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FINAL REPORT

IMPROVED WEATHER AND FLOOD INFORMATION SYSTEM FOR COMMUNITY BASED RISK AND RESOURCE MANAGEMENT



UNDER
STRENGTHENING HOUSEHOLD ABILITY TO RESPOND TO DEVELOPMENT OPPORTUNITIES
(SHOUHARDO) III PROGRAM OF CARE BANGLADESH

PROJECT DURATION: JULY'2019 TO SEPTEMBER'2021

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1. Introduction

1.1. Background

Regional Integrated Multi-Hazard Early Warning System (RIMES) supports its member countries to develop their capabilities in generating forecast and risk informed early warning and tailor-made applications at different time scales (1-15 days, monthly, seasonal etc.). In Bangladesh RIMES provided technical support to the Flood Forecasting Warning Center (FFWC) of Bangladesh Water Development Board (BWDB) to develop and operationalize the 1-10 days probabilistic flood forecasting system. As part of RIMES commitment, the technical support to BWDB was continued beyond the project period to ensure that the system is operational during monsoon season. In addition to 10 days flood forecasting system, a Flash Flood Guidance System was also developed by RIMES for Sylhet and Cox's Bazar region. Bangladesh Meteorological Department (BMD) also gets regular technical support from RIMES for enhancing their numerical weather prediction system, conducting user forums and agro-meteorological advisory services. Through different innovative decision support systems, community-oriented capacity building programs to transform and tailor the forecast products to more sector oriented actionable format; RIMES has been working relentlessly to connect the science, institutions and society to reach the last mile of the end-users.

Strengthening Household Ability to Respond to Development Opportunities (SHOUHARDO) III program of CARE Bangladesh works with poor rural beneficiaries from 8 districts of the char and haor regions of Bangladesh. These beneficiaries are highly dependent on agriculture and livestock for their livelihood. By repeatedly being exposed to natural hazards, these communities do not have the capacity to buffer against the impacts of climate risk through their own assets which makes them the most vulnerable to disasters. The SHOUHARDO III sites and the nature of beneficiaries makes it an ideal program for piloting the application of weather and flood forecast information. To overcome the underlying risks of climate variability and furnish better agricultural/livestock production and disaster risk reduction, RIMES has implemented the project "Improved Weather and Flood Information System for Community Based Risk and Resource Management" under SHOUHARDO III program of CARE Bangladesh, supported by USAID and with complementary support from the Government of Bangladesh. Aiming towards the transition of 'what the weather will be' to 'what the weather will do'; the project has made an effort to enable risk and resource management in poor and extreme poor communities by providing community focused and multi-sectoral action oriented forecast information that will enhance their resilience and eventually reduce livelihood risk. The project period was from July, 2019 to September, 2020.

For the past few decades, Bangladesh has shown significant progress in forecasting of flood, weather and other weather induced hazards. However, these forecasts rarely reach the at-risk communities with enough lead time to take any early action. Even if this information reaches the end-users, sometimes are difficult to interpret at the community level due to lack of capacity. So, it is crucial to improve lead time of the forecasts as well as interpret these forecasts into understandable and actionable advisories.

The project made an effort to deliver timely and location specific forecast and advisories in a comprehensive and executable format to the remote communities at risk. Besides forecast enhancement, capacity building programs of the farmers, women and children's groups, extension workers, local government representatives have been simultaneously conducted to develop and sustain the practice of interpreting and applying forecast information.

1.2. Objectives

The overall goal of the project was to enhance community resilience by reducing risks from extreme natural events and maximize benefits from favorable weather condition using forecasts of different timescales through adaptive techniques for better decision making in community-based risk and resource management through the following objectives:

- ✚ Improve Medium-Longer Range (10-15 days) Flood Forecasting Technology of FFWC
- ✚ Customize location specific weather forecast at BMD up to Upazila level
- ✚ Pilot forecast based warning/advisory services through DDM, DAE, DLS in selected SHOUHARDO III program Upazilas
- ✚ Enhance capacity of National and local level stakeholders in forecast application, risk and resource management

1.3. Study area

SHOUHARDO III Program works in 115 unions in 23 upazilas of 8 char and haor districts. For piloting the interventions under this project, project sites were selected jointly by CARE Bangladesh and RIMES based on the following criteria:

- ✚ Risk of flooding
- ✚ Risk of Extreme Weather Condition
- ✚ % Vulnerable population
- ✚ Crop Diversity
- ✚ Livestock rearing density
- ✚ Availability of FFWC's existing river monitoring stations

The project site included 15 Unions of 13 Upazilas under the 8 SHOUHARDO III Districts - Kurigram, Gaibandha, Jamalpur, Sirajganj, Netrokona, Kishoreganj, Habiganj and Sunamganj.

The following unions were selected considering the criteria:

Table 1 Selected unions for the piloting project interventions

Region	District	Upazila	Union
Char	Kurigram	Nageshwari	Bamandanga
			Narayanpur
		Char Rajibpur	Mohanganj
	Gaibandha	Fulchhari	Erendabari
			Fazlupur
		Saghatta	Haldia
	Jamalpur	Islampur	Belgacha
	Sirajganj	Chowhali	Omarpur
			Belkuchi
		Shahjadpur	Sonatoni
Austogram			Kalma
Haor	Kishoreganj	Nikli	Singpur
		Baniachong	Manduri
	Netrokona	Madan	Maghan
	Sunamganj	Tahirpur	Dakkhin Sreepur

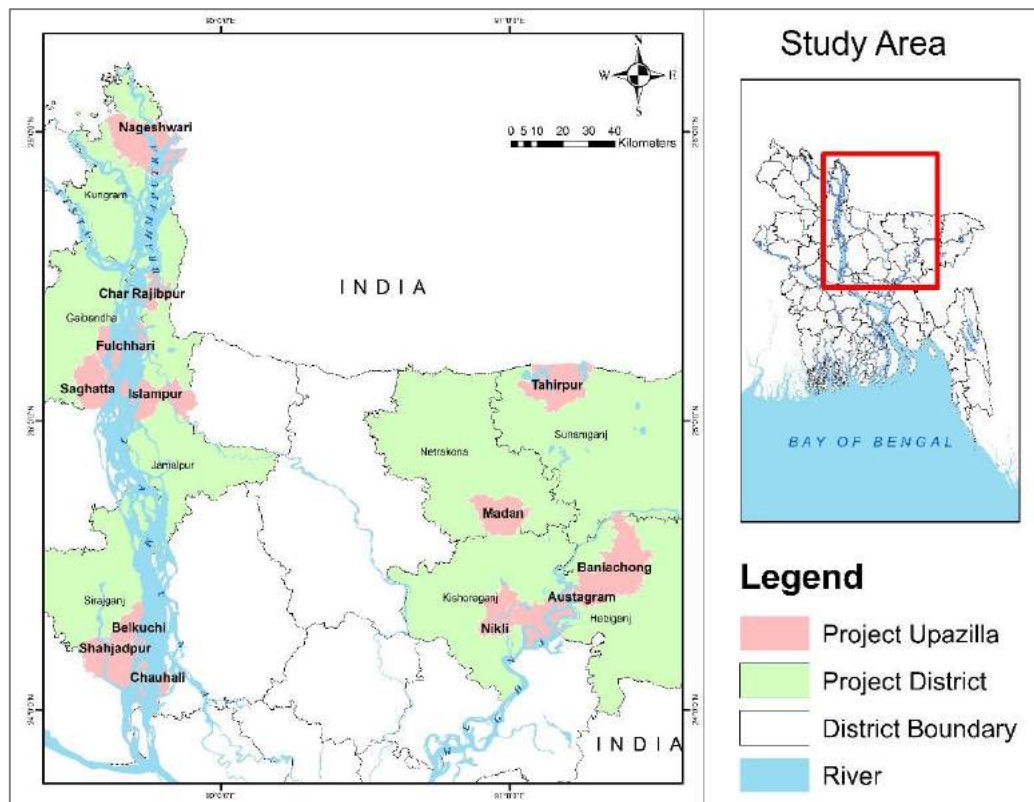


Figure 1 Study Area

Under the selected unions, 10176 Beneficiaries were selected as the direct beneficiaries of the project. Among which 65% beneficiaries were female and 35% were male. Each beneficiary represents a single household and belonged to the SHOUHARDO livelihood group of agriculture and livestock.

1.4. Implementation Arrangement

RIMES implemented the project as the technical partner of CARE Bangladesh in collaboration with their field level implementation partners along with the Government partner institutions. Overall coordination and management of the program was the responsibility of RIMES. At the national level, RIMES has collaborated with Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), Department of Disaster Management (DDM), Department of Agricultural Extension (DAE) and Department of Livestock Services (DLS) for system development, generation and dissemination of forecast and early warning and associated advisories. RIMES provided capacity building training to these organizations at different administrative levels and other stakeholders on the operations and maintenance of the newly developed technologies under the project, warning generation, interpretation, translation of forecasts information and application.

As implementing partners of CARE Bangladesh – NDP in Sirajganj, ESDO in Jamalpur, SKS in Gaibandha, MJSKS in Kurigram, POPI in Netrokona and Kishoreganj and DAM in Habiganj and Sunamganj, supported RIMES in implementation of the local level activities.

1.5. Challenges

The biggest challenge faced during the implementation of the project was the Covid-19 pandemic. Due to COVID-19 pandemic the implementation of the project was slowed down from March to August 2020 (around six months). During this period any activity involving field trips or physical meetings were halted. This mainly impacted the capacity building and technology transfer components of the project. While field-based activities were stagnant, RIMES expedited the system development activities related to flood and weather forecasting and advisory dissemination. On the other hand, virtual engagement with the national level stakeholders continued on a limited scale during this period. Reviewing the progress of implementation (both physical and budgetary) till August 2020, RIMES proposed a cost extension plan of the project during October 1, 2020 – March 31, 2021. This included few additional and modified activities based on the learning accumulated, recommendations from the key stakeholders and considering COVID-19 situation.

The proposed activities during October, 2020 – March, 2021 included continuation of some existing activities and some new activities. It included support in dissemination of advisories incorporating some advanced features in voice broadcasting, enhancing water level data collection in selected stations and development of the Decision Support System (DSS) for livestock sector by integrating weather-based advisories. The national level training or capacity building activities were aimed at transferring the technologies to

relevant departments. On the other hand, capacity building activities at the local level were conducted with an attempt to enhance interpretation and application. The capacity building of UzDMC, UDMC and UDV in forecast-based risk and resource management were excluded in an attempt to reduce field activities.

However, due to continuation of the pandemic and rise of death toll, repeated lockdown were imposed. As a result, the activities could not be conducted as per plan. A no-cost extension was proposed for April, 2021 - September, 2021 where the planned activities were revised to adjust the activities within September, 2021. Alternate residential trainings for 5-6 personnel for BMD and BWDB-FFWC were proposed instead of secondment of BMD and BWDB-FFWC Official in RIMES Headquarter, Bangkok, Thailand.

