

WHAT VALUE DOES CARE's SHOUHARDO II ADD IN CURRENT FLOOD FORECASTING WARNING SYSTEMS IN BANGLADESH?



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USAID
FROM THE AMERICAN PEOPLE



Overview

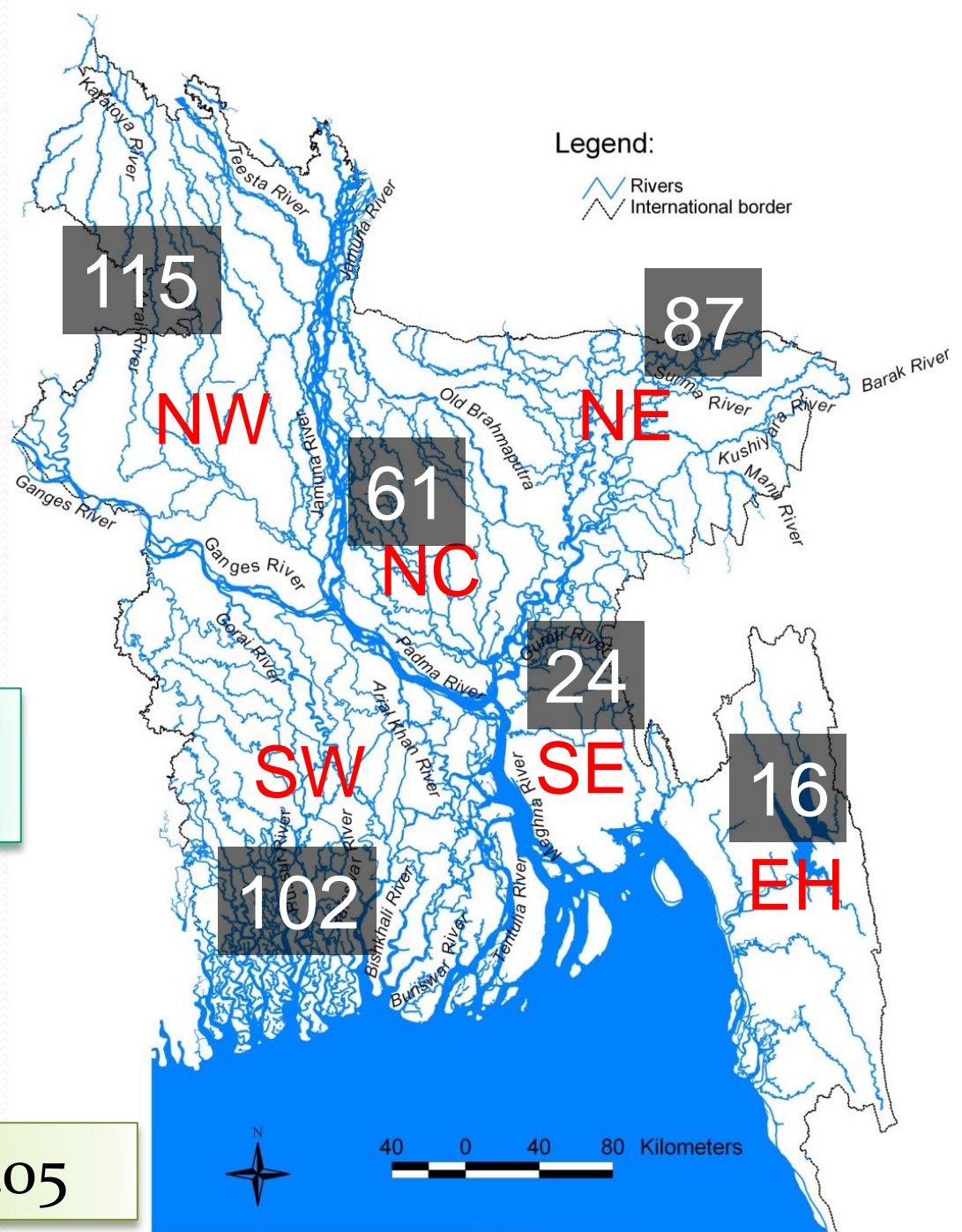
Bangladesh and Flood:

