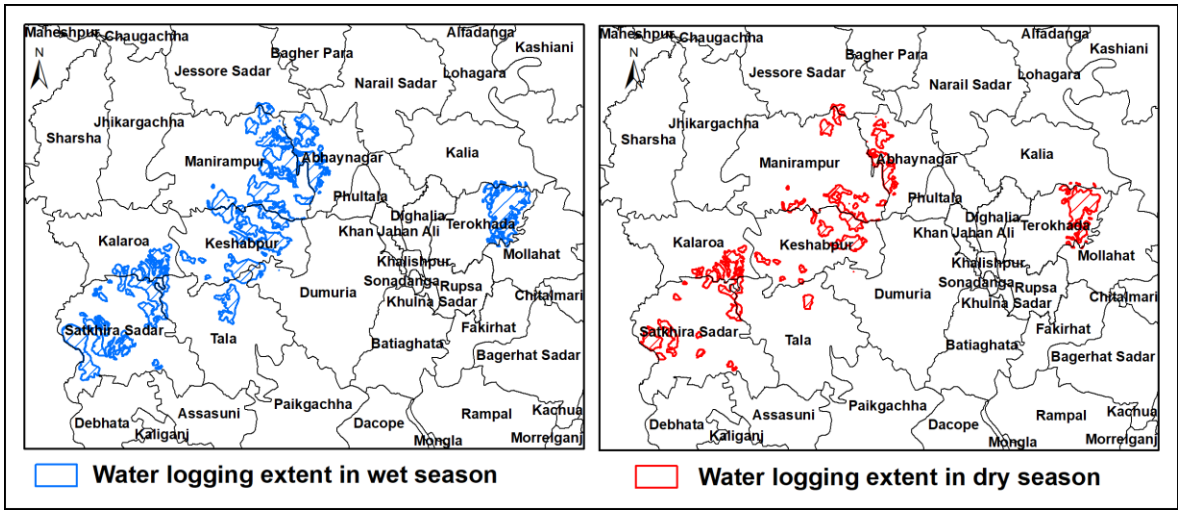


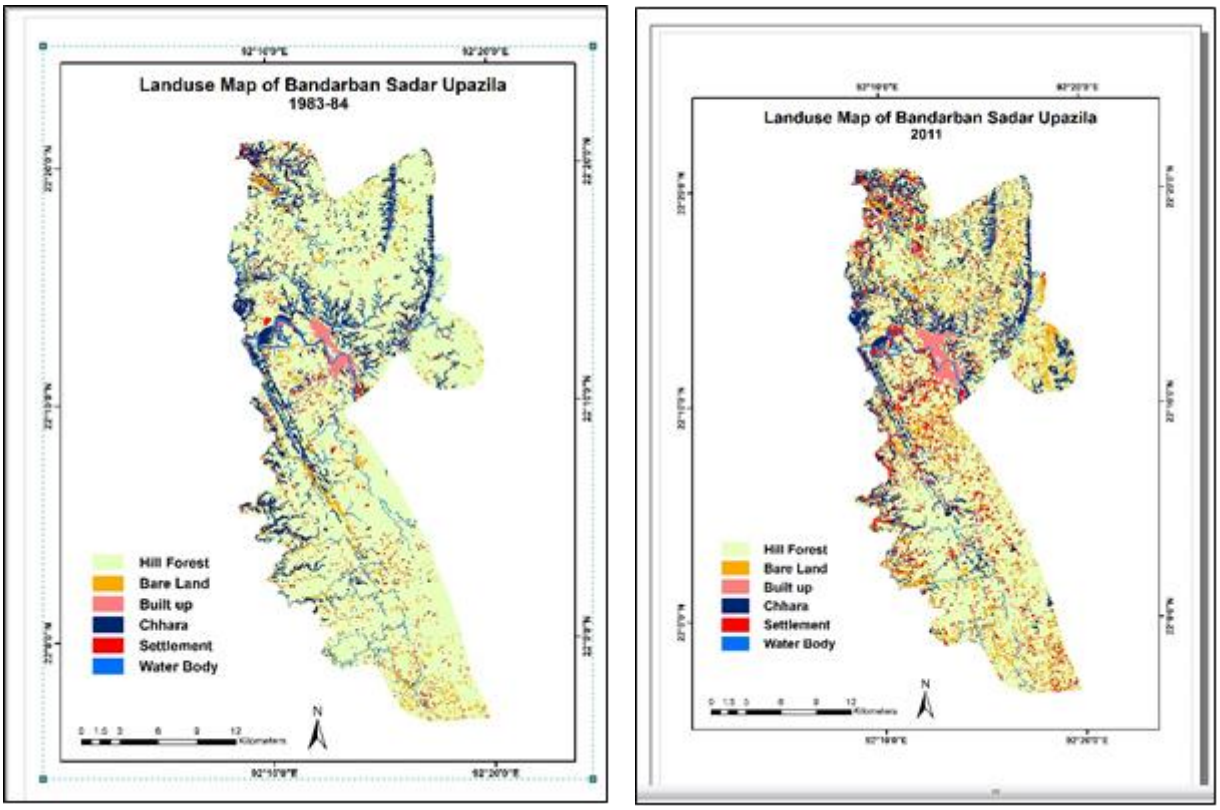
Figure 19. Water logged areas the south-west region in 2019.

2.6 Photography Division

Assessment of Land Use and Land Cover Changes in Bandarban Upazila of Bandarban District of Bangladesh: A RS and GIS Approach

The study area is situated in the southeastern region of Bangladesh which in between 22°14′ N and 22.233°N north latitudes and in between 92°11.5′ E and 92.1917 east longitudes.

Bandarban is located in Chittagong Division. This district belongs to one of the three hill districts of Bangladesh which is a part of the Chittagong Hill Tracts. Bandarban Hill District is a continuation of the Himalayan Tract. About 90% of the total area of the district is hilly, 4% covers villages, rivers and marshes, and the remaining 6% represents valley suitable for intensive agricultural production (Osman 2013).



(a) (b)

Figure 20: Land and land cover maps of Bandarban Sadar Upazila; (a) Land use map of 1983 and (b) Land use map of 2011

This study aimed to assess land use and land cover changes in Bandarban Sadar Upazila of Bandarban District. Aerial photographs and satellite images were used to identify changes in the land use and land-covers in Bandarban Upazila during the last 28 years. Decrease of vegetation cover and increase of settlement area and bare land in the land use change patterns have been investigated using aerial photographs and satellite images. The study found that 4,162 hectares of the hill forest have been converted to 1,633 hectares of bare land and 2,177 hectares of settlement during the last 28 years (1983-2011).

2.7 Fisheries Division

Inventory of Fishery Resources and Study of the Land use Association-A Pilot Study

For proper planning management and sustainable development of fisheries resources in the country, it is urgently needed to know the present condition, extent and location along with their infrastructure facilities. The present study aims to do land use mapping of water bodies for fisheries development with special emphasis on shrimp farming areas in Debhata and Tala upazila of Satkhira district applying remote sensing and GIS techniques.