RIMES adapted to the new normal and followed COVID-19 considerations for all activities:

COVID-19 Considerations

Considering the COVID-19 pandemic and possible limitations, following strategies were adopted –

- ✚ Events involving government stakeholders were organized in compliance with their rules and regulations for physical distancing and public gathering.
- ✚ For training of the beneficiaries, semi-virtual sessions were attempted. For ‘farmers and women groups training’ RIMES staff travelled to the field and organized semi-virtual interactive sessions with smaller groups, each consisting of maximum of 7 - 10 participants. The experts from FFWC/BMD, DAE, DLS or Bangladesh Rice Research Institute joined physically as well as virtually to conduct technical and question answer sessions. Sub-Assistant Agricultural Officers (SAAOs) from DAE and local service providers were utilized on spot along with RIMES staff for practical demonstration sessions.
- ✚ Participants were allowed in any event after instant body temperature check and were provided with basic personal protective gears (masks, hand rubs) during the training. Each event included a 10 minutes awareness briefing about COVID-19.
- ✚ Advocacy meetings with the stakeholder departments were prioritized on virtual platforms.
- ✚ Instead of training with schoolchildren IEC materials and digital contents were distributed to the schools for awareness raising.

2. Accomplishments

The major accomplishment of the project included development of the 15-day streamflow forecasting system, upazila specific weather forecast and dissemination of forecast and advisories through voice messaging system. The detailed accomplishments of the project are given below against the project framework:

Table 2 Project Accomplishments

Objective 1: Improve Medium-Longer Range (10-15 days) Flood Forecasting Technology of FFWC	
Expected outputs	Accomplishments
An operational 15 days streamflow forecasting model for GBM basins	The 15 days streamflow forecasting model has been integrated into the operational flood forecasting system of FFWC
Seamless operation of 10 days probabilistic water level forecasting system	10 days probabilistic water level forecasting system has been integrated into the operational flood forecasting system of FFWC
Forecast Performance analyzed and published in FFWC's annual report	Forecast performance has been analyzed and published in FFWC's annual report of 2019 and 2020
At least 10 BWDB professionals trained on the system	2 trainings have been conducted where in total 12 BWDB professionals have been trained on the system
Objective 2: Customize location specific weather forecast at BMD up to Upazila level	
Expected outputs	Accomplishments
Operational upazila specific weather forecast for 23 upazilas available at BMD website	Upazila specific weather forecast for 211 upazilas integrated into BMD website
At least 16 BMD professionals trained on the new system	2 trainings have been conducted where in total 16 BMD professionals have been trained on the system

Objective 3: Pilot forecast based warning/advisory services through DDM, DAE and DLS

Expected outputs	Accomplishments
Web-based Database of disaster management committee; DMC database populated with data from 23 upazilas under SHOUHARDO III program	A web-based DMC database developed; DMC database populated with data from 23 upazilas under SHOUHARDO III program
Voice Message dissemination platform; Voice message Broadcasting to 10,000 beneficiaries receive early warning/advisories through voice message	Voice message broadcasting tool developed; more than 50,000 recipients received early warning/advisories through voice message
At least 10 trainings conducted for DDM, DAE, DLS professionals	6 trainings conducted for DDM, DAE, DLS professionals (Due to Covid-19 pandemic, the 4 planned trainings for upazila and union level DDM professionals were omitted)
DSS for forecast based livestock management	National Livestock Advisory Services (NLAS) developed
At least 2 consultation workshops arranged for DSS development	2 National level consultation workshops were arranged for DSS development
At least 2 evaluations conducted of community response to advisories	2 evaluations conducted of community response to advisories

Objective 4: Enhance capacity of National and local level stakeholders in forecast Application, Risk and Resource Management

Expected outputs	Accomplishments
Training guide on Forecast Application and Risk Management	Training guide on Forecast Application and Risk Management developed
Farmers, women groups from the pilot communities trained in forecast application and risk management; At least 300 members of farmers and women groups trained in forecast application and risk management	179 Farmers, women groups from all 13 upazilas trained on forecast application and risk management (Field activities were conducted in limited scale due to Covid-19 pandemic)
Local service providers, private sector agents and small entrepreneurs trained in forecast dissemination and application; At least 100 persons from LSPs, private sector agents and small entrepreneurs trained	42 LSPs, private sector agents and small entrepreneurs trained on forecast application and risk management (Field activities were conducted in limited scale due to Covid-19 pandemic)

School children made aware of the early warning system; At least 6 batch of school children participated in the awareness raising program

2 batch of school children participated in the awareness raising workshop; 2000 copies of each of the 3 IEC materials prepared for raising awareness among school children; IEC materials distributed among 4 schools

2.1. Technology Development

15 days Streamflow Forecasting System

RIMES has successfully operationalized the 15 days streamflow forecasting system at the Flood Forecasting and Warning Center of the Bangladesh Water Development Board. The model developed for the Brahmaputra-Ganges-Meghna River basins were calibrated, validated and automated to generate 15 days probabilistic forecast for these three river basins. The system was integrated into FFWC’s operational forecasting in June 2020 and it has been used by FFWC to provide two-week extended outlook for the floods. It is available on FFWC’s website: <https://flood-ffwc.rimes.int/>.

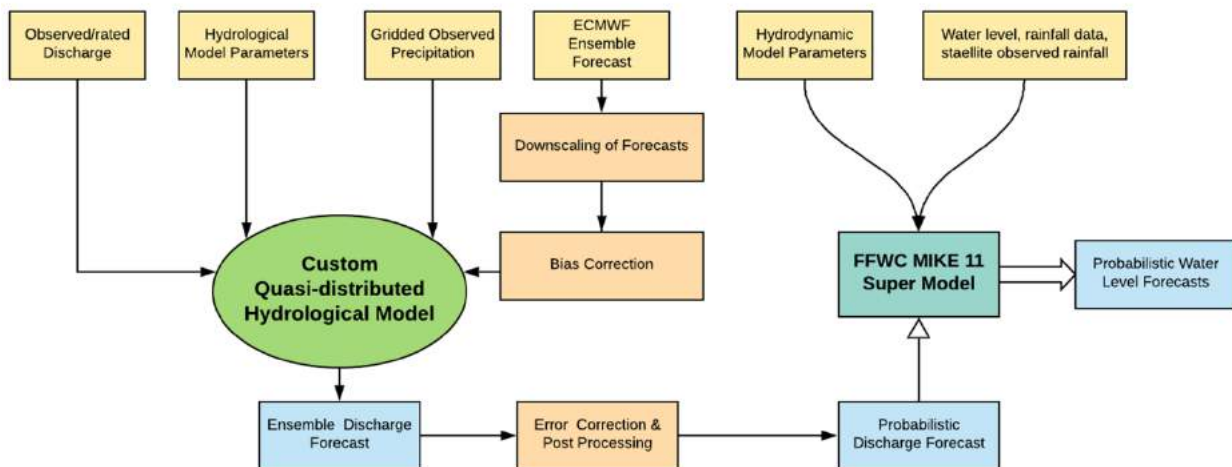


Figure 2 Overall schematic diagram of the 15 days Streamflow Forecasting System

The monsoon flood during 2020 was captured by the system fourteen days ahead with more than 80% probability.

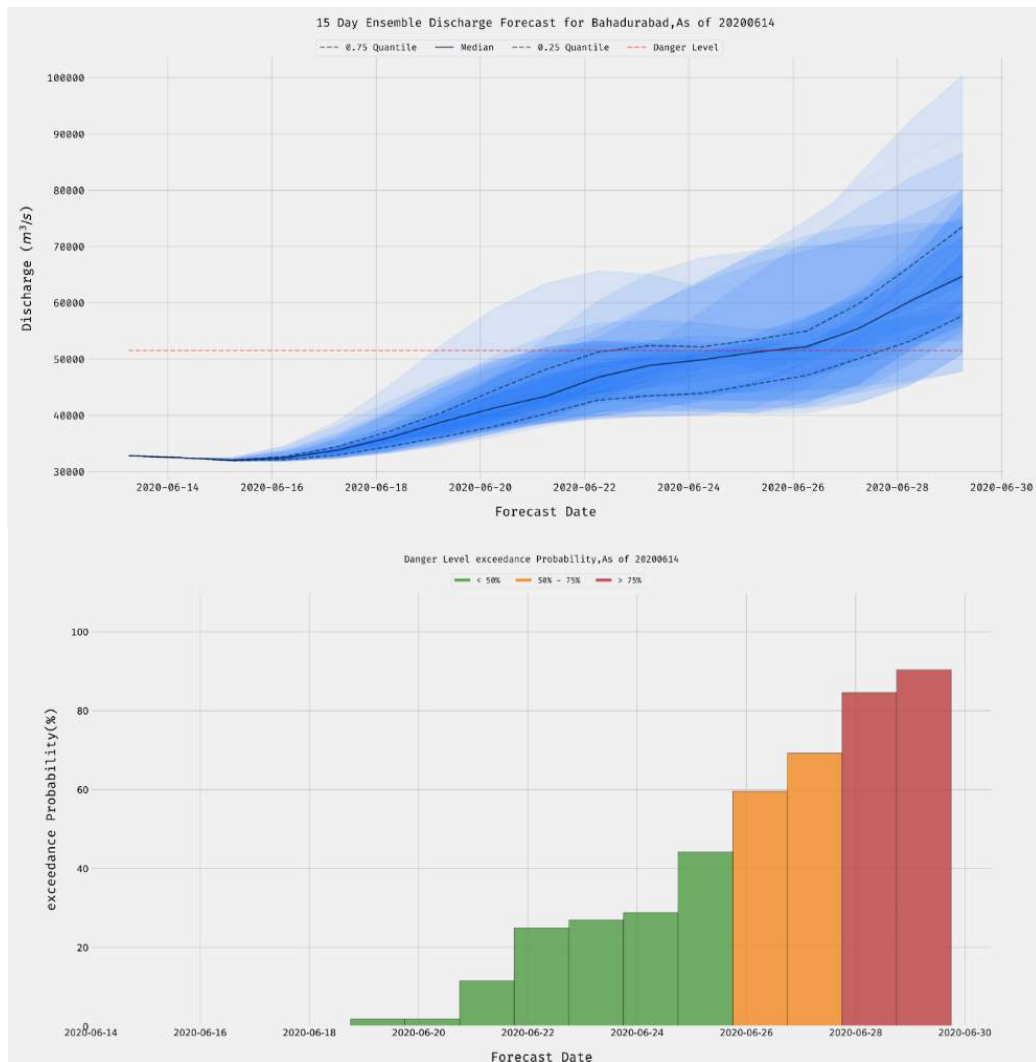


Figure 3 Fifteen days forecast for Brahmaputra basin captured the June flood 14 days ahead with more than 80% probability

The output from this system is also utilized in 10 days probabilistic water level forecasting. The special flood outlooks issued by FFWC used 15 days probabilistic streamflow forecast and 10 days probabilistic water level forecast to disseminate early warning to the stakeholders. The forecasts were also used during the flood-preparedness planning meeting of the Inter-Ministerial Disaster Management Coordination Committee (IMDMCC) on July 9, 2020 chaired by the State Minister of the Ministry of Disaster Management and Relief. The information was also disseminated to the beneficiaries of SHOUHARDO III program, Supporting Flood Forecast Based Early Action and Learning (SUFAL) project and the concerned lead farmers of Department of Agricultural Extension (DAE).

Resolve issues with 10 days WL forecast System at FFWC

A 10 days flood forecasting system was developed during earlier SHOUHARDO phases. The system continued its operation at FFWC beyond the project period from 2014 to 2016 with technical support from RIMES. However, FFWC faced technical difficulties with part of the system and could not run the model during 2017 monsoon. RIMES investigated the technical

issues and concluded that it would be more feasible to develop an alternate system rather than trying some cumbersome temporary fix.