- Riverine Country
- Prone to Flood Risk – Geophysical setting, Low-lying, Experiencing flood - a common phenomenon
- Flash Flood, Rain Flood, Seasonal Monsoon Flood & Tidal Flood (due to storm surge)

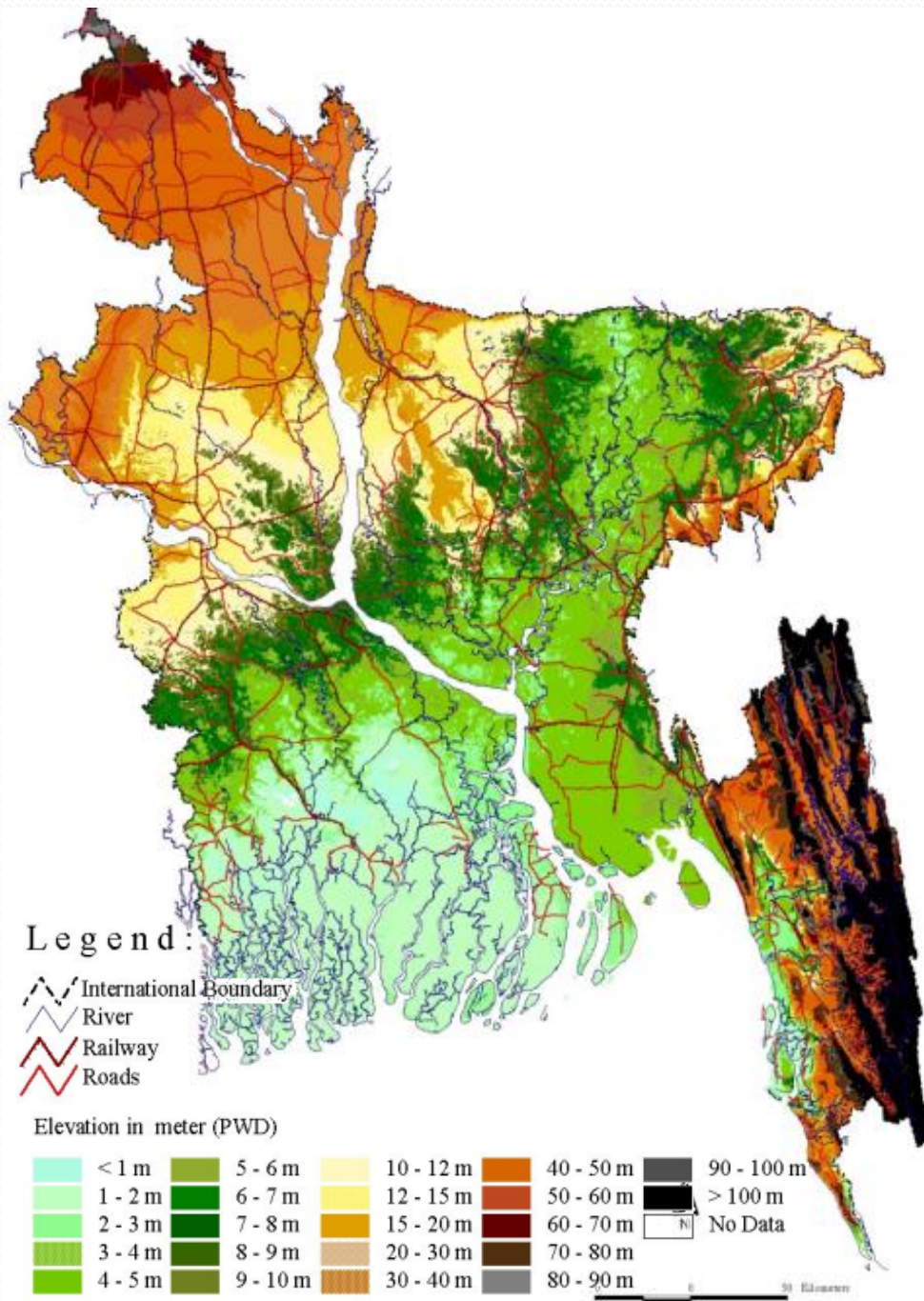
Bangladesh is a Land of Rivers