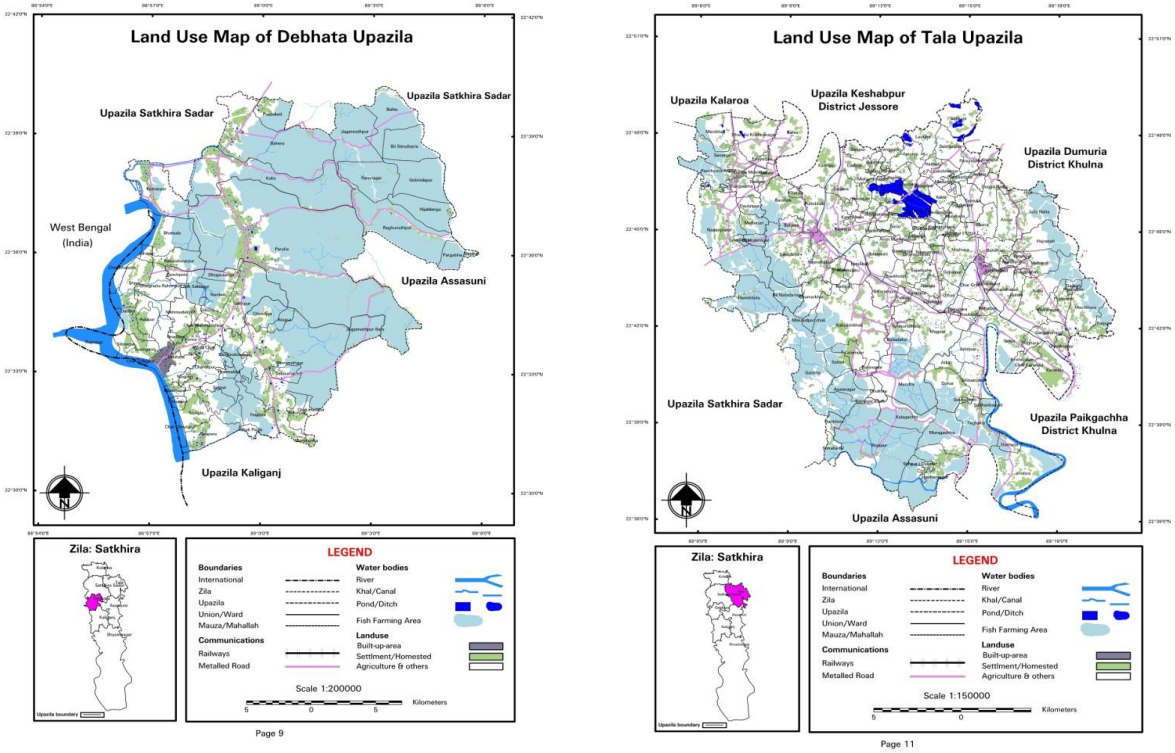


Figure 21: Land Use Map of Debhata and Tala Upazila

The present study finds that Debhata upazila comprises larger fish farming area (25076 acres) than that of Tala upazila (19012 acres). Whereas Tala upazila comprises larger pond area (1712 acres) compare to Debhata upazila (247 acres).

2.8 Geology Division

Geomorphological and Tectonic Study of Jaflong, Sylhet Area Near Dauki Fault Using Remote Sensing (RS) and Geographic Information System (GIS).

Geomorphology is closely related to geology, soil science, hydrology and environmental science and is being increasingly applied in planning, mining and hydrological sectors, and within environmental consultancy and tourism. Under this study an attempt was made to establish the relationship between geomorphic unit and existing landuse based on remote sensing data.

Jaflong area consists of two unions of Gowainghat upzila under Sylhet district named as Paschim Jaflong union and Purba Jaflong union (Fig. 22). Tectonically this area belongs to Surma Basin situated into Bengal Fore deep zone of Bengal Basin also known as Sylhet Trough. It is very close to Dauki Fault line and situated in high risk earthquake zone. It is important to consider geomorphological viewpoint for permitting a comprehensive approach to environmental investigations and achieving sustainable environmental management.

Sentinel 2 satellite data of 28 March and 14 October 2019 have been used for the study. Erdas Imagine 2015 and ArcGIS 10.3.1 software is applied to carry out the research. This study was taken to provide geo-scientific information for future development plan and disaster management.

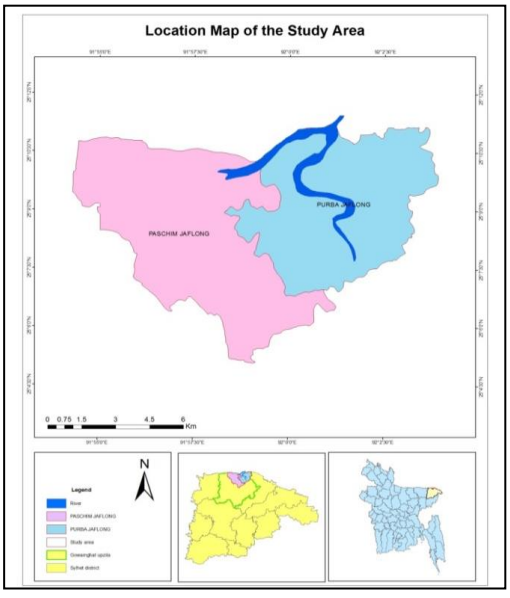


Figure 22: Study area

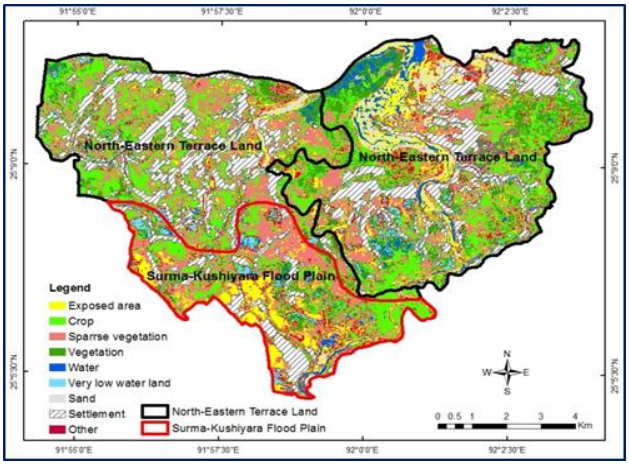


Figure 23: Physiographic unit wise landuse setting of the study area during March 2019.

The study area Jaflong is under two different physiographic units (1) North-Eastern Terrace Land and (2) Surma-Kushiyara Flood Plain. Again, Jaflong is also covered by two surface geological units (1) Young Gravelly Sand and (2) Marsh Clay and Peat.

Purba Jaflong area is falls in North-Eastern Terrace Land (Fig. 23) and Marsh Clay and Peat deposit (Fig. 24). But Paschim Jaflong area is falls physiographically in both North-Eastern Terrace Land and Surma-Kushiyara Flood Plain. It is also cover Young Gravelly Sand and Marsh Clay and Peat geological deposit.

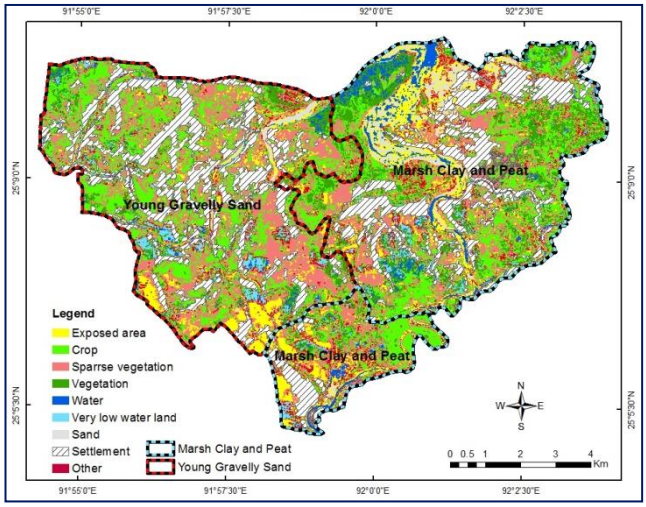


Figure 24: Surface Geological unit wise landuse setting of the study area during March 2019.

In Jaflong area nine landuse categories were identified through remote sensing and GIS techniques. The study area falls under two different physiographic units North-Eastern Terrace Land and Surma-Kushiyara Flood Plain with two surface geological units Young Gravelly Sand and Marsh Clay and Peat. From analysis no relationship has been found between landuse classes with its physiography and surface geology.

2.9 Space Physics and Rocket Dynamics Division

Earth Observation (EO) Satellite Mission Analysis for Bangladesh

To plan a satellite development proposal, you need to have some background information such as what type of satellite is needed, its orbital parameters, coverage, satellite image type (payload quality), etc. In a space development program, this work is known as the first of seven phases (phase 0).

This research work was based on simulation and analysis by STK and MATLAB programming.

This research work focuses on the mission analysis of small satellites required for Bangladesh that can acquire Earth observation / remote sensing multispectral images and send them to the ground station.