Considering the demand from FFWC, in 2017, RIMES started a research activity for an alternate system which resulted in the development of the 15 days Streamflow Forecasting System. From the 15 days streamflow forecast, the first 10 days forecast is used in the 10 days water level forecast model to provide uninterrupted forecast at 38 locations at 21 different rivers.

Under this project, problems with hydrograph generation and data assimilation in the 10 days water level forecast system was resolved. The medium range 10 days forecast model is now able to assimilate the changes in data assimilation made by FFWC in previous monsoon seasons. The resolved hydrographs are available in medium range 10 days forecast bulletin. FFWC disseminates the medium range (1-10) days water level forecast bulletin on a regular basis through their email broadcasting system. The medium range forecast products are available at FFWC's website (www.ffwc.gov.bd) under Forecast and Warning Tab. The interactive hydrographs can be found at the FFWC website: <http://ffwc.gov.bd/index.php/hydrograph/medium-range-1-10-days-forecast>.

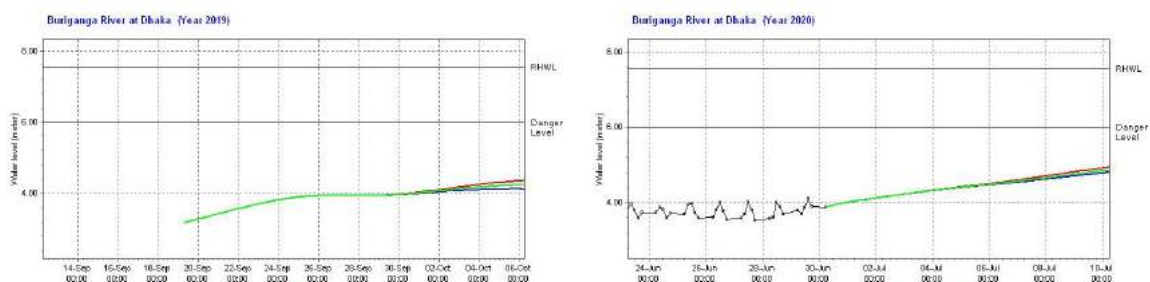


Figure 4 Erroneous hydrograph at Dhaka station during 2019 monsoon (L) and hydrograph at Dhaka station on June 30, 2020 after resolving problems (R)

During the monsoon season, the flooding in Brahmaputra-Jamuna basin was monitored efficiently using the medium range (1-10 days) forecasts. Daily flood situation updates for the SHOUHARDO III program areas were prepared and regular flood forecasts were disseminated in the program areas during the monsoon season.

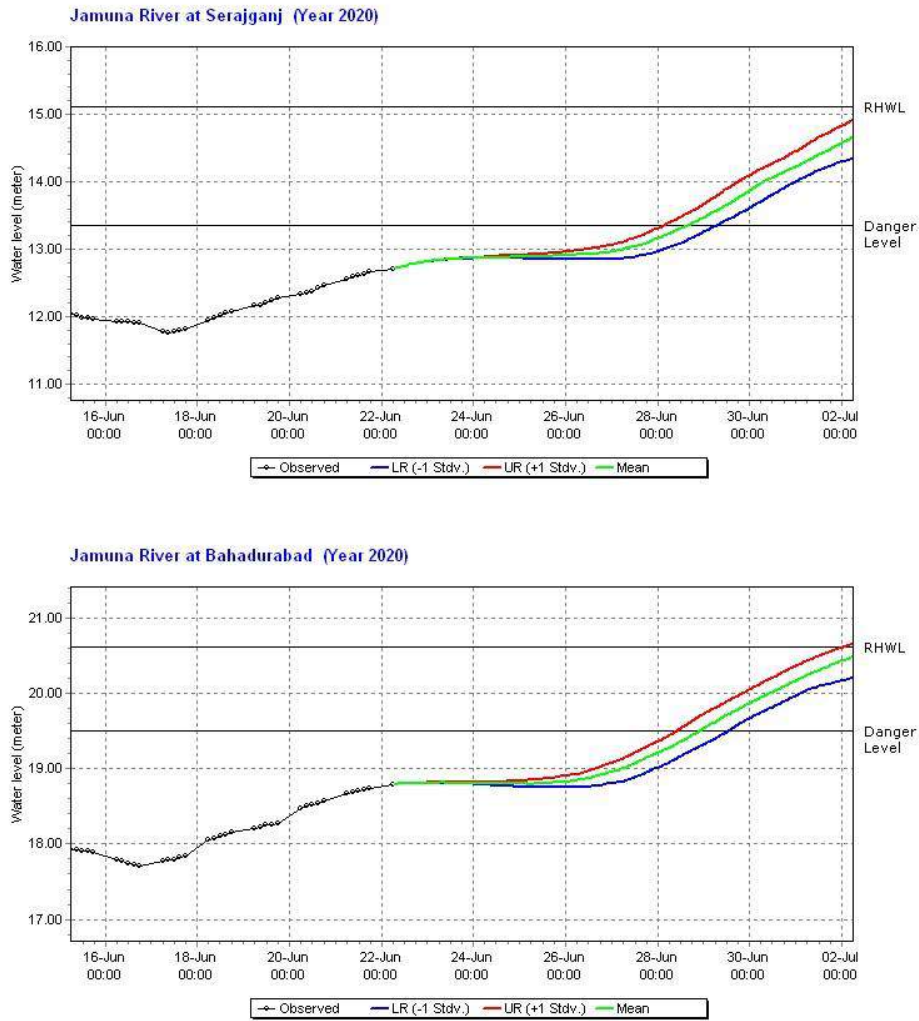


Figure 5 Medium Range (1-10) days water level forecast capturing the June flood in Sirajganj and Jamalpur

Location Specific Forecast

The project customized the available weather forecast products at BMD for the Upazila level. Location specific weather forecasts for upazila level has been customized and linked with web platform. The forecast data has been represented in a visually intuitive format through iconography. All the meteorological data are also translated in Bangla for easy understanding of the users. The system has been operationalized at BMD and is now updating on a daily basis. The location specific forecasts can be accessed from BMD Website and also available in the link: <http://bmd.bdservers.site>.

The site provides 7 days weather forecast summary and 3 days detailed weather forecast (3 hourly) for selected upazilas. RIMES proposed to customize the upazila level forecast for 23 upazilas under SHOUHARDO III program. However, the newly developed system has incorporated forecast data for 211 upazilas under the 17 districts including the SHOUHARDO III Working upazila, Dhaka and Chittagong city.



Figure 6 The Upazila Specific Forecast is available at the BMD Website

The Upazila Specific Forecast portal was inaugurated by Dr. Md. Abu Hena Mostafa Kamal, ndc, Secretary of Ministry of Defence in an inauguration ceremony which was the closing session of a 3-day semi-virtual training for the BMD professionals on customizing location specific forecast products, associated data analysis, processing and visualization.



Figure 7 (From left) Dr. Md. Mahamud-Ul-Hoque, Additional Secretary, MoD; Dr. Md. Abu Hena Mostafa Kamal, ndc, Secretary, MoD; Mr. Shamsuddin Ahmed, Director, BMD during the inauguration of the Upazila Weather Portal

Dr. Md. Abu Hena Mostafa Kamal, ndc, attended the ceremony as the chief guest and Dr. Md. Mahamud-Ul-Hoque, Additional Secretary was present as Special Guest. Dr. A. R. Subbiah, Director, RIMES, Walter Mwasaa, Chief of Party of SHOUHARDO III, Shahnaz Zakaria, Senior Food Security Advisor, USAID, Tofayel Alam, Project Management Specialist, USAID, representatives from DDM, FFWC, DAE, DLS, BARI, BRRI, BLRI, DRROs from the eight SHOUHARDO districts, SHOUHARDO program staff and RIMES Headquarters and Bangladesh staff also attended the inauguration ceremony.

Forecast based Livestock Decision Support System

As part of the project interventions, RIMES piloted Forecast based Livestock Decision Support System in Bangladesh. Despite the demand from farmers, there has not been a climate-risk informed advisory service for the livestock sector. It is essential for climate smart livestock extension service. The need for such a system came as a recommendation from the National Monsoon Forum in June 2018. Furthermore, from the baseline survey conducted in September, 2019 revealed the lack of such services and a general interest in livestock advisories.

Following a consultation workshop in September 2019, based on the discussions and recommendations, RIMES in collaboration with DLS formed a national level Technical Working Group (TWG) in November 2019 consisting of researchers, academics, and practitioners from DLS, Bangladesh Livestock Research Institute (BLRI), Bangladesh Agricultural University (BAU) and SAARC Agriculture Centre (SAC). The TWG coordinated the translation of the forecast information into actions and advisory generation. Through intensive literature review, data availability analysis, and in-depth discussion of the TWG, an initial framework was drafted in October 2020 for the livestock DSS - “National Livestock Advisory Services (NLAS)”.

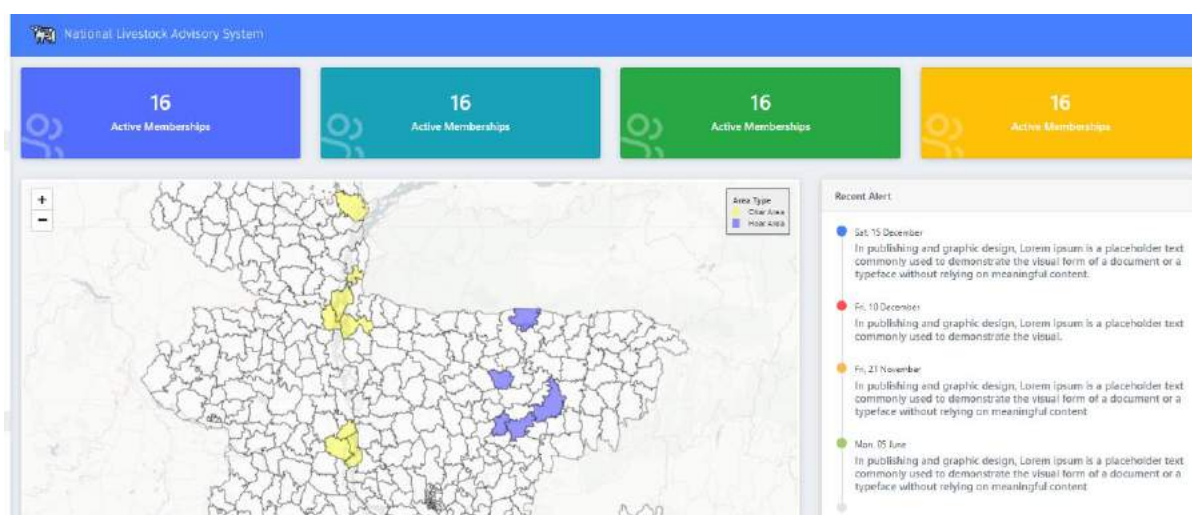


Figure 8 Dashboard of the DSS for Livestock Sector

RIMES also conducted literature reviews and analyzed archive advisories from the Indian Meteorological Department and the Bangladesh Agro Meteorological Information System (BAMIS) portal and similar other systems. RIMES also explored the weather, climate and livestock data need in close coordination with the TWG.