6 Hydrological regions of Bangladesh

Total number of rivers 405



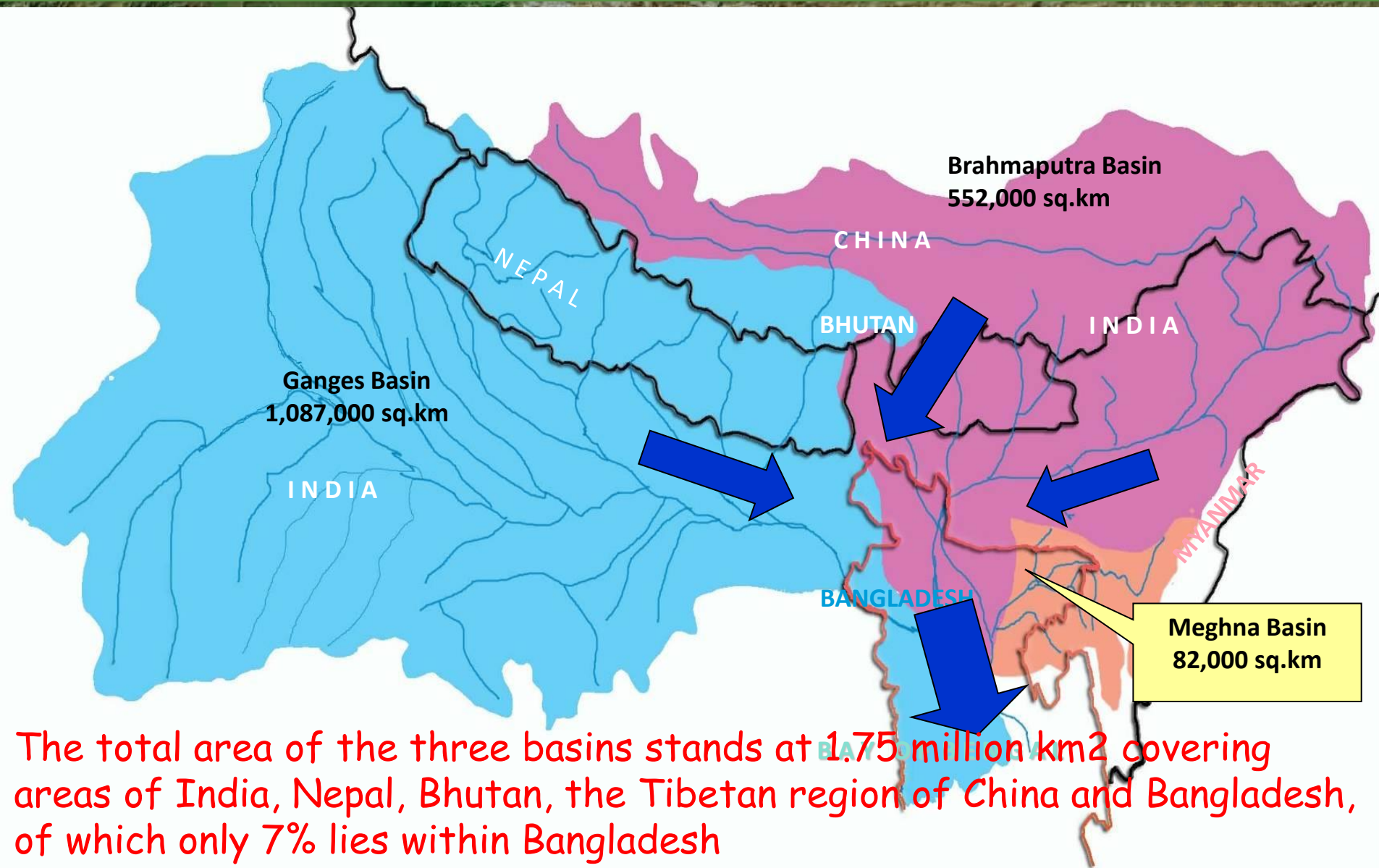
Topography of Bangladesh



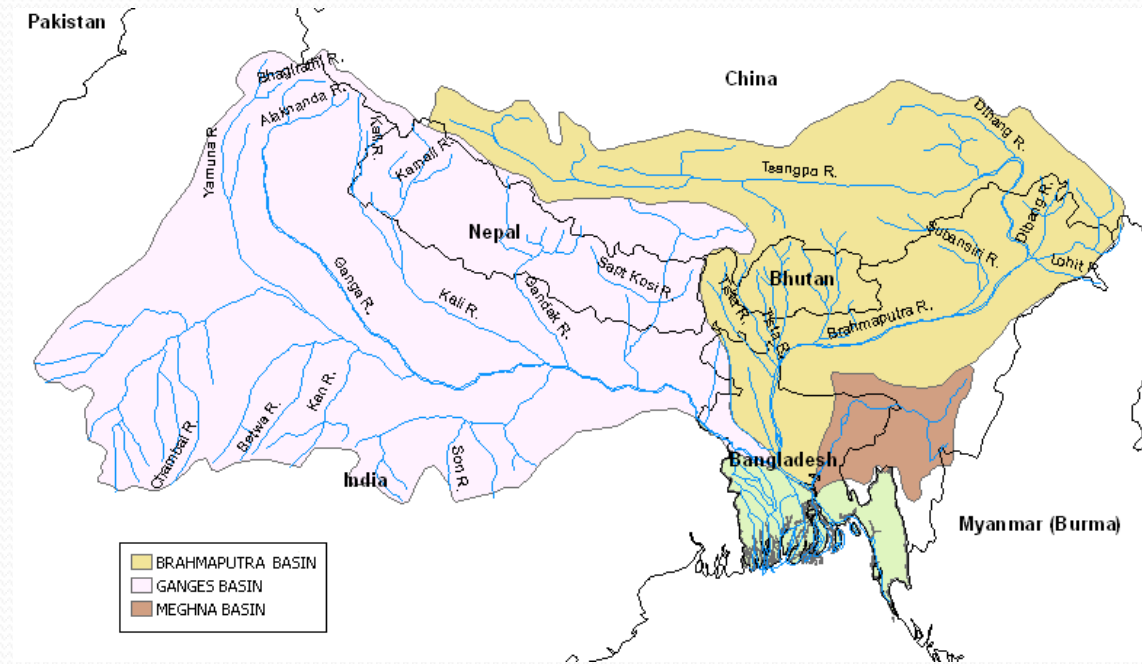
- *About 16% of the area below 1.50 m of MSL*
- *About 50% of the country is within 6-7 m of MSL*
- *25-30% of the area is inundated during normal flood*
- *Max. 68% area inundated during 1998 flood*

Source: FFWC, BWDB

Bangladesh rivers receive runoff from a catchment of 1.75 million sq-km, around 12 times its land area