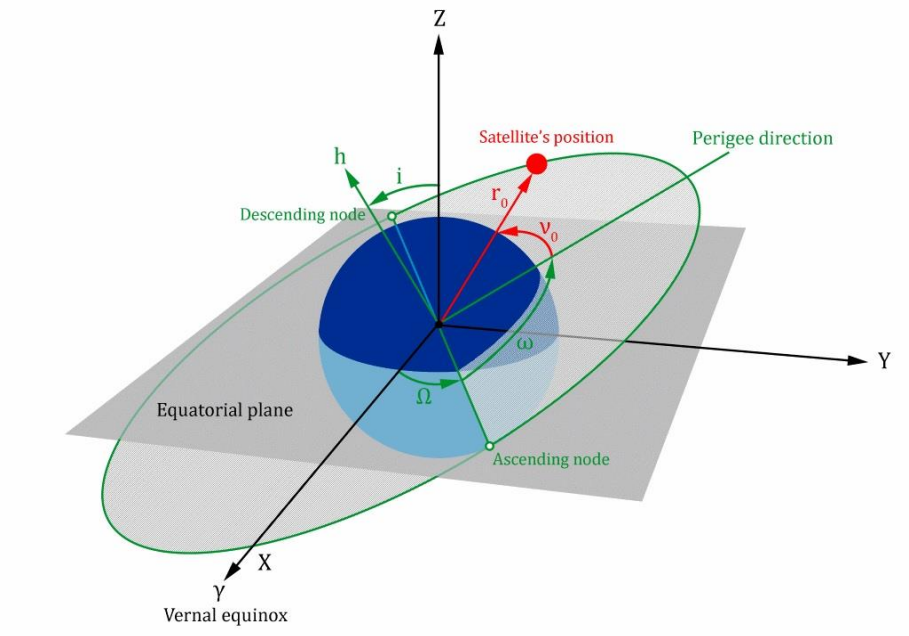


Figure 25: Orbital analysis of the satellite

CHAPTER 3
DEVELOPMENT PROJECT

Blue Economy Project

Recently Bangladesh won a large area of the Bay of Bengal, potential for the extraction of natural marine resources, from two neighbor countries i.e. India and Myanmar. Government is very much interested to incorporate the blue economy with the mainstream economy to facilitate the socioeconomic development of the country. To ensure the effective and sustainable extraction of marine fish resources, SPARRSO has taken an initiative to identify potential marine fishing zone from the chlorophyll content, total suspended solids and temperature of sea water using advanced remote sensing technology.

Project Title: Establishment of Geographic Information System of the Coastal Areas of Bangladesh and Marine Fishing Zones Identification System Based on Remote Sensing and GIS Techniques.

Objective of the project

Two main objectives of the project are as follows:

a) Establish a geographical information system of coastal area of Bangladesh

b) Identify the potential fishing zone for Bay of Bengal of Bangladesh

Through this project following two systems would be developed:

I. Establishing a Geographic Information System of the coastal areas of Bangladesh using high resolution satellite image and monitoring the dynamic of the geographical structures of the coastal area on regular basis.

II. Establishing a system for identifying potential fishing grounds in the Bay of Bengal through space technology applications.

Stakeholder, PIC meetings

For indigenous knowledge gathering about the marine fishing zones, three stakeholder meetings arranged in Moheshkhali (Cox's bazar) on September 05, 2019, Kalapara (Patuakhali) on October 02, 2019 and Charfesson (Bhola) on 30 October, 2019 with the help of Local Government Officials and fishermen. For discussion on project implementation, a PIC (Project Implementation Committee) meeting was held on 14 November, 2019 at SPARRSO, Dhaka.

Figure 26: Stakeholder meeting at Moheshkhali.

Figure 27: Stakeholder meeting at Kalapara.

Figure 28: 1st Project Implementation Committee (PIC) meeting for Blue Economy Related Project of SPARRSO.

Field data collection and test

Field data collection

Sea water sample was collected from the deep sea and shallow zone with the help of Bangladesh NAVY and Bangladesh Coast Guard from February 23-26, 2020 and March 06-08, 2020, respectively.

Figure 29: Water sample collection with NAVY.

Figure 30: Temperature test of water sample.

Test of sea water sample

Chlorophyll-a content and Total Suspended Solid (TSS) of sea water sample was tested in the Laboratory of the Department of Botany, University of Dhaka under the supervision of Professor Mohammed Almujaddade Alfasane.

CHAPTER 4
ADMINISTRATIVE AND FINANCIAL ACTIVITIES

4.1 Administration

4.1.1 New Chairman of SPARRSO

Mr. Mizanur Rahman has been working as the Chairman of Bangladesh Space Research and Remote Sensing Organization (SPARRSO) since 05 February 2020. He is an Additional Secretary to the Government of the People's Republic of Bangladesh.

He belongs to Bangladesh Civil Service (Administration) cadre. He served at the various positions at field administration such as Assistant Commissioner, Upazila Nirbahi Officer and Additional Deputy Commissioner. He served in the Ministry of Public Administration and Ministry of Land as Senior Assistant Secretary. He worked in the Prime Minister's Office (PMO) as Director. He worked at Access to Information (a2i) Program under UNDP as Admin Specialist. He worked in the Ministry of Public Administration as Joint Secretary. He served as Member (Finance) of Bangladesh Export Processing Zone Authority (BEPZA) before joining his current position as Chairman, SPARRSO.

He did his M. Sc. Degree with honours in Applied Physics and Electronics from University of Dhaka in 1986. He has obtained his second Master's degree with Netherlands Fellowship Programme scholarship in Geo-Information Science and Earth Observation from ITC, the Netherlands.

Figure 31: Sharing of views with all officers by newly appointed Chairman Mr. Mizanur Rahman (Additional Secretary) on 05 February 2020 .

4.1.2. New Financial Adviser of SPARRSO

Mr. Mohammad Sanaul Huq has been working as the Financial Adviser of Bangladesh Space Research and Remote Sensing Organization (SPARRSO) since 09 March 2020. He is a Deputy Secretary to the Government of the People's Republic of Bangladesh.

Being a Bangladesh Civil Service (Administration) cadre, he served at the various positions in field administration such as Assistant Commissioner & Magistrate, Upazila Nirbahi Officer and Additional Deputy Commissioner in upazila and district level. He has also worked in Finance Division, Ministry of Health & Family Welfare and Dhaka South City Corporation bearing different responsibilities and positions.

He did his honours and Masters in Economics from the University of Dhaka. He obtained another Master's degree in Development Management (Public Economic Management & Finance) from the University of Birmingham, England, UK.

4.1.3 Board Meetings

SPARRSO is governed by a Board consists of Chairman and four Members. In 2019-2020 Financial year there were seven (07) board meetings held, which are listed below:

Serial No.	Number of Meetings	Date
01	108th Board Meeting	11 July 2019
02	Special Board Meeing	25 July 2019
03	109th Board Meeting	17 October 2019
04	110th Board Meeing	24 November 2019
05	111th Board Meeing	29 December 2019
06	112th Board Meeing	20 February 2020
07	113th Board Meeing	14 June 2020

4.1.4 Farewell of Member (Technology 1)

Dr. Hafizur Rahman, Chief Scientific Officer and Member (Technology 1) went to (PRL) on 09 February 2020. On the occasion of his departure, a farewell program was organized at SPARRSO conference room. Mr. Mizanur Rahman, Chairman, SPARRSO mentioned his great contribution in research activities and wished him for sound and healthy life in the retirement period.

Figure 32: Farewell greetings handing over to Dr. Hafizur Rahman (left side) by SPARRSO Chairman, Mr. Mizanur Rahman (right side).

Figure 33: Crest handed over to Dr. Hafizur Rahman by Chairman, SPARRSO

Dr. Hafizur Rahman joined at SPARRSO on 02 March 1986 as a Scientific Officer. He served the organization more than 34 years being promoted as Chief Scientific Officer and Member (Technology 1).

4.1.5 Farewell of Member (Research)

Mr. Muhammed Azam, Joint Secretary to the Government of the People's Republic of Bangladesh and Member (Research) of SPARRSO had been released from SPARRSO from 20 February 2020 on account of joining to the Ministry of Public Administration as an Officer on Special Duty. On the occasion of his departure, a farewell program was organized at the SPARRSO conference room which was presided over by SPARRSO Chairman, Mr. Mizanur Rahman.