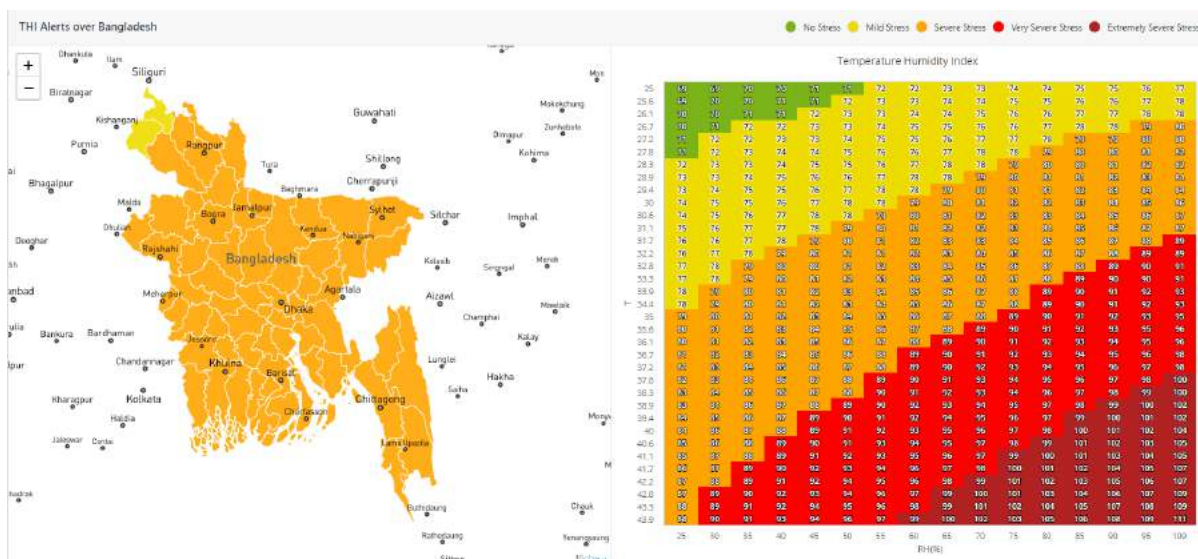


Figure 9 Temperature Humidity Index (THI) Alert for livestock in the NLAS

Several meetings of the TWG were held from December, 2020 to September, 2021. The TWG also visited Shaghata upazila of Gaibandha where they interacted with several progressive farmers and learnt about their needs/problems. The TWG members visited the house of the farmers and saw the different livestock and fodder management practices of these farmers. The farmers explained challenges from extreme weather events and floods in presence of livestock experts and discussed about different other issues regarding their livestock and poultry.



Figure 10 TWG members having a discussion with beneficiaries from Gaibandha

The TWG members visited the Upazila Livestock Office in Shaghata upazila and discussed about the different facilities and services offered by DLS for the general population. The recommendations made from the visit were utilized in development of the advisories for the DSS.



Figure 11 Dr. Md. Zulfekar Ali prescribing medicines for a cow of a beneficiary during the field visit

The progress of the DSS was shared with professionals from DLS in a consultation workshop on 18th March, 2021 where discussions were carried on identifying ways of improvement, ways of integrating the DSS into the operations of DLS and for gathering feedback on the overall system. The recommendations from the consultation workshop were used in further development of the system.

Upon several consultations and field visit, the TWG analyzed the need and demand of the farmers as well as the National stakeholders. They agreed on preparing advisories for the country as a whole rather than dividing the country in certain regions or zones. Initially, a common advisory for the whole country will be generated. Advisory can be generated for a specific district or area on need basis. The frequency of advisory dissemination was also finalized. Initially, monthly advisories will be generated. Based on the requirements or weather conditions or any outbreak of diseases, advisories can be disseminated accordingly. Advisory bulletin on heat wave and flood conditions- flood preparedness, during flood and after flood were disseminated using the DSS to the district and upazila livestock officers of DLS.

Disaster Management Committee Database

As per requirement from Department of Disaster Management, RIMES has developed a Disaster Management Committee (DMC) database portal with information of the district, Upazila and Union level DMC members, covering the RIMES-CARE project areas.

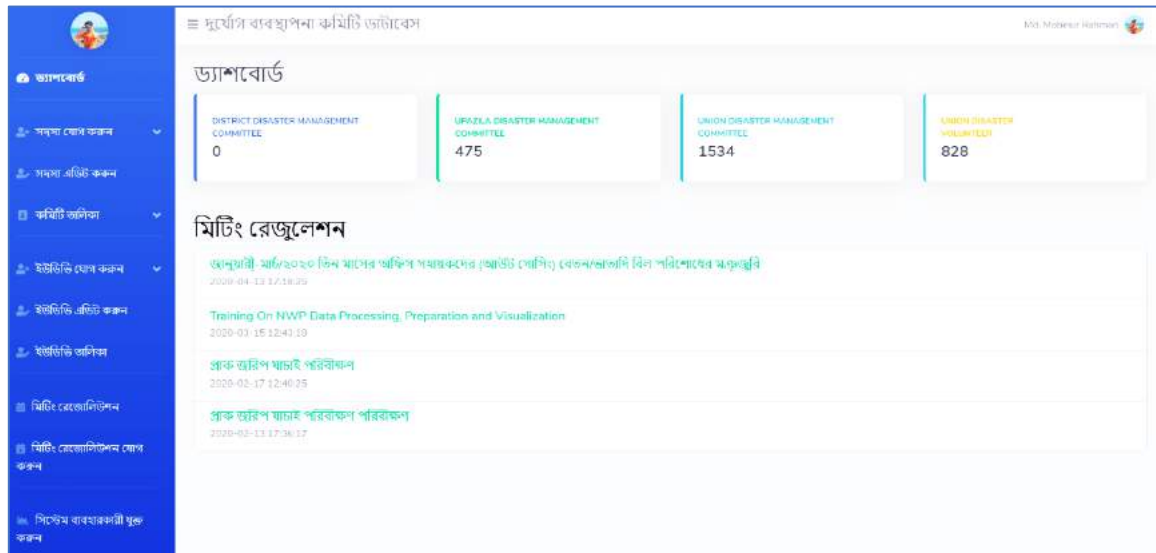


Figure 12 Dashboard of DMC database

This portal can be used for systematic storage and updating of DMC data and for location specific rapid dissemination of information from national to local level. Information such as phone number, email address, affiliation etc. of DMC members and Union Disaster Volunteers has been stored in the database.

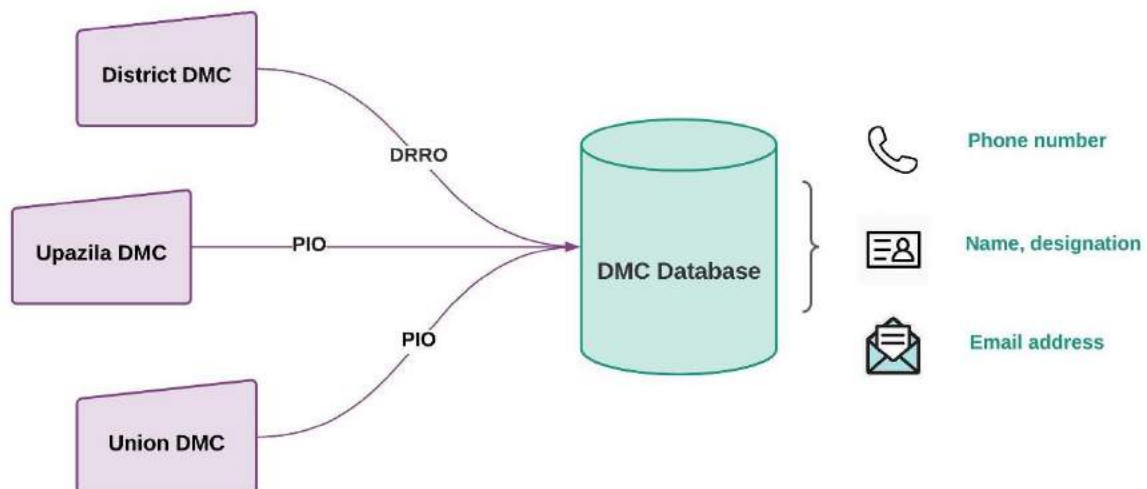


Figure 13 Data entry into DMC Database

For ensuring easy understanding of its users, the portal is available in both Bangla and English. Using this portal, information of the DMCs of a certain district, upazila or union will be easily accessible. The information from the DMC portal helps in wider and rapid

dissemination of flood forecast, early warning, advisory bulletin etc. Using the information from the DMC database, information can be disseminated simultaneously at all administrative levels saving the time and effort required in gathering the updated information of DMC members. This will increase the lead time that the DMC members usually receive during disasters.

For example, FFWC issued a Flood warning only for Haldia union of Saghatta upazila, Gaibandha with 5 days lead time. The flood warning needs to be disseminated to only Haldia union. Using the DMC database, the information of the DMC members of Haldia union can be filtered and the phone numbers can be extracted in csv format. The filtered phone numbers can then be used in the voice message broadcasting tool for rapid dissemination of the flood warning. The Union Disaster Management Committee members will receive the flood warning via voice message with 5-days lead time. This process is illustrated in figure 3 for better understanding.

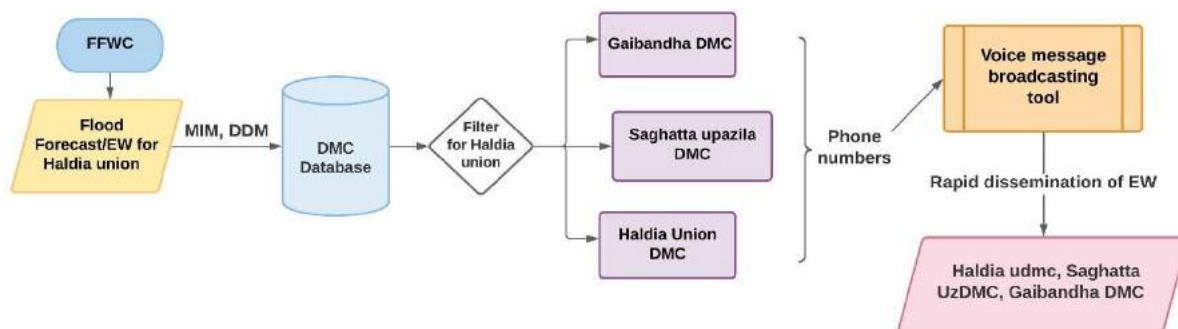


Figure 14 Warning dissemination using DMC Database

To ensure maximum reach of hazard warning, information of DMC members and UDV's of all SHOUHARDO III program areas are being uploaded into the database by DDM.

2.2. Generate and Disseminate Advisories

RIMES developed a voice message broadcasting tool which was completed in the January-March, 2020 quarter which was transferred to the server installed at BMD during April'2020. With each broadcast, the system is being updated for efficient service and maximum reach. Using this broadcasting tool, RIMES has disseminated forecast, warning, advisory messages to more than 50,000 recipients throughout the project period. The voice messages are broadcast using the phone number "9666777200". Using this system, rapid dissemination of information has been possible which has reduced the cost of call by 60%. The cost of call reduced to 0.40 taka/minute with this developed voice message broadcasting tool. Dissemination of information by voice message also overcomes the constraints of illiteracy.