Lower riparian country

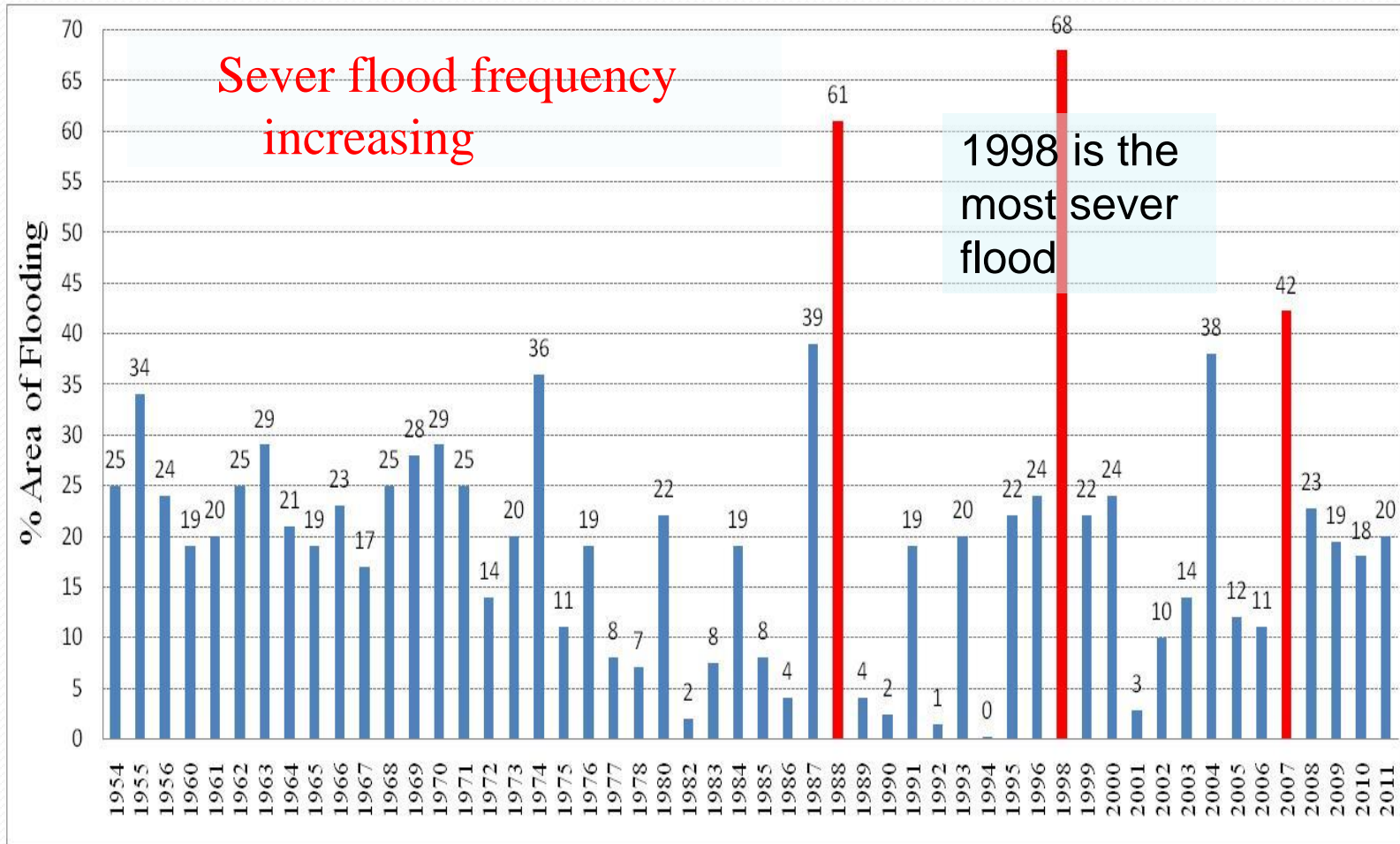


Excessive rainfall in GBM basins is the principal cause of riverine floods in Bangladesh.

There are 57 rivers which originate outside the boundary of Bangladesh.

About 1.18 trillion cubic meters of water flows annually to the sea, of which 1.07 trillion cubic meters or 91 per cent enters Bangladesh from upstream catchments and the rest are contributed by total internal rainfall

Flooded Area from 1954 to 2011



So, Flood Forecasting is very important! Who does it?

Institutional arrangements:

Flood Forecasting and Warning Center (FFWC), established in 1972, a wing of Bangladesh Water Development Board (BWD) is officially mandated to generate and disseminate the flood forecasting and warning to appropriate authority for further dissemination down to the community

Time period: Flood Information Center (FIC) of FFWC operates from 3rd week of May to October each year

FFWC 's Current Capacity in Flood Forecast

Very Short term flood forecast – 24 hours (1day)

Short Range flood forecast – up to 3 days

Short Range flood Forecast – up to 5 days (**started in 2013, supported by CDMP/UNDP**)

(These are deterministic type with specific values)