Mr. Muhammed Azam joined at SPARRSO on 11 July 2018 and basically it was his last working place before retirement. Presently, Mr. Md. Zafar Ullah Khan, Joint Secretary and Member (Application) of SPARRSO has been performing the additional responsibilities of Member (Research).

Figure 34: Farewell program of Mr. Muhammed Azam, Member (Research), SPARRSO.

Figure 35: Farewell greetings handing over to Mr. Muhammed Azam (left side) by SPARRSO Chairman, Mr. Mizanur Rahman (right side).

4.1.6 Virtual meetings among SPARRSO officials

Under the direction and guidance of Mr. Mizanur Rahman, Chairman, SPARRSO, near about 30 (Thirty) virtual meetings were being conducted via Skype and Zoom apps throughout the month of April to June considering the Covid-19 pandemic and lockdown situation. A number of decisions had been taken on several issues like MASTA and DOCSTA Program of

APSCO, Blue Economy Project, Satellite Data Purchase, donation of one day salary for Covid-19 affected people, feasibility study of Ionospheric Project, APSCO DSSP Development Project, APSCO development plan related activities after being discussed in those virtual meetings. The progress of the research projects of SPARRSO was also discussed in the virtual meetings.

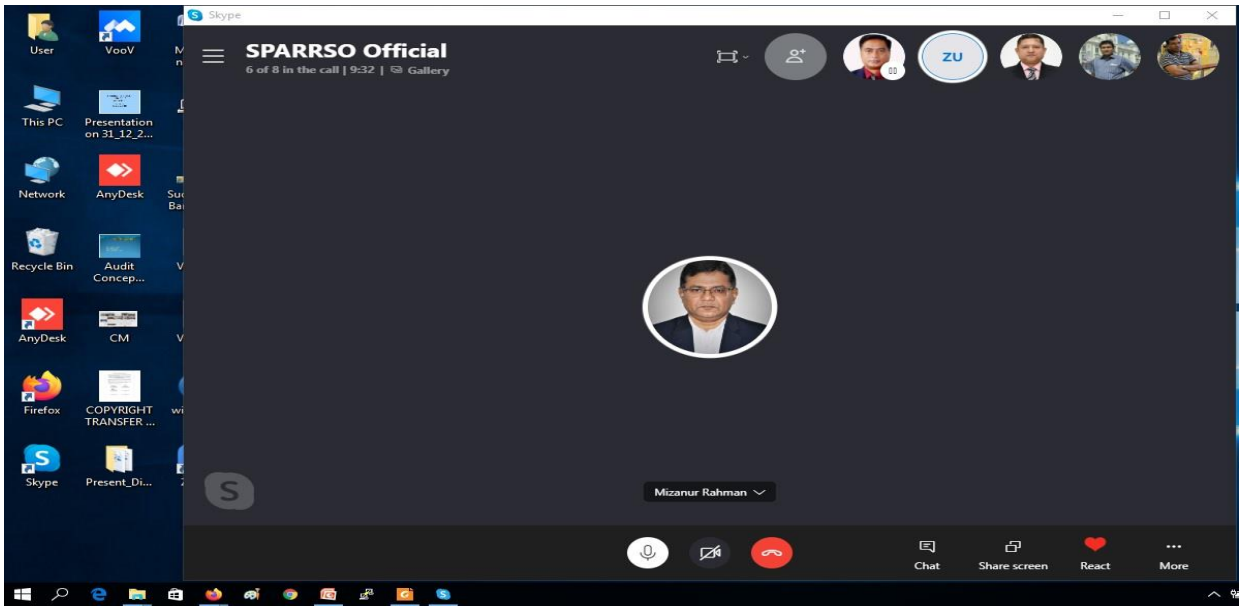


Figure 36: Virtual meetings among SPARRSO officials.

4.1.6 COVID-19 Situation Management

During the on-going pandemic situation, SPARRSO authority has been taken quite a good number of initiatives to avoid the COVID-19 outbreak among SPARRSO officials.

Figure 37: COVID-19 Situation Management (Hand Sanitization)

Figure 38: COVID-19 Situation Management (Examination of Body Temperature)

A five members committee led by Mr. Md. Zafar Ullah Khan, Member (Application) along with other four members such as Secretary, Financial Adviser, Dr. Md. Abdus Salam, CSO and Mr. Md. Nur Hossain Sharifee, CSO of SPARRSO was formed on 01 June 2020 following the guidelines published by Health Services Division of Bangladesh. This Committee has taken relevant steps to minimize the COVID-19 outbreaks such as recording body temperature, wearing mask at all the time during office hours, washing hands by soap, using hand sanitizer, maintaining a social distance among personnel during meetings and other official activities.

4.1.7 Post Retirement Leave (PRL) and Retirement

During this tenure, 09 Officers and 09 Staffs have gone to PRL (Post Retirement Leave). Although, 01 Officer and 4 Staffs also went for retirement after finishing their PRL period. The names of Officers and Staffs according to the effective date are written in chronologically:

Mr. Md. Abdul Awal, Librarian has gone to PRL on 30 July 2019. He joined SPARRSO on 20 July 1995 and served the organization for more than 24 years.

Mr. Sunity Kumar Chakma, Store and Procurement Officer has gone to PRL on 04 August 2019. He joined SPARRSO on 24 November 1990 and served the organization for more than 28 years.

Mr. Md. Ali Akbar, Office Helper has gone to PRL on 31 August 2019. He joined SPARRSO on 01 August 1981 and served the organization for more than 38 years.

Mr. Md. Yunus Ali Mondol, Security Guard has gone to PRL on 13 October 2019. He joined SPARRSO on 15 June 1985 and served the organization for more than 34 years.

Mr. Shyamal Baran Saha, Senior Engineer has gone to PRL on 01 November 2019. He joined SPARRSO on 26 December 1985 and served the organization for more than 31 years.

Mr. Mir Haris Ali, Assistant Engineer has gone to PRL on 02 November 2019. He joined SPARRSO on 09 February 1983 and served the organization for more than 36 years.

Mr. Kazi Shahjahan, Finance Officer has gone to PRL on 30 December 2019. He joined SPARRSO on 05 February 1985 and served the organization for more than 34 years.

Mr. Mostafizur Rahman Akhand, Principal Scientific Officer has gone to PRL on 30 December 2019. He joined SPARRSO on 29 April 1985 and served the organization for more than 34 years.

Mr. S. M. Mizanur Rahman, Principal Scientific Officer has gone to PRL on 30 December 2019. He joined SPARRSO on 01 July 1982 and served the organization for more than 37 years.

Mr. Md. Shafiqul Islam, Junior Engineer has gone to retirement with effect from 31 December 2019. He joined at SPARRSO on 01 August 1981 and served the organization near about 38 years.

Mr. Md. Haidar Ali, Library Assistant has gone to retirement with effect from 31 December 2019. He joined at SPARRSO on 21 April 1985 and served the organization near about 34 years.

Mr. Tojammel Haque, Security Guard has gone to PRL on 08 January 2020. He joined SPARRSO on 18 April 1985 and served the organization for more than 35 years.

Mr. Md. Rafiqul Islam, Technician 1 has gone to PRL on 11 January 2020. He joined SPARRSO on 29 April 1985 and served the organization for more than 35 years.

Mr. Md. Atair Rahman, Security Guard has gone to PRL on 31 January 2020. He joined SPARRSO on 29 April 1985 and served the organization for more than 35 years.

Mr. Md. Iqbal Hossain, Junior Engineer has gone to PRL on 01 February 2020. He joined SPARRSO on 01 August 1981 and served the organization for more than 39 years.

Dr. Hafizur Rahman, Member (Technology 1) and Chief Scientific Officer has gone to PRL on 09 February 2020. He joined SPARRSO on 02 March 1986 and served the organization for more than 34 years.

Mr. Sukumar Dutta, Principal Scientific Officer has gone to retirement with effect from 14 February 2020. He joined at SPARRSO on 04 January 1986 and served the organization near about 34 years.

Mr. Md. Saheb Ali, Assistant Engineer has gone to PRL on 29 February 2020. He joined SPARRSO on 09 February 1986 and served the organization for more than 34 years.

Mr. Md. Mofazzal Hossain, Technician 1 has gone to retirement with effect from 22 March 2020. He joined at SPARRSO on 01 August 1981 and served the organization near about 39 years.