Initially, RIMES prepared two advisory bulletins in collaboration with DAE and disseminated with experimental voice broadcasting system during 25-26 December 2019 to about 2000 beneficiaries. Since then, RIMES has broadcast 155 voice messages which included agromet advisories, livestock advisories, flood forecast and warnings, advisories for before, during and after floods. Special thunderstorm safety awareness messages and a weather alert for the Cyclone Amphan were also broadcast.



Figure 15 Overview of unique messages generated throughout the project

Sample voice messages are given below:

Flood Forecast and Preparedness Advisory

Today is 29th August, 2021. According to the information of 9:00 am from Flood Forecasting and Warning Centre, waterlevel at Fulchhari Station is currently flowing almost 12 cm or almost 5 inches below danger level. According to today's flood forecast, the waterlevel of Jamuna river may rise for the next 24 hours. As a result, the ongoing flood situation in the riverine lowland and charlands of Haldia union of Saghatta Upazila may prevail for at least 6 more days.

As part of flood preparedness measure:

- ✚ Store dry foods, fuel and water purification tablets for using during emergency time.
- ✚ Residents of flood-prone lowlands or charlands should take shelter in comparatively higher or in a safe place. Maintain social distancing in shelters for avoiding spread of Covid-19.
- ✚ Take your cattle and poultry to higher and safer grounds and make arrangements for fodder and feed.
- ✚ Keep an eye on small children to avoid accidents like drowning.
- ✚ Store Carbolic Acid to avoid snake bites during floods.
- ✚ Share the flood forecast with your relatives and neighbors.

Livestock Advisory

Today is 21st August, 2020. You already know during the monsoon season, different type of diseases in cattle and poultry increase and crisis of animal food usually occurs in the Haor region.

Advisories in this situation are:

- ✚ Vaccinate your animals against infectious diseases such as Foot and Mouth disease, Black Quarter, Pneumonia, Anthrax etc. For vaccination, contact the local vets or Upazila Livestock Office.
- ✚ Feed your animal deworming medicine as advised by the Vet.
- ✚ Cattle must be fed dry hay. Wet or rotten straw should be avoided.
- ✚ Feed your animal banana, mango, jackfruit, fig leaves or mix straw with water hyacinth to make up for the lack of green grass.
- ✚ Give 300 to 400 gm broken rice or rice bran to lactating animals and growing heifers.
- ✚ If possible, give 20 to 25 g of any branded mineral mixture for boosting immunity and growth of animals.
- ✚ Vaccinate your poultry against Newcastle disease.

The voice messages are broadcast more than once depending on the gravity of the content and situation. The weather and flood forecast messages are prepared using the improved forecasts that have been developed under the project. Agromet advisories are customized for the upazilas under the project using the agromet advisories found in the BAMIS portal. The livestock advisories are prepared in collaboration with the Technical Working Group (TWG).

RIMES in collaboration with CARE Bangladesh also disseminated COVID-19 health awareness and Violence against Women awareness messages from April 2020 to September 2020. These messages were broadcast to more than 45184 phone numbers. The forecast/advisory messages have been broadcasted to SHOUHARDO III program beneficiaries and other relevant stakeholders (e.g., Upazila Disaster Management Committee Members, Union Disaster Committee Members, Union Disaster Volunteers, DRR leaders, Local Service providers etc.). The voice message broadcasting tool has been serving as a common platform for the five Government Stakeholders - BMD, DAE, DLS, DDM and FFWC to disseminate early warning and advisory information. In 2020 monsoon season, DAE also broadcasted agromet messages to 5011 lead farmers and extension officials in the flood affected districts. Under the AMISDP project, DAE has broadcast several agromet advisories to 6590 lead farmers of the coastal region in 2021.

Regular monitoring through randomly calling the recipients were carried out. Feedback was collected from the message recipients to maximize the reach and benefit of the value-added information. Adjustments were made based on the recommendations of the recipients. The most important recommendation that was unanimous in all upazilas, is the need to express their problems, issues and thoughts. The participants were eager to discuss their problems via mobile phone in the same way they receive the voice messages.

2.3. Capacity building trainings for National Stakeholders

For smooth transfer of technology, maintenance and operations of developed systems, warning content development, interpretation of forecast and advisory generation - capacity building programs were conducted for the National Stakeholders - BMD, FFWC, DDM, DAE and DLS as per their requirements. The following capacity building trainings were conducted throughout the project period:

- ✚ 12 Professionals from BWDB trained on Operation and Maintenance of newly developed system
- ✚ 16 Professionals BMD trained on Operation and Maintenance of newly developed system
- ✚ 32 Professionals from DDM including district and upazila level officials trained on warning content development & dissemination and DMC Portal
- ✚ 43 Professionals from DAE including district and upazila level officials trained on forecast interpretation and advisory generation
- ✚ 10 Professionals from DLS including district and upazila level officials trained on forecast interpretation

Table 3 Capacity building trainings for National stakeholders

No of Trainee	Organization	Date and location	Training coverage
16	BMD	28-30 September, 2020; BMD	Technology transfer, customizing location specific forecast products, associated data analysis, processing and visualization.
12	BWDB-FFWC	2-5 November, 2020; BWDB	Technology transfer, 15-days streamflow forecasting model operations, meteorological data processing for providing input into the model and troubleshooting of the model.
22	DDM	9 th November, 2020; DDM	Warning content developed using the improved weather and flood information system developed through the interventions of this project and dissemination of these warnings through the voice message broadcasting system.
32	DDM	16 th November, 2020; DDM	DMC database and how to access, operate and use this portal for rapid dissemination of warning and information.
26	DAE	28 th November, 2020; NATA, Gazipur	Agrometeorological information services, disaster risk management, forecast interpretation, advisory generation
8	DAE	5 th September, 2021; DAE	Operations of Voice Message Broadcasting System

No of Trainee	Organization	Date and location	Training coverage
20	DAE	21 st September, 2021; BRAC CDM Savar	Agrometeorological information services, disaster risk management, forecast interpretation, advisory generation
13	DLS	20 th September, 2021; BRAC CDM Savar	Disaster risk management, forecast interpretation, advisory generation through DSS
6	BMD	26-30 August, 2021; BRAC CDM Rajendrapur	Day to day operations and maintenance of the developed systems
5	BWDB-FFWC	27-30 August, 2021; BRAC CDM Rajendrapur	Day to day operations and maintenance of the developed systems

2.4. Capacity building programs for community members in forecast application and risk management

Several community level trainings have been conducted in forecast application and risk management. Before the Covid-19 pandemic, one training was arranged for farmers including youth farmers and women group in forecast application and risk management as part of the capacity building program among the community. The modality of the capacity building programs was changed into semi-virtual sessions to adapt to the new normal. 13 semi-virtual sessions for farmer and women groups were conducted in 13 unions of the project areas following social distancing protocol. In total 179 farmers, women groups including 91 female participants have been trained under the project on community-based risk and resource management.



Figure 16 Samia Jahan Chowdhury, Project Manager explaining the application of weather and flood forecasting to the participants at Austagram Upazila

Similar trainings were conducted for local service providers, market actors, private sector agents, UDC entrepreneurs in accessing forecast information, forecast application in agriculture and livestock management and overall risk management. In total 42 local service providers, market actors, private sector agents, UDC entrepreneurs including 14 female participants have been trained.

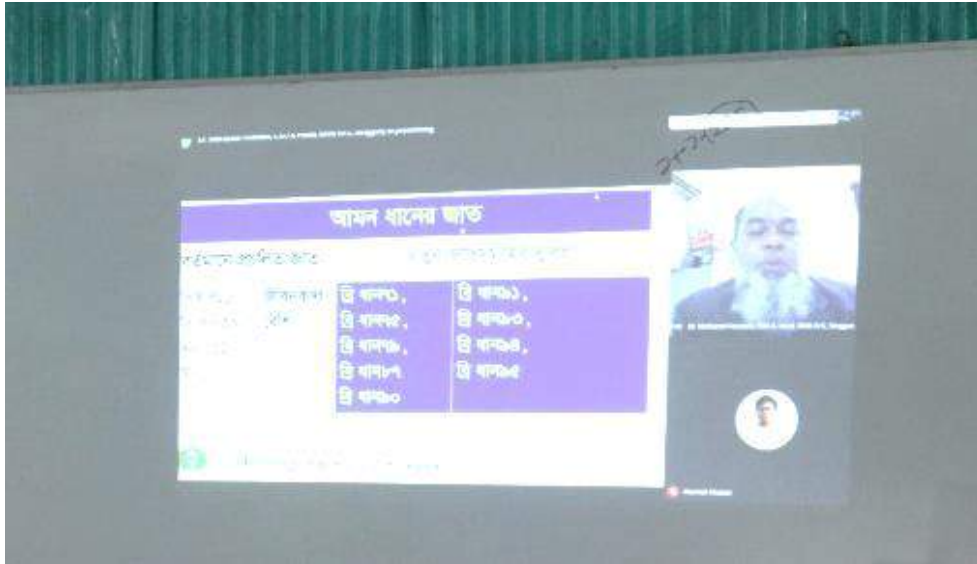


Figure 17 Facilitators joined virtually via video conferencing system for some of the training sessions

RIMES professionals along with facilitators from BMD, FFWC, BRRI, DAE, BLRI, DLS conducted the several sessions of these trainings. Hands on demonstrations on livestock fodder management as part of early action and irrigation water management were also conduct shown during these trainings.



Figure 18 Dr. Sardar Muhammad Amanullah demonstrating the process of silage making



Figure 19 Dr. ABM Zahid Hossain demonstrating the AWD method

2.5. Awareness raising activities

Awareness raising activities were carried out at both national and local level.

Awareness raising workshop for school children

2 awareness raising workshops were arranged for school children on 20th January, 2020 and 21st January, 2020 at Haldia Union, Shaghata Upazila of Gaibandha and Belgacha Union, Islampur Upazila of Jamalpur District respectively. School children of grade 8, 9 and 10 of Haldia Union Bera Adarsha Girls High School and Bera Boys High school total more than 100 students participated in the 1st workshop at Haldia union. About 150 students of grade 9 & 10 of Belgacha High School participated in the 2nd workshop at Belgacha union, Islampur, Jamalpur. Md. Arifuzzaman Bhuyan, Executive Engineer, FFWC and Md. Rasheduzzaman, Meteorologist, BMD facilitated the workshops along with RIMES professionals.

During the workshop sessions, the schoolchildren were able to interact with the meteorologists and get to know different weather forecasting services of BMD and their uses. FFWC professionals shared knowledge of flood forecasting and how it can be utilized to minimize the risk and damage caused by floods. An animation video on “Thunderstorm/ Nor'wester” was shown to demonstrate how thunderstorms are formed and what to do and what not to do during a thunderstorm. RIMES discussed about early warning system and dissemination.



Figure 20 School Children with BMD, FFWC and RIMES Officials at Belgacha Union, Islampur

IEC material for awareness raising among school children

Comprehensive, interactive and user-friendly digital materials in the form of information, education and communication (IEC) materials have been designed and developed for raising awareness among school children. Initially, awareness raising workshops were planned for school children on accessing weather and flood information, forecast application, thunderstorm risk management etc. However, due to the Covid pandemic situation, IEC materials were proposed as an alternate to the workshops. As schools have been closed since the beginning of March, 2020, IEC materials were hand overed to selected schools in Nikli, Chowhali, Nageshwari and Saghatta upazila during September, 2021.