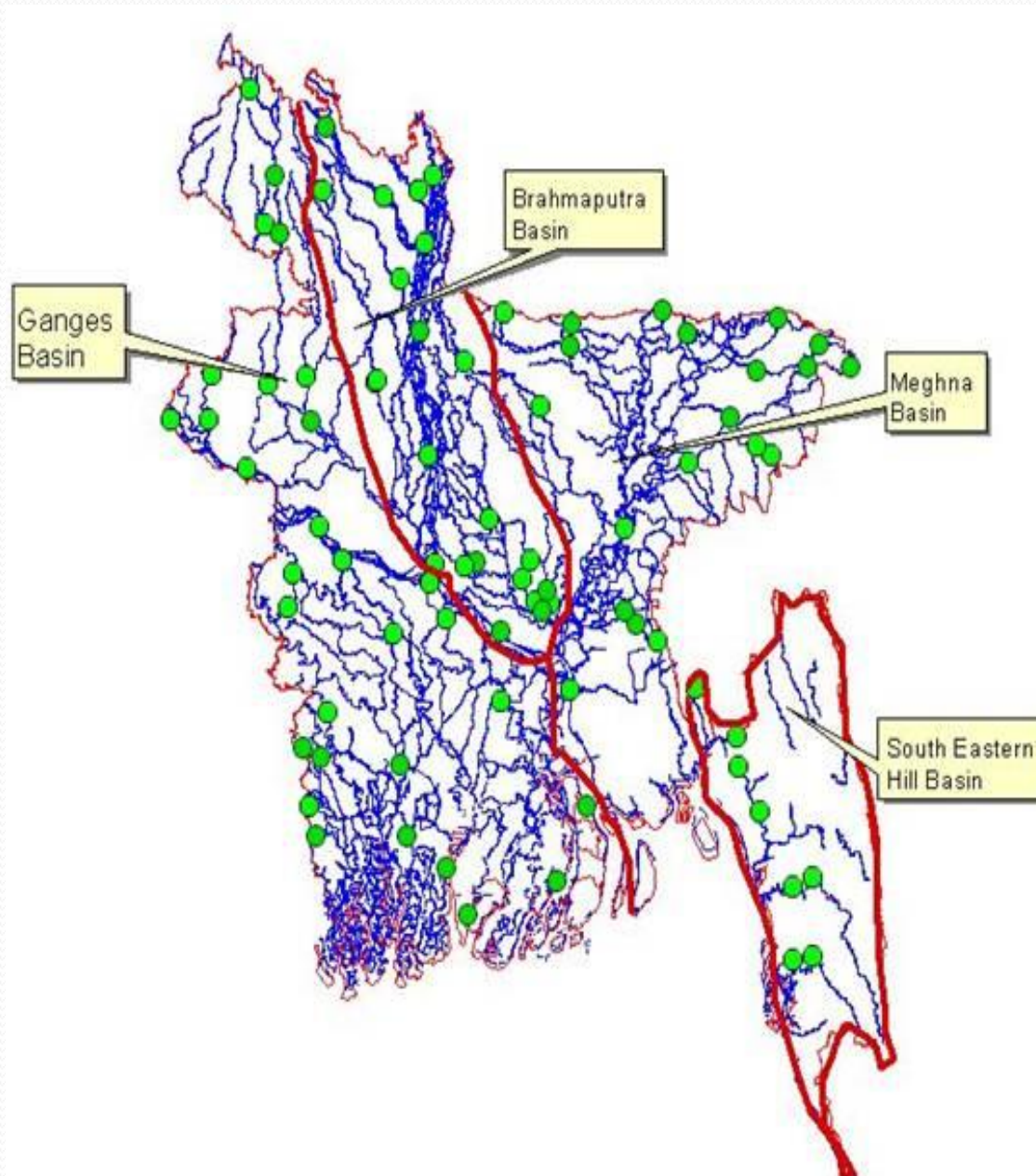
Medium range forecast – up to 10 days probability approach with upper band average and lower band

Flash flood forecast – **Started in 2012** (Experimental)

Long Rang/Seasonal – **Just started in 2014**(Experiment on going)

(Supported by CARE's SHOUHARDO Program/USAID)

For Flood Forecasting Purpose 4-Basins considered



CARE/SHOUHARDO's Contribution in Flood Forecasting

Enhancing Flood Early warning System for community based response in Bangladesh, SHOUHARDO II

Goal:

To increase lead time