Mr. Md. Momtaz Uddin, Field Assistant has gone to retirement with effect from 28 April 2020. He joined at SPARRSO on 01 August 1981 and served the organization near about 39 years.

Mr. Mir Md. Belal Hossain, Senior Technician has gone to PRL on 09 May 2020. He Joined at SPARRSO on 01 August 1981 and served the organization more than 39 years.

Mr. Md. Abdul Baten Khan, Office Helper has gone to PRL on 09 May 2020. He Joined at SPARRSO on 01 August 1983 and served the organization more than 37 years.

Mr. Md. Enayet Ullah , Office Assistant cum Computer Typist Helper has gone to PRL on 20 June 2020. He Joined at SPARRSO on 03 September 1995 and served the organization more than 35 years.

Mr. Md. Moshiur Rahman, Stenographer has gone to retirement with effect from 30 June 2020. He joined at SPARRSO on 04 April 1987 and served the organization near about 33 years.

4.1.8 Promotion

In the 2019-2020 financial years, 02 staffs got promotion. The name and effective date of respective staff are listed below:

SL. No.	Name	Promoted Post	Effective Date
01	Mr. Md. Nuruzzaman	Senior Technician	04/07/2019
02	Mr. Md. Lutfor Rahman	Field Assistant	15/01/2020

4.1.9 Installation of fire fighting System at SPARRSO

During the financial year 2019-2020, SPARRSO installed Fire Fighting System at the Building 01 and 02 which was a mandatory issue being KPI (Key Point Installation) Institution. This was accomplished by the help of Public works Division (PWD).

Figure 39: Installation of Fire Fighting System at SPARRSO as KPI Regulations

4.1.10 Construction of Security Post and Elevation of Boundary Wall at SPARRSO

In order to enhance security performance, 04 security watch tower was built up in the 2019-2020 financial year. Along with this, SPARRSO boundary wall at north-west side was elevated and RCC road were constructed. These constructions were accomplished by Public Works Division (PWD).

Figure 40: Security Post and Elevation of Boundary Wall and RCC Road at SPARRSO

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 2019 to June 2020 are given below:

Organization and Code	Financial Year	Allocated Budget (BDT)	Revised Budget (BDT)	Expenditure (BDT)	Remarks
Bangladesh Space Research and Remote Sensing Organization (SPARRSO) 131003300	July 2019 – June 2020	22,11,68,000/-	17,11,15,000/-	13,58,79,769/-	Unspent money 3,52,35,231/- has been deposited in the government treasury through invoice

4.2.1 Audit

During this tenure, SPARRSO accomplished 2013-2014 to 2018-2019 financial year audit for 06 years. The Defence Audit team came to the SPARRSO at 27 June 2019 and continued till 01 August 2019. After reviewing the financial matters only 18 objections were raised during this audit. For the disposal of defence audit team objections, Accounts and Budget Section of SPARRSO has been sent a detailed broadsheet documents to the Ministry of Defence for addressing the concerned issue. Hopefully, in the next year the addressing issues would be resolved.

CHAPTER 5
OTHER ACTIVITIES

5.1 Visitors to SPARRSO

Following officers, teachers and students from different organizations visited SPARRSO during reporting period:

Sl. No.	Organizations	Date
01	Navy Wing, Defence Services Command and Staff College (DSCSC) 2019-2020	14 July 2019
02	Weather Squadron, Air Force Base, Jashore Cantonment	11 September 2019
03	Signal Training Center and School (STC & S), Dhaka	20 October 2019
04	School of Air Traffic Service (SATS), BAF, Dhaka	30 October 2019
05	Flight Controller Training Unit (FCTU), BAF, Dhaka	02 December 2019
06	Bangladesh Air Force Commandant and Staff Training Institute (CSTI), BAF, Dhaka	23 February 2020
07	Bangladesh Air Force Flight Controller Training Unit (FCTU), BAF, Dhaka	09 March 2020

Figure 41: Navy Wing, Defence Services Command and Staff College (DSCSC) 2019-2020

Figure 42: Participants of Officer Basic Course (Sigs-42) from Signal Training Center & School

Figure 43: Participants of CSTI officers and Student Officers of BAF

5.2 Secretary of Ministry of Defence visit to SPARRSO

The Honourable Secretary of the Ministry of Defence, Mr. Abdullah Al Mohsin Chowdhury visited the Bangladesh Space Research and Remote Sensing Organization (SPARRSO) on March 11, 2020. The Secretary met with SPARRSO officials to exchange of views and Mr. Mizanur Rahman (Additional Secretary to the Government), Chairman of SPARRSO delivered the welcome address at the meeting.

Dr. Md. Abdus Salam, Principal Scientific Officer delivered a presentation on SPARRSO activities at the meeting. He planted a sapling of tree at the SPARRSO premises and also visited various labs including SPARRSO Gallery. Apart from intensifying research activities, the Secretary also directed all scientists and engineers to carry out research activities capable of contributing to the national welfare.

Figure 44: Secretary, Ministry of Defence, Chairman and Other SPARRSO Officials at the Meeting on 11 March 2020

Figure 45: Crest Handed over By Mr. Mizanur Rahman (Left Side), Chairman, SPARRSO to Mr. Abdullah Al Mohsin Chowdhury, Secretary, MOD on 11 March 2020 at SPARRSO Conference Room.

Figure 46: Tree Plantation by Secretary of Ministry of Defence and SPARRSO Officials on 11 March 2020.

5.2 User Services

Delivery of Satellite Data Product

SPARRSO Photographic Division provided different types of remote sensing data products to different government, non-government organizations and universities for conducting their study and project works. These are mentioned below:

Product Description	Supplied to the Concerning Authority
RapidEye Satellite Image Map 2010 Sentinel Asia Satellite Image 2018	Department of Architecture Shahjalal University of Science & Technology
RapidEye Satellite Image Map 2010	Military Institute of Science and Technology (MIST)
Landsat TM Image Map	Wisdom Foundation

5.3 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 workshop, symposia and conference etc. covering different thematic areas of space science and remote sensing. It is an automated library which 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 retuning the library materials. The library database management system avoids duplication of the work by introducing computerized library management system and it helps to improve the existing services.

At present, there are about 16,000 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 2019 to June 2020 the following books were procured. The category-wise numbers are listed below:

Table 4: List of procured books

Description	Number
	July 2019 to June 2020
Books on Remote Sensing	11
Books on the Father of the Nation Bangabandhu Sheikh Mujibur Rahman	12
Dictionary (Bangla Academy)	16
Total	**39**

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 purpose in every working day.

Library Hours

SPARRSO library remains open from 9:00 am to 5:00 pm in all working days (Sunday to Thursday) and it remains closed on all government holidays.

Contact Numbers: +88-02-9113957, Cell Phone: +88-01717892042

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

Email: jakirjosna020608@gmail.com

5.4 Setting up Internet connection via radio link at SPARRSO

Earlier, the BTCL internet connection speed through optical fiber at SPARRSO was 10 Mbps. This speed was indeed very slow and most of the time BTCL's optical fiber line was cut off and the internet connections were disconnected. To solve these problems, BTCL's internet connection speed was upgraded to 50 Mbps in February 2020 and another 50 Mbps wireless internet connection was taken from Bangladesh Online (BEXIMCO) through radio link. By "merging" the two connections, the internet speed of SPARRSO has been increased to 100 Mbps. In the current situation, if one connection is disconnected, the other connection will act as a backup, thus contributing to uninterrupted internet service at SPARRSO.

Figure 47: Radio link Connection at SPARRSO

CHAPTER 6
INTERNATIONAL COOPERATION AND COLLABORATION

6.1 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.

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 1 August, 2006. Since then Bangladesh has been actively participating different programs and events organized by APSCO.

6.2 13th Council Meeting of Asia Pacific Space Cooperation Organization (APSCO)

The 13th Meeting of APSCO Council was held in Ulaanbaatar, Mongolia during 5-7 November, 2019. The Council Members and representatives from Member States Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand, and Turkey attended the Meeting. It is the highest decision-making forum of APSCO. Mrs. Jebennessa Karim, Additional Secretary, Ministry of Defence led the Bangladesh Delegation. Dr. Md. Abdus Salam Chief Scientific Officer & Focal Point of APSCO from Bangladesh also attended the meeting as a member of the delegation. The Council reviewed the recommendation made by the Administrative Heads Meeting on each agenda item and gave the confirmation/approval as and when it was appropriate.