These interactive, user-friendly and comprehensive IEC materials have been designed in such a way that school going children can easily understand the content and grasp the information. “BOXOFFICE” consultant agency has been hired for the design and development of the IEC materials through a competitive bidding process. To make these IEC materials more attractive and interesting, BOXOFFICE had proposed the unique idea of making the IEC materials in form of 3-D pop-up book.

Three 3-D pop-up books has been developed for

- 📖 Thunderstorm awareness
- 📖 Accessing weather and flood information
- 📖 Utilization of weather forecasting in decision making

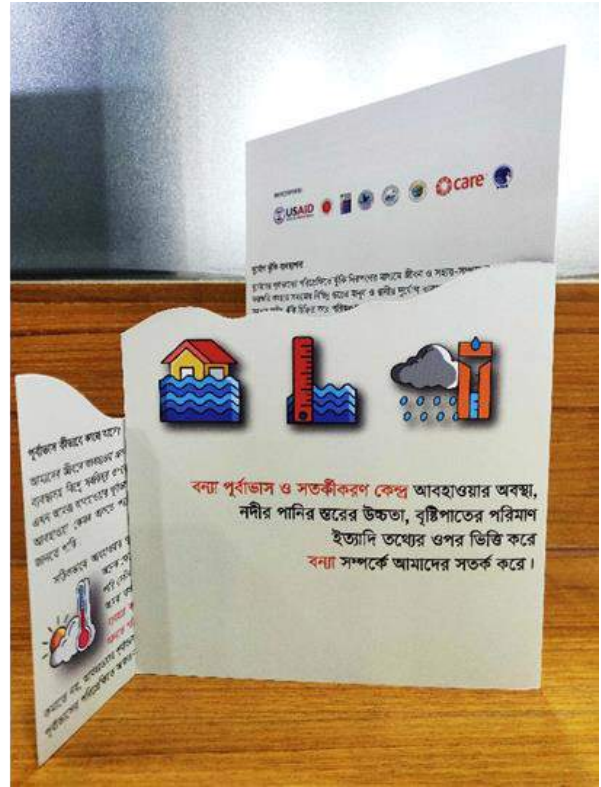


Figure 22 IEC material on Thunderstorm awareness (Left) and Utilization of weather forecasting in decision making (Right)

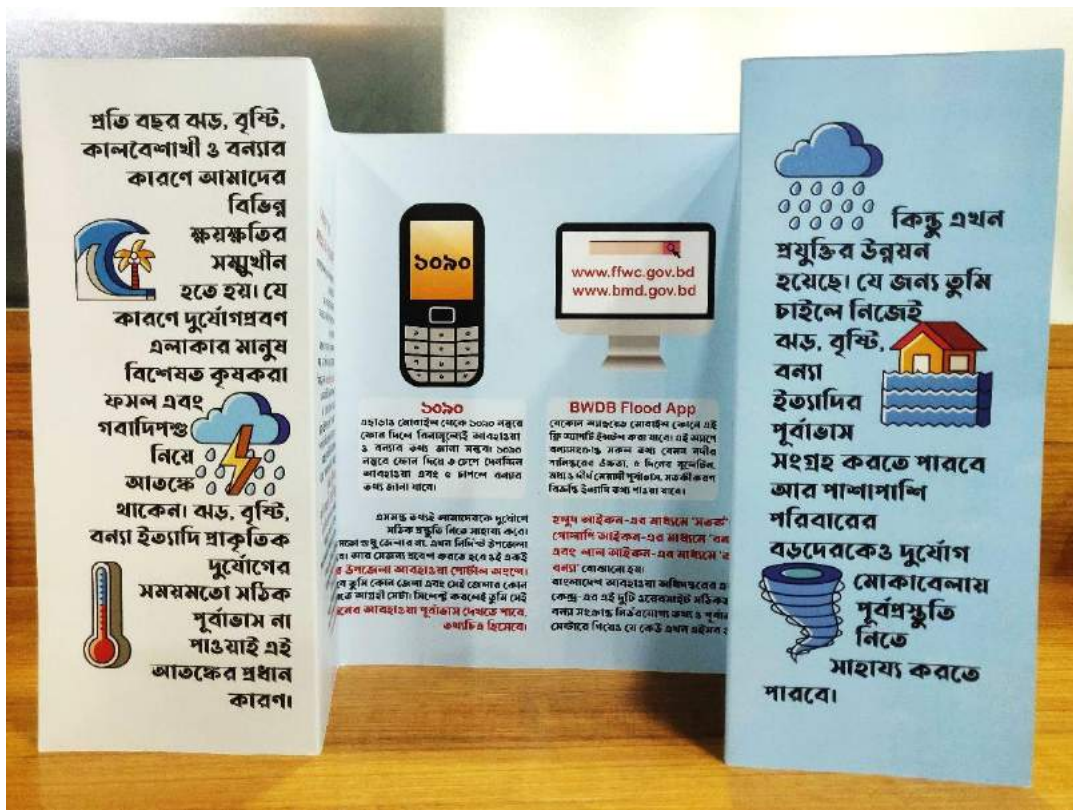


Figure 21 IEC material on Accessing weather and flood information

The materials are developed in Bangla for easy understanding and maximizing reach. The design and content have been finalized and shared with relevant Government Stakeholders for vetting. 2000 copies of each of the 3 IEC materials has been printed by BOXOFFICE after proper vetting and finalizing.



Figure 23 Students of Islampur Government Primary School going through the IEC Materials



Figure 24 Headmaster, teachers and school children of Bharatkali Girls' High School along with RIMES staff during the handover of IEC Materials

Digital Information Content development

Besides capacity building trainings, comprehensive, interactive and user-friendly digital materials in the form of short video animation (motion graphics) have been developed for forecast-based risk and resource management. Through a competitive bidding process and

intensive evaluation, “EndingScene” consultant agency was selected for the development of digital information content.

The selected consulting agency “EndingScene” has prepared six digital contents to visualize the information on the following topics:

- ✚ Thunderstorm awareness,
- ✚ Influence of weather parameters on Blast disease, Brown Plant Hopper and Yellow Stem Borer outbreak of paddy and farmers,
- ✚ Forecast based livestock management,
- ✚ Early warning and early action,
- ✚ Accessing different forecast information and
- ✚ RIMES introduction and activities

These videos have been finalized after vetting with the relevant Government Stakeholder Organizations. To make sure the videos are in compliance with USAID branding and marketing strategy, the videos were shared with CARE Bangladesh and updated by incorporating the feedbacks.

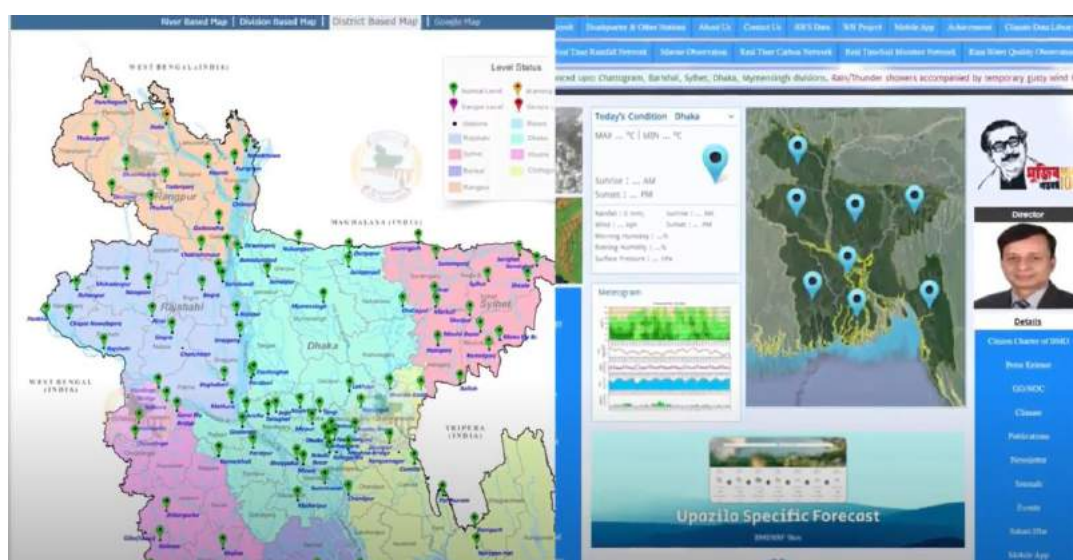


Figure 25 A snapshot of the digital Content "Accessing weather and flood information"

These animation videos have been developed with Bangla voice-over for easy understanding of the community. English subtitle will also be added to the videos for sharing with English-speaking personnel. These will be shared with the Government Stakeholders for broadcasting in their official website and social media accounts. The digital contents will be demonstrated to the community during the courtyard demonstrations planned for the July-September, 2021 quarter. A portable projector has been purchased during this quarter for ensuring the smooth visualization of the digital content in a rural setup.

These contents will be played in the websites of the government counterparts, uploaded in relevant mobile application (if any) and social media platforms of stakeholder departments for knowledge

dissemination and awareness raising. The contents visually explain how to implement some agroment, flood/thunderstorm, livestock advisories and how to access information etc. The concepts can help in local level capacity building. The Sub-Assistant Agricultural Officers (SAOs) have already received tabs from Agrometeorological Information System Development Project (AMISDP) and National Agricultural Technology Program (NATP). On the other hand, smartphone penetration is good among the LSPs (entrepreneurs, market actors etc.). The digital content can be used by these groups for knowledge dissemination and training of farmers.

Support FFWC in improving waterlevel data collection

For supporting FFWC in improving waterlevel data collection for enhancing flood monitoring, 11 set of Smartphones and monitoring gears- lifejackets, gum boots and raincoats were provided to the gauge readers of the 11 waterlevel stations of Brahmaputra-Jamuna River system in the SHOUHARDO III working areas. For handing over the smartphones and monitoring gears, a half-day program was organized on 24th January, 2021 at Rangpur RDRS conference room. Engr. Md. Nurul Amin, Chief Engineer (Hydrology), BWDB attended the program as the chief guest. Engr. Bigyut Kumara Saha, SE, BWDB and Engr. Mohd. Sarfaraz Banda, SE, BWDB attended the program as special guest.



Figure 26 (Top Row) Gauge readers of 11 waterlevel stations Brahmaputra-Jamuna River system in the SHOUHARDO III working areas received smart phones and monitoring gear

(Bottom row from left) MR. Raihanul Haque Khan, Engr. Mohd.Sarfaraz Banda, Engr. Md. Nurul Amin, Engr. Bigyut Kumara Saha and Engr. Arifuzzaman Bhuyan during the handover ceremony

During 2020 monsoon flood it was experienced that there was no flood monitoring data for Dudhkumar river in Nageswari, Kurigram. So, an initiative was taken to bring an existing gauge at Dudhkumar river into FFWC's monitoring network. The existing water level monitoring station in Dudhkumar was linked with FFWC's existing SMS based data collection system and incorporated in FFWC's monitoring network in this quarter. Engr. Arifuzzaman Bhuyan along with RIMES personnel visited two gauges: one at Pateshwari for Dudhkumar river and

another gauge at Noonkhawa for Brahmaputra River for monitoring the current situation of the gauge. Engr. Arifuzzaman Bhuyan inspected the gauges and briefed the gauge reader on data collection. The findings from these visits were used for improving the overall data collection system of FFWC.