Figure 48: Delegates of 13th Council Meeting of APSCO on 5-7 November 2019, Ulaanbaatar, Mongolia.

Before the Council Meeting, a technical visit to the Space Park for APSCO delegation was also arranged with the guidance of Mr. Jugderdemidiin Gurragcha, who is the first Mongolian hero to go into space.

6.3 5th Expert Group Meeting on Development Plan of Cooperative Activities of APSCO for Next Decade 2021-2030

The 5th Expert Group Meeting on the Development Plan of Cooperative Activities of APSCO (2021-2030) was held in Beijing, China from 29 June to 3 July, 2020 through teleconference. The Development Plan Committee Members and Experts from all Member States of APSCO participated in the meeting. The main objective of the meeting was to discuss and finalize the draft Development Plan of Cooperative Activities of APSCO (2021-2030). New cooperative activities/projects proposals were presented and evaluated by the Development Plan Committee during the teleconference. Bangladesh submitted five project proposals for inclusion in to the Development plan of APSCO and out of those four projects were accepted to be included in the Development Plan of Cooperative Activities of APSCO (2021-2030). The APSCO Development Plan Committee unanimously agreed to propose the draft Development Plan of Cooperative Activities of APSCO (2021-2030) to the 13th Administrative Heads Meeting for their recommendations to the APSCO Council for approval. Mr. A Z Md. Zahedul Islam, Member Technology-1, SPARRSO Dr. Md. Abdus Salam, Principal Scientific Officer, SPARRSO attended the meeting as Development Plan Committee Members.

Figure 49: Members and Experts from all Member States of 5th Expert Group Meeting on Development Plan of Cooperative Activities of APSCO at online teleconference.

6.4 Site Selection for Optical Telescope and Data Center in Bangladesh

To determine the possible location for setting up an Optical Telescope and Data Center in Bangladesh under the APSSO (Asia-Pacific Space Science Observatories) Project; Mr. Md. Zafar Ullah Khan, Member (Application) and Mr. Mohammed Nur Hossain Sharifee, Chief Scientific Officer visited Botanical Garden and Ecopark at Sitakudo Upazila on 24 July 2019 and Ecopark at Banskhali Upazila of Chattogram on 25 July and also Lalmai hills at Cumilla sadar upazila on 30 July 2019 respectively. During this time, the team of SPARRSO made a fruitful discussion with respective Upazila Nirbahi Officers and Forest department Officers. Before these two visit, there was a visit conducted along with former SPARRSO Chairman Mr. Ziaul Hasan, ndc at South Surma Upazila in Sylhet on 24-25 April 2019.

At the end of spot inspection of those areas, SPARRSO team concluded into a decision for setting up the telescope to Sitakundo EcoPark because of having roadways and electricity facility.

Figure 50: Google Earth Location of Sitakundo EcoPark

CHAPTER 7
INTERNATIONAL EVENTS

7.1 APSCO Training Course on Space Law

APSCO Training Course on Space Law was held during 23-26 September 2019 in Istanbul Technical University, Istanbul, Turkey. The training was jointly organized by APSCO and TUBITAK Space Technologies Research Institute (TUBITAK UZAY), with the contribution of United Nations Office for Outer Space Affairs. Over 40 participants from APSCO Member States participated in this training course. Dr. Md. Abdus Salam, Principal Scientific Officer and Mr. Kazi Shahjahan, Finance Officer, Bangladesh Space Research and Remote Sensing Organization (SPARRSO) attended the training.

Figure 51: APSCO Training Course on Space Law on 23-26 September 2019, Istanbul, Turkey.

This training course aimed at strengthening the space law education at the regional and global level; developing the skills and knowledge of participants, through training program on space law related to space technology application that can contribute to the exploration and peaceful uses of outer space and sustainable development in each country; providing information related to national space legislation and policy for the participants; promoting the exchange, understanding and cooperation in the areas of space law education.

7.2 United Nations/ Turkey/ APSCO Conference on Space Law and Policy

United Nations/ Turkey/ APSCO Conference on Space Law and Policy were jointly organized by the Asia Pacific Space Cooperation Organization (APSCO) and TUBITAK Space Technologies Research Institute (TUBITAK UZAY) with the contribution of (UNOOSA) during 23-26 September 2019 in Istanbul Technical University, Istanbul, Turkey. Around two hundred participants attended this conference including from eight Member States (Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand and Turkey) of APSCO. A four member's delegation including Mr. Shah Abdul Alim Khan, Joint Secretary, Ministry of Defence, Dr. Hafizur Rahman, Member Technology-1, Dr. Md. Abdus Salam, Principal Scientific Officer and Mr. Kazi Shahjahan, Finance Officer, Bangladesh Space Research and Remote Sensing Organization (SPARRSO) attended the conference.

Figure 52: United Nations/ Turkey/ APSCO Conference on Space Law and Policy on 23-26 September 2019, Istanbul, Turkey.

Altogether twenty six papers have been presented the five thematic sessions. Dr. Md. Abdus Salam was the Moderator of the session: Best Practices in Sharing Remote Sensing Data. Three presentations namely (i) Remote Sensing Data Policies and the Sharing of EO Data for Non-Commercial Purposes (ii) Environmental Applications of Remote Sensing and (iii) Best practices in Sharing Remote Sensing Data to Achieve the Sustainable Development Goals were presented in that session. Main objectives of the conference were to address important and contemporary topics such as: promoting responsible, peaceful and safe use of outer space, best practices in sharing remote sensing data, legal regime of outer space and global

governance, long-term sustainability of outer space activities and strengthening capacity-building in space law and policy.

7.3 First Expert Group Meeting on Feasibility Study of DSSP Application Projects

The First Expert Group Meeting on Feasibility Study of Data Sharing Service Platform (DSSP) Application Projects was held during 9-11, December, 2019 in Headquarters of APSCO in Beijing, China. The experts in total 23 delegates from eight Member States namely Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand and Turkey actively, participated in the Meeting. Dr. Md. Mahamudur Rahman, Principal Scientific Officer SPARRSO and Dr. Md. Abdus Salam, Principal Scientific Officer, SPARRSO attended the meeting. It is an ample opportunity for Member States to use the data available in Data Sharing Service Platform for Application Projects to show the best practices.

Figure 53: Meeting Session and Member States Participants of Data Sharing Service Platform (DSSP) Application Projects on 9-11December 2019 in Beijing, China.

During this meeting, 11 proposals were introduced and discussed by all the Member States, involving the first batch of all 6 approved DSSP Application Projects submitted by China, Iran, Pakistan, Peru, Thailand and Turkey and the other 5 newly proposals submitted by Bangladesh and Mongolia. 13th Council Meeting of APSCO has approved to conduct the Feasibility Study of 6 proposals. As for the newly proposals submitted from Bangladesh and Mongolia, shall be submitted to the upcoming Development Plan Meeting in 2020 and complete its due procedures.

7.4 Preliminary Design Review Meeting on APSCO Earthquake Research Project Phase II: Integrating Satellite and Ground Observations for Earthquake Signatures and Precursors organized by APSCO

The Preliminary Design Review (PDR) Meeting of the APSCO Earthquake Research Project Phase II: Integrating Satellite and Ground Observations for Earthquake Signatures and Precursors was organized during 19-21 November, 2019 in Pattaya, Thailand. Project Management Board (PMB) members, delegates from Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand and Turkey, the meeting co-organizer, the National Digital Economy and Society Commission (ONDE), Thailand, and the Project Management Team from APSCO Secretariat attended the meeting. Mrs. Farhana Tazneen and Mohammad Mahdi Hasan Scientific Officer attended the meeting as a participant from SPARRSO. Delegates agreed that the project has completed the PDR milestone and it is ready to transit into its next stage.

Figure 54: Member States Participants of APSCO Earthquake Research Project Phase II on 19-21 November, 2019 in Pattaya, Thailand.

7.5 Review Meeting on the Feasibility Study Report of the First Batch of DSSP Application Projects

Review Meeting on the Feasibility Study Report of the First Batch of Data Sharing Service Platform (DSSP) Application Projects was held in Beijing, China from 22 to 24 June, 2020 through teleconference. Six Review Teams composed of 57 experts, from all Member States of APSCO namely: Bangladesh, China, Iran, Mongolia, Pakistan, Peru, Thailand and Turkey attended the six sessions of the meeting. Dr. Md. Mahamudur Rahman, Principal Scientific Officer SPARRSO and Dr. Md. Abdus Salam, Principal Scientific Officer, SPARRSO

attended the meeting as Review Team Members. Feasibility Study reports of six submitted DSSP Application projects were reviewed and discussed in the meeting and the Review Team agreed to submit the updated Feasibility Study Report to the 13th Administrative Heads Meeting for their recommendations to the APSCO Council for approval.

Figure 55: Online Review Meeting Participants of the First Batch of DSSP Application Projects from 22 to 24 June, 2020.

7.6 Distance Training Course Space Debris: Challenges and Mitigation Techniques

The distance-training course on "Space Debris: Challenges and Mitigation Techniques" were jointly conducted by the APSCO Secretariat and the Pakistan Space and Upper Atmospheric Research Commission (SUPARCO) from 22 to 26 June 2020. Almost sixty participants from Bangladesh, Indonesia, Iran, Mexico, Mongolia, Pakistan, Peru, Thailand and Turkey were attended in this Training. Mrs. Nasrin Sultana, Scientific Officer, Mr. S. A. M. Arif-Ul-Haque, Scientific Officer, Mr. Mohammad Mahadi Hasan, Scientific Officer, Mr. Jagobondu Some, Scientific Officer and Mr. S. M. Noman Chy. Assistant Scientific Officer, SPARRSO, participated the training.

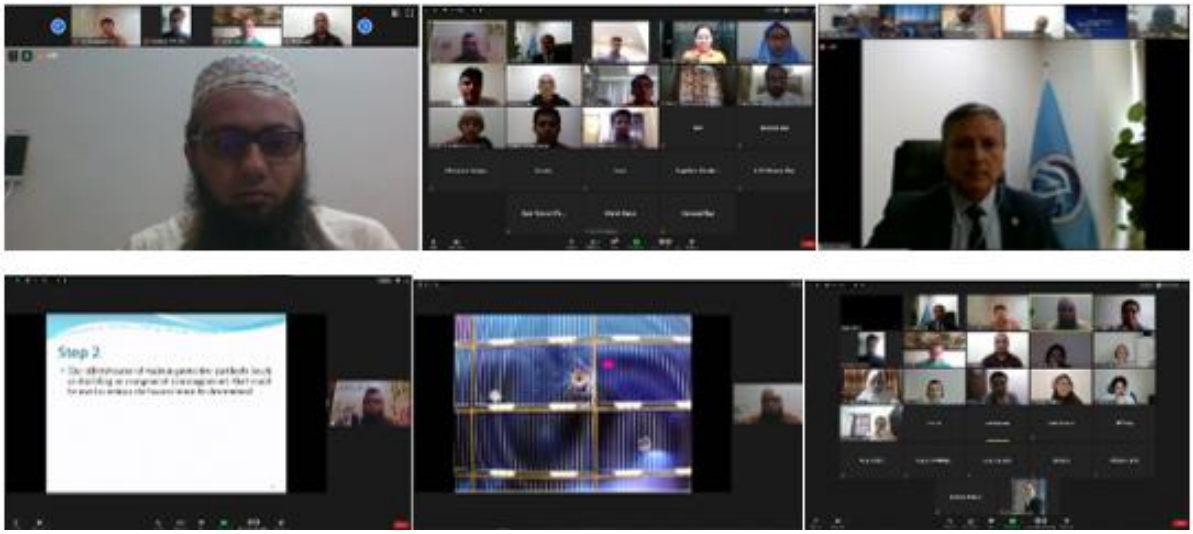


Figure 56: Distance Training Course Space Debris: Challenges and Mitigation Techniques on 22 to 26 June 2020.

The distance training course was furnished with six hour classes included a final quiz. During the training topics like Introduction to Space Debris Environment, History, Challenges, Designing of Space Debris and Space Debris Mitigation Techniques were covered. The training offers the participants opportunity to gain modern knowledge and to interact positively with the lecturer and colleagues from various countries. This concluded with capacity building of APSCO Member States.

7.7 Foreign Participation

The following officers, scientists and engineers participated in foreign training, workshop, seminar, symposium, conference, meeting and study tours during July 2019– June 2020:

S M Ahsan Habib, Scientific Officer participated in a CSSTEAP's short course on Weather Forecasting using Numerical Weather Prediction Models at the Space Application Centre (ISRO), Bopal campus, Ahmedabad, India on 01-12 July 2019.

Md. Mahmudul Haque, Administrative Officer participated in the training entitled on "Space Based Technologies for Disaster Risk Assessment" and also attended "9th UN-SPIDER Conference" at Beijing, China on 05-12 September 2019.

Sumangal Chakma, Senior Engineer participated in the training entitled on "International Training Workshop on Capacity Improvement of Addressing Climate Change through Space Technology" at Beijing, China on 14-29 September 2019.

B.M. Refat Faisal, Senior Scientific Officer attended "GIS, Remote Sensing Information System and Community Participation for Biodiversity Conservation" organized by JICA Sapporo (Hokkaido Center (Sapporo), Japan on 02 October – 07 December, 2019.

Mohammad Mahdi Hasan, Scientific Officer participated in a training on "Information and Communication Technologies for Meteorological Services" organized by Korea International Cooperation Agency (KOICA) at Jakarta, Indonesia on 13-17 October 2019.

Md. Abdul Kader, Senior Scientific Officer attended "The First EGM on 'APSCO Data Policy' in Changchun, China organized by Asia-Pacific Space Cooperation Organization (APSCO), on 14 to 16 October, 2019.

Mr. Jagobandhu Some, Assistant Engineer in a training on "Capacity Building for Maintenance of Meteorological Instruments and Early Warning System" by Korea International Cooperation Agency (KOICA) at Seoul, South Korea on 27 October to 16 November 2019.

Mohammad Mahdi Hasan, Scientific Officer participated in the "Preliminary Design Review (PDR) Meeting on The APSCO Earthquake Research Project Phase II: Integrating Satellite and Ground Observations for Earthquake Signatures and Precursors" at Pattaya, Thailand on 19-21 November 2019.

Mr. Md. Zafar Ullah Khan, Member (Application) and Mr. Md. Nur Hossain Sharifee, Principal Scientific Officer attended "2nd Workshop and Final Review Meeting of Radiometric Calibration of Satellite Sensors Project" organized by APSCO at Antalya, Turkey on 02-05 December 2019.

Mr. Abu Mohammad, Senior Engineer participated the Training on "Capacity Building on the Earth Observation Applications and Research Fundamentals, Emerging Technological Tools and Services for BIMSTEC Countries" Sponsored by Ministry of External Affairs,

Government of India Organized by the North Eastern Space Applications Centre during 06-17 January 2020.

Mohammad Imrul Islam, Scientific Officer participated the Training on "Capacity Building on the Earth Observation Applications and Research Fundamentals, Emerging Technological Tools and Services for BIMSTEC Countries" Sponsored by Ministry of External Affairs, Government of India Organized by the North Eastern Space Applications Centre during 06-17 January 2020.

Tofayel Ahammad, Assistant Scientific Officer attended "Capacity Building on the Earth Observation Applications and Research: Fundamentals, Emerging Technological Tools and Services for BIMSTEC Countries" Sponsored by Ministry of External Affairs, Government of India Organized by the North Eastern Space Applications Centre during 06-17 January 2020.

Nasrin Sultana, Scientific Officer attended "Space Debris: Challenges and Mitigation Techniques" organized by APSCO and the Pakistan Space and Upper Atmosphere Research Commission (SUPARCO) through virtually (Zoom) on 22-26 June 2020.

Mohammad Mahdi Hasan, Scientific Officer attended "Space Debris: Challenges and Mitigation Techniques" organized by APSCO and the Pakistan Space and Upper Atmosphere Research Commission (SUPARCO) through virtually (Zoom) on 22-26 June 2020.