Figure 27 Engr. Arifuzzaman Bhuyan discussing the issues and challenges faced by the gauge reader of Pateshwari

Community level Demonstration for strengthening forecast based action

Community level demonstrations were conducted in limited scale to minimize the knowledge gap of farmers, women groups and LSPs so that they are able to visualize the forecast based actions that they listen to in the voice messages e.g. fertilizer name, type and application, diseases detection, new high-yield and specialized rice variety for various regions etc. These demonstrations will help adaptation of these techniques for translating forecast into actions and help in sustaining these practices beyond the project period.

The digital information content- animation videos have been developed by “EndingScene” consultant agency in Bangla for demonstrating the application of weather and flood information in agricultural and livestock management, thunderstorm awareness, accessing weather and flood information, utilizing this information in risk reduction. These videos were demonstrated to the community in Nikli upazila of Kishoreganj, Chowhahli Upazila of Sirajganj, Nageshwari Upazila of Kurigram, Saghata upazila of Gaibandha.

These videos will be displayed on the websites and social media accounts of the key Government stakeholders for wider dissemination. The videos can be used even after the

project termination by the relevant stakeholders for awareness raising among the communities.



Figure 28 Participants of Chowhahli Upazila watching the animation video on forecast-based livestock management

Workshop on Flash flood risk management at Haor Region

A workshop was arranged in Sunamganj District for consultation on flash flood early warning and providing extension services at the north-eastern region of Bangladesh on 24th March, 2021 at the Sunamganj DC Office. Md. Jahangir Hossain, Deputy Commissioner, Sunamganj chaired the workshop.



Figure 29 Md. Jahangir Hossain, DC, Sunamganj discussing about the risk of flash flood in Sunamganj and how these risks can be mitigated with the help of flash flood early warning

Dr. Md. Abdul Mueed, Director General (prl), Department of Agricultural Extension (DAE), Engr. Bidyut Kumara Saha, Superintending Engineer (SE), Bangladesh Water Development Board (BWDB) and Engr. Khushi Mohan Sarker, SE, BWDB attended the workshop as special guests.

In total 42 participants from Sunamganj DC Office, Sunamganj District Livestock Office, Sunamganj Agricultural Extension Office, BWDB, BMD, DDM, Sunamganj Haor Protection Committee and media attended the workshop.

Discussions were carried out on the importance of flash flood early warning system in Bangladesh, the available technologies of DAE for harvesting and taking early action for the agricultural sector in response to flash flood warning.



Figure 30 Dr. Md. Abdul Mueed shared his previous experience as DG in flash flood risk management for agricultural sector

Livestock practitioners mentioned that livestock sector suffers as much loss as the agricultural sector due to flash flood. Even though livestock has mobility, the loss incurred from loss or death of livestock is much higher due to its comparatively higher price. The participants also appreciated the initiative of voice message advisory service and also expressed the need of such services for flash flood warning for all national and relevant stakeholders in north-eastern region.

Workshop on Livestock Decision Support System

A National level workshop was organized on the “Decision Support System (DSS) for forecast-based livestock management” on 27th September, 2021 at the Pan Pacific Sonargaon Hotel, Dhaka. Mr. Shaikh Azizur Rahman, Director General, Department of Livestock Services (DLS) attended the half-day workshop as Chief Guest. Dr. Md. Abdul Jalil, Director General, Bangladesh Livestock Research Institute (BLRI) and Dr. Ali Akbar, Ex- Vice Chancellor, Bangladesh Agricultural University (BAU) attended the workshop as special guests. 24 Participants from DLS, BLRI, DLS, BAU and representatives from Bangladesh

Water Development Board (BWDB) and Bangladesh Meteorological Department (BMD) were present during the workshop. The workshop was organized with a view to advocate the importance of the Livestock Decision Support System that has been developed under the project to the Government Officials of the Livestock Sector.



Figure 31 Dr. Shaikh Azizur Rahman, Director General, DLS during his remarks as Chief Guest at the workshop

An interactive session was conducted by Dr. Md. Zulfekar Ali, SO, BLRI and RIMES on the importance priority for livestock management for decision making. The participants of the workshop engaged in the interactive session and provided their input. This input has been gathered for understanding the decision-makers perspective for livestock management. These will be used for further improvement of the DSS.



Figure 32 Dr. Shaikh Azizur Rahman, DG, DLS with BLRI and RIMES professionals during an interactive session at the workshop

2.6. Evaluation of Community Response to Advisory Services and Early Warning Systems

Assessment of user's baseline capacity and information need

In order to improve the forecast products and understand the existing capacity of the community in forecast application, response to warnings and assessment of the user capacity and information need of the end users are prerequisites. In this connection, an assessment was carried out to understand users' baseline capacity and information need during December, 2019 in the selected pilot areas of RIMES.

It was revealed during the user's baseline assessment and information need which was conducted in December'2019 that despite being vulnerable and in need of advisories to cope with agricultural and livestock management practices in the face of climatic shocks, 84% of the respondents from the Char region and 87% respondents in Haor region neither received agrometeorological advisories nor got timely early warning before an extreme event. This information was usually received from TV or by dialing the IVR number 1090. Through FGDs and KIIs, it was revealed that the current lead time of forecast for different extreme events in Char and Haor Region is 1- 3 days. It was reported during the FGDs that during the flood of 2019, the participants received the flood warning only hours before flood water started to enter their house. For this they could not take any early action. It was also revealed from the survey that no livestock advisory system was available during that time and they received little to minimum agricultural and livestock advisory from the local seed, fertilizer sellers, vaccinators etc.

Using the learnings and recommendations from the users' baseline capacity assessment, RIMES has collaborated with different national stakeholders to improve the weather and flood information system and advisory services. The findings of the baseline assessment were also used as a base to compare the impact of the project interventions and the response of the beneficiaries to the forecast and advisory services.

Post-monsoon Assessment, 2020

The flood of monsoon 2020 was unique because of its duration and intensity. In fact, it was the recorded highest flood of the month June. Almost 40 % of the country was inundated (FFWC, 2020). Duration of flood in many areas of the country exceeded that of 1988, 2018, 2019 etc. The most devastating effects were faced by the char region. During this period, RIMES closely worked with FFWC and provided technical support for the developed 15-day streamflow forecasting system. RIMES disseminated regular flood forecast, flood warning, flood preparedness advisories, agromet and livestock advisories for during and post flood conditions to the beneficiaries of the flood- affected project areas. To evaluate the impact of the weather and flood information system as well as the advisory services at the community level and the response of the community to these information and advisories, RIMES professionals along with a team of enumerators carried out a post-monsoon assessment from 19-30th September, 2020. The assessment was mainly focused on the flood affected districts of the pilot areas. The char region experienced severe flooding during the monsoon season of 2020. Tahirpur upazila of Sunamganj district also experienced flooding during the monsoon season.



Figure 34 Focus group discussion in Haldia union of Shaghata upazila

In total 678 participants took part in the assessment were 69% were female participants. Following social distancing protocol, the assessment took place in two parts- onsite and over the phone survey. It was observed from the assessment that around 90% participants have received early warning during the floods of 2020. Among them, 78% participants have received the warning through voice message. During FGDs, it was observed that the participants were enthusiastic about the voice messages. Although in the initial stages, the participants were reluctant about the voice messages as this was a completely new process for them. Many participants said that they did not even knew that it was possible to get weather and flood information in advance. But when they realized the forecast information in the messages were correct, they started to trust the voice messages. In fact, they wait for the voice messages eagerly for receiving weather, flood information and advisories.



**Available time for response
Increased from 1-2 days to
5 days**

**Number of participants receiving
timely forecast, early warnings and
advisory increased from less than
20% to 97%**

**Amount of money saved in different sectors
by following forecast-based advisories**



**39,460 Bdt
470 USD**



**26,850 Bdt
320 USD**



**10,170 Bdt
121 USD**



Figure 33 Findings of the post-monsoon assessment

It was also observed that on an average, the participants saved 39967 BDT per household by taking early action according to the forecast based advisories. Participants saved the most amount in livestock sector by following the advisories. Participants saved as much as 39460 BDT per household in the livestock sector and 26850 BDT per household in the agriculture sector.

Evaluation of community response to advisories, 2021

Due to the continuation of Covid-19 pandemic, a limited scale assessment was carried out in September, 2021 to evaluate the community response to advisory messages, for identifying the learnings and areas for improvement. The assessment was conducted in Nikli Upazila of Kishoreganj, Chowhali Upazila of Sirajganj, Nageshwari Upazila of Kurigram, Saghatta Upazila of Gaibandha. Qualitative assessment was carried out as due to Covid-19 pandemic situation, restricted movement was advised in the field. Total 80 beneficiaries under the above-mentioned areas including 48 female participants took part in this assessment.

Focus group discussions were carried out in each location with limited participants. The participants shared their thoughts on the overall voice messaging system, their understanding of the voice message content, how it can be improved, what are their demands, their overall need for capacity building etc. Participants expressed the need of two-way communication as well as additional help in terms of resources and knowledge in taking response to the advisories.



Figure 35 Participants taking part in FGDs during the assessment process in Chowhali Upazila

2.7. Sustainability Efforts

The Flood Forecasting System supported earlier by RIMES has become a core part of FFWC's operation and the forecast is one of their key products. The updated or additional flood forecasting tools has been built on the existing operational system at FFWC. The 15 days

streamflow forecasting system has been integrated into FFWC's operational system during monsoon 2020. The system is automated and requires minimum resources for maintenance. Because of its high demand as a longer lead time forecast, it is highly likely to sustain unless there is an unforeseen trouble. In case of unforeseen difficulties, RIMES can provide technical support as part of the RIMES cooperation agreement after the project has ended. On the other hand, trainings have been provided to FFWC Officials to ensure local operation and maintenance of the system beyond the project period.

The location specific weather forecast generation has also been integrated similarly in the BMD's system. The model run, data processing and uploading are automated, so, minimum effort or human resources will be required from BMD to sustain it. It should be noted that no additional cost would be incurred to use the tools by FFWC or BMD beyond the project period. Technology transfer training for BMD was also proposed for enhancing capacity of BMD professionals to maintain the systems beyond the project. During the training a wide range of participants were covered so that staff retention does not necessarily impact the immediate operation and maintenance of the system.

In case of DAE, they have been generating agromet advisories through the Agro-Meteorological Information System Development project. DAE has also started utilizing the voice message broadcasting platform for disseminating the advisories to their lead farmers. As the voice message broadcasting system developed by RIMES is cheaper than the text message broadcasting system of DAE, DAE expressed their interest in using this system for which an account of the voice message broadcasting tool was hand overed to DAE. For officially handing over the VMB account to DAE, a ceremony was organized on 21st September, 2021. A K M Manirul Alam, Director, Field Service Wing, DAE received the account on behalf of DAE where Dr. Shah Kamal Khan was present as the witness. The handover ceremony was part of the sustainability efforts made by RIMES.



Figure 36 A K M Manirul Alam, Director, Field Service Wing, DAE along with Dr. Abdul Muyeed, Ex-Director General, DAE and Mr. Raihanul Haque Khan, Country Program Lead, Bangladesh, RIMES during the Handover of the VMB account

Trainings have also been conducted to enhance the capacity of the extension workers (district/upazila and union level) and familiarize them with the newly developed forecast tools for application in advisory generation. In the longer term, DAE might also allocate budget from their text messaging service to voice broadcast.