Dr. Md. Mahamudur Rahman, Principal Scientific Officer attended "The First Expert Group Meeting on Feasibility Study Report of the „Ionospheric Modeling through Study of Radio Wave Propagation and Solar Activity" Project Phase II organized by APSCO on 14-15 April 2020 through teleconference.

Mr. Md. Zafar Ullah Khan, Member (Application) and Mr. Md. Nur Hossain Sharifee, Principal Scientific Officer attended "Framework of the First Expert Group Meeting on Ground Station Networking of SMMS Constellation Program" organized by APSCO virtually (Tencent) on 11-13 May 2020.

Mr. A Z Md. Zahedul Islam, Member (Technology 2) attended the 1st Expert Group Meeting on the Feasibility Study Report of "Establishment of a Framework for Researches on

Application of Space Technology for Disaster Monitoring in the APSCO Member States Project Phase II", organized by APSCO on 1-2 June 2020.

Mr. S.A.M. Arif-Ul-Haque, Scientific Officer participated on "Cubesat Communications: Resolving Spectrum and Licencing Issues" based webinar, organized by Australian Centre for Space Engineering Research, UNSW on 04 June 2020.

CHAPTER 8

IN-HOUSE AND LOCAL EVENTS

8.1 In-house Training

SPARRSO organized a virtual training on Procurement for 27 officers and staff on 15 June 2020, which was conducted by Mr. Md. Zafar Ullah Khan, Member (Application) (Joint Secretary) of SPARRSO.

8.2 Local Participation

8.2.1 International Conference on Earth & Environmental Science and Technology for Sustainable Development (ICEEST), 2020

The International Conference on Earth and Environmental Sciences & Technology for Sustainable Development (ICEEST) 2020 organized by Faculty of Earth and Environmental Sciences, University of Dhaka held during 25-27 January 2020, at Hotel Intercontinental Dhaka, Bangladesh. Bangladesh Space Research and Remote Sensing Organization (SPARRSO) was one of the co-sponsors of the conference. Mr. Md. Imtiaz Hossain, Secretary, Dr. Md. Mahmudur Rahman, Principal Scientific Officer, Dr. Md. Abdus Salam Principal Scientific Officer, Mr. Mohammed Nur Hossain Sharifee Principal Scientific Officer and Mrs. Farhana Tazneen, Scientific Officer of SPARRSO attended the conference. A research paper on Tree crown detection of planted mangroves using WorldView-3 satellite imagery was presented by Forestry division of SPARRSO. Geology Division of SPARRSO presented a scientific poster on “Assessment of Irrigation Potentiality over an Area through the Combined Application of Remote Sensing (RS) and Geographic Information System (GIS)” in the conference.

Figure 57: SPARRSO Officials at International Conference on Earth & Environmental Science and Technology for Sustainable Development (ICEEST) from 25-27 January 2020, at Hotel Intercontinental Dhaka, Bangladesh.

Besides, the following officers also participated in different local training, workshop, seminar, symposium, conference, meetings that are enlisted below:

Tofayel Ahammad, Assistant Scientific Officer attended "(Krisi Media bhittik Prantik Kormosala)" organized by Department of Agricultural Extension (DAE) on 11 September, 2019.

Md. Abdul Kader, Senior Scientific Officer attended 'Disaster Response Exercise and Exchange (DREE) Bangladesh -2019) at Kurmitola, Dhaka on 27 to 31 October, 2019

Tofayel Ahammad, Assistant Scientific Officer attended "Workshop on Integrated Food Security Phase Classification (IPC) 3rd and 4th Chronic Analysis" organized by Food and Agriculture Organization (FAO) on 3-8 November and 8-12 December, 2019.

B.M. Refat Faisal, Senior Scientific Officer attended "Advancing Agro ecological Zones (AEZ) monitoring and information systems to improve adaptation to climate change and food security in Bangladesh" organized by Soil Resource Development Institute (SRDI) on 10 February, 2020.

B.M. Refat Faisal, Senior Scientific Officer attended "Midterm workshop on Projection of sea level rise and assessment of its sectoral (Agriculture, water and infrastructure) impacts" organized by Department of Environment (DoE) on 05 March, 2020

CHAPTER 9

PUBLICATIONS

The scientists and engineers of SPARRSO made some publications both in national and international journals on remote sensing and GIS technology based research work of SPARRSO. They also presented papers on specific topics in the national and international seminars and symposia. Some of them are mentioned below:

A Z Md. Zahedul Islam, Md. Abdul Kader and SM Ahsan Habib. Study of recent geo-morphological condition of a selected part of the coastal area of Bangladesh based on remote sensing techniques. *Dew-Drop*, 2019; 6(1), 87-95.

Faisal BMR, Rahman H, Sharifee NH, Sultana N, Islam MI, Ahammad T. Remotely Sensed Boro Rice Production Forecasting Using MODIS-NDVI: A Bangladesh Perspective. *AgriEngineering*, 2019; 1:356-375.

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CHAPTER 10

OBSERVATION OF NATIONAL EVENTS

SPARRSO organized and celebrated different national day, national and official agenda, internal training during the financial year of 2019-2020. Some of these activities are shown in below with pictorial and short briefing format.

Figure 58: Celebration of National Mourning Day (15 August 2019)

Figure 59: Farewell of Retiring Officers and Staffs (15 October 2019).

Figure 60: In house Training Course on Office Management (from 24 November to 28 November 2019) for all officers and Staffs.

Figure 61: Rally for Celebrating of Digital Bangladesh Day (12 December 2019).

Figure 62: Celebration of National Victory Day (16 December 2019).

SPARRSO Paid Tribute on International Mother Language Day

In the remembrance of Bengali Language Movement Martyrs, SPARRSO officials paid tribute to the Shahid Minar on the eve of 21 February 2020. A group of officials led by Mr. Mizanur Rahman, Chairman went to the Shahid Minar at the midnight to show the respect of all language movement martyrs.

Figure 63: SPARRSO Chairman, Mr. Mizanur Rahman and other senior officials at the Shahid Minar premises.

Figure 64: Paying tribute to the language martyrs by SPARRSO Chairman, Mr. Mizanur Rahman and other senior officials.

ABBREVIATION AND ACRONYMS

APSCO	Asia Pacific Space Cooperation Organization
APSSO	Asia-Pacific Space Science Observatories
BAF	Bangladesh Air Force
BBS	Bangladesh Bureau of Statistics
BDT	Bangladesh Taka
BEPZA	Bangladesh Export Processing Zone Authority
DDM	Department of Disaster Management
CSTI	Commandant and Staff Training Institute
DSCSC	Defence Services Command and Staff College
DOCSTA	Doctor of Space Technology Applications
DSSP	Data Sharing Service Platform
ETSI	Environmental Thermal State Indicator
FCTU	Flight Controller Training Unit
GIS	Geographic Information System
ISBN	International Standard Book Number
ISRO	Indian Space Research Organization
JICA	Japan International Cooperating Agency
KOICA	Korea International Cooperation Agency
KPI	Key Point Installation
MASTA	Master of Space Technology Applications
MIST	Military Institute of Science and Technology
MVC	Maximum Value Composite
MODIS	Moderate Resolution Imaging Spectroradiometer
NESAC	North Eastern Space Applications Centre
NFMS	National Flood Monitoring System
NDVI	Normalized difference vegetation index
OLI	Operation Land Imager
PMO	Prime Minister's Office
PMB	Project Management Board
PDR	Preliminary Design Review
PRL	Post Retirement Leave
RCC	Roller compacted concrete
RS	Remote Sensing
SATS	School of Air Traffic Service
SPARRSO	Bangladesh Space Research and Remote Sensing Organization
STC	Signal Training Center
TM	Thematic Mapper
TSS	Total Suspended Solid
TUBITAK UZAY	TUBITAK Space Technologies Research Institute
UNOOSA	Unite Nations Office for Outer Space Affairs
UN-SPIDER	United Nations Platform for Space-based information for disaster
SUPARCO	Pakistan Space and Upper Atmospheric Research Commission
WLMS	Water Logging Monitoring System

****The End*****