For DLS, a weather and flood forecast based Decision Support System (DSS) for livestock management has been developed. Through consultation, the system will be integrated into the operations of DLS. As per recommendations of DLS, the system has been developed in a way that requires minimum human intervention. A Technical Working Group (TWG) has been working for the advisory development for the DSS. Using this system, DLS has started to disseminate advisory bulletins to the District and Upazila Livestock Officers. DLS professionals were trained for the maintenance and operations of the system. The system will be further enhanced under the Climate Adaptation and Resilience for South Asia (CARE)" project which is a 5-year long World Bank funded project. RIMES will continue to provide technical support to DLS beyond the project period as required.

RIMES has initiated the process of signing MoU with both DAE and DLS. Through the MoU, the existing collaboration with DAE and DLS will be strengthened and it will help in empowering agriculture extension workers and livestock service providers as well as enhancing forecast based advisory services in agriculture and livestock management. This will provide additional support in the sustainability of the SHOUHARDO interventions in DAE and DLS. As of September, 2021, the MoU with both DAE and DLS are at final stage of signing at the relevant Ministry.

Through the current project a platform for voice message dissemination has been developed which has reduced the dependency and cost of dissemination by 60%. The voice message broadcasting tool has been serving as a common platform for the five Government Stakeholders - BMD, DAE, DLS, DDM and FFWC to disseminate early warning and advisory information. DDM has recently signed MoU with Local Government Engineering Department (LGED) under PROVATI3 project through which they will further work to integrate voice message broadcasting system in their operation. The system will be further enhanced i.e. capacity of broadcasting will be increased, new features will be added, etc. Through different assessments in the project areas, the response of the beneficiaries to the forecasts, early warning and advisory services have been evaluated and stories of good practices have been captured. Using the evidence of the benefits of the system, RIMES is trying to further advocate on this.

The project is designed to retain linkage created at the local level through trained community members especially the LSPs/market actors (seed/fertilizer dealers, medicine sellers, veterinary doctors etc.)/entrepreneurs/farmer leaders/UDVs etc. who in most cases are the people proactively responding to community's information need. The capacity building programs conducted under the project, help in developing a mindset and create demand for information among the beneficiaries for application of forecast in risk and resource management.

The project promotes community response to forecast/warnings through action-oriented advisories by interpreting and translating them into ex-ante actions. Interaction with the communities through the capacity building programs, evaluations and other field activities parallel to dissemination and continue to throughout the coming more monsoon season

for better assessment, identify the underlying gaps and determine way forwards for long term sustainability.

Table 4 summarizes the different sustainability efforts with the GoB stakeholders.

Table 4 Sustainability efforts with the GoB stakeholders

Organization	Project Interventions	Sustainability Efforts
FFWC	Development of the 15 days probabilistic streamflow forecasting system for Ganges, Brahmaputra and Meghna river basins. The system has been integrated into the operational flood forecasting system of FFWC.	<p>FFWC professionals trained on operations and maintenance of the system.</p> <p>System is automated and required minimum resources for maintenance</p> <p>RIMES will provide technical support beyond project period (if required)</p> <p>No additional cost will be required for use of the system by FFWC</p> <p>Modified 4-day residential training conducted instead of secondment for operation and maintenance of the system</p>
BMD	Customized and operationalized upazila specific weather. The system has been integrated into the weather forecasting operations of BMD	<p>BMD professionals trained on operations and maintenance of the system.</p> <p>System is automated and required minimum resources for maintenance</p> <p>RIMES will provide technical support beyond project period (if required)</p> <p>No additional cost will be required for use of the system by BMD</p> <p>Modified 5-day residential training has been conducted instead of secondment for operation and maintenance of the system</p>
DDM	Pilot warning dissemination using voice message broadcasting platform and development of DMC database.	<p>DDM officials has been trained in warning content development and the operations of the DMC database</p> <p>The voice message broadcasting tool will be further enhanced under PROVATI3 project</p>

Organization	Project Interventions	Sustainability Efforts
		<p>Through assessments of the response of the beneficiaries to the voice messages, RIMES has been trying to generate evidence of the benefits of the system. This will help in creating more demand with the Government.</p> <p>DDM has initiated data collection for populating the DMC database which they will continue.</p>
DAE	Utilized improved weather and flood forecast & early warning information and piloted dissemination of advisories	<p>Capacity building trainings for extension officials to familiarize them with the new forecast tools for use in forecast application for agriculture.</p> <p>Use of the voice message broadcasting tool for dissemination of advisory/warning to the lead farmers has started.</p> <p>An account for the VMB system has been hand overed to DAE and it is likely that it will get internal funding support in the long term.</p> <p>In process of signing MoU between RIMES and DAE which will help in sustaining the interventions of the project</p>
DLS	Develop weather and flood forecast based Decision Support System (DSS) for livestock management and piloted dissemination of advisories through voice message broadcasting	<p>The livestock DSS will be further enhanced under the World Bank-CARE project.</p> <p>In process of signing MoU between RIMES and DLS which will help in sustaining the interventions of the project</p>

3. Learnings and Recommendations

From different evaluations, field activities, advocacy meetings, several lessons were identified. The lessons learned through out the project period as well as recommendations are given below:

- ✚ The experimental 15 days forecast proved to be very useful in detecting flood events 10 – 12 days ahead. However, observing the forecast constancy with this lead time is very important. While the project has capacitated FFWC, BWDB to operationalize the system, further awareness raising is needed among other sectoral stakeholders especially the NGOs on the use and application of this forecast.
- ✚ There is high demand for upazila specific iconographic forecast products. This needs to be scaled up across the country. Currently 17 districts are covered in this portal. There is also a demand from the user side to develop a mobile application for this portal. There is still room for improving the forecast products. RIMES is currently working with BMD to improve this through post processing.
- ✚ The project was hit hard by the first wave of COVID-19 when the capacity building activities were about to start. The project adapted to the situation by introducing semi-virtual modality which enabled local communities to connect with sectoral experts remotely maintaining social distancing. Digital explainer contents and IEC materials were produced to support the process. This proven practice can be taken forward in other projects as well.
- ✚ The project conducted limited scale training for the beneficiaries and stakeholders on interpretation and application of forecast in risk and resource management. In general, there are gaps in contextualization of the risks and sensitization of communities how forecast can be utilized in value added decision making.
- ✚ The project developed a voice message broadcasting platform which has been used as the key channel for dissemination. This is one way broadcasting system. However, it was revealed from local level assessment that communities do not only want to listen to the advisories but also ask further case specific questions. An umbrella call center for climate services, through an interfacing agency can be developed in future to cater this need.
- ✚ While the project continuously tried to improve the content of the messages according the feedback from the beneficiaries. Lot of work still needs to be done to make the technical messages more understandable.
- ✚ Voice messages can provide advisories. The farmers need further understanding to implement the advisories in the field. The explainer videos and IEC materials can help minimize this gap.
- ✚ Connecting farmers with experts is mutually beneficial. Regular outreach programs need to be introduced by the climate service providers.
- ✚ Although the forecast-based advisories can significantly reduce losses, minimize risks; in order to maximize the benefits from these services, additional support, resource availability/mobilization should be ensured. A good example could be the way DAE managed labors and harvesters in 2020 flash flood season for harvesting Boro rice in haor region.
- ✚ There might be false sense of security or popular misconception that having mobility makes livestock less vulnerable to hazards. In contrast, potential damage

avoidance by taking early actions is higher compared to other sectors due the monetary value of livestock as well as its importance as a productive asset. This sector has huge potential for forecast based actions. However, a huge capacity gap lies from district to upazila and downwards for taking advisory services to the ground. This area also requires research interventions for livestock weather /climate sensitivity.

- ✚ There has been significant improvement in Agromet advisory service through AMISD project (BAMIS portal: www.bamis.gov.bd). However, available data might still be underutilized. Available data need to be arranged and analyzed in more visually intuitive manner. More capacity building programs needed.
- ✚ While mobile services can improve the information delivery manifolds, there are still challenges with advisory service delivery to the women. Although the project provided information to women groups, further action required to ensure women are equally informed. Women have been found to be more proactive in listening to and adhering to advisories in some cases. There still exists issues such as ownership of mobile phones, role of women in decision-making etc.
- ✚ Local Service providers (LSPs) can play an instrumental role in accessing, interpreting and applying forecast information in the ground. Many cases they are the first responders to farmer queries.

Feedback from Community Members



Most. Haowa

Sonatoni union, Shahjadpur upazila, Sirajganj

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After getting the information of the flood from the voice message, I discussed it with my husband and my family. We moved our valuables to the higher ground beside the road, stocked puffed rice and other dry foods and also made arrangements for fodder. We moved our livestock, chicken and ducks to the higher ground as well. We also shared the flood forecast with our neighbors. By getting the information I was able to take early action and made arrangements before flood water arrived. I was able to save my only cattle which was my biggest asset at that time.

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Mukul Mia

Haldia union, Saghatta upazila, Gaibandha

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When I received my first call from SHOUHARDO III, it was Jute cultivating season. The voice message said there was a possibility of flood and we were advised to harvest jute if it was around 80% mature. But some of us did not believe in that message as flood usually does not arrive this early and At that time the jute was not matured enough for harvest. Again, some of us did not have the capacity. As a result, none of us could save our jute crop from flood. After that, I always followed the advisories and took action accordingly. I did not plant Aman when the flood water receded as I was warned that water will rise again. I also took preparedness measures for my cattle and goat during flood by taking them to the shelter 3 days before the flood.

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Nazia Khatun

Sonatoni union, Shahjadpur upazila, Sirajganj

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When I first received the flood warning message, I shared the information with my neighbors. At first, they didn't believe the message, they said how can you tell the future. When they saw the forecasts were correct, again they came to me to know when the water will recede, if I got another call etc. When I received another message, I immediately told them that water will rise again after 12th July. I also asked the local Imam to announce the forecast using the mosque loudspeaker. By following the advisories from these messages, we saved our livestock, we were able to take preparations for 5 days ahead of the flood. This was very helpful and effective and I personally appreciate the initiative.

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Rafiqul Islam

Omarpur union, Chowhali upazila, Sirajganj

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I am a Local Livestock Vaccinator. We face many queries while visiting farmers. If we can get connected to experts directly about the impacts of weather on our livestock, we could save more. We know that the weather has critical influence on our livestock and poultry but there is need for capacity building and resource allocation for realizing the benefits at scale. This year with the power of forecast based advisories, I was able to help some local farmers which also boosted my business before the floods. I also got the warning of the new outbreak disease, named LSD. This type of advisory service is highly appreciable.

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Abdul Alim

Eerendabari union, Fulchhari upazila, Gaibandha

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I am the Imam of my locality. From the very beginning, I listened to the advisories and shared among the villagers when they gathered at the mosque. During the flood, this became a popular practice as the forecasts were correct and more people came to me for getting information about the flood. After the 1st week of August when flood water started to recede, I began to plant groundnut in my land. But after receiving a voice message saying that water may rise in next 3-5 days, I promptly stopped planting and saved my input cost in groundnut. As per my calculation, I think I have saved around 20,000 BDT by this single message.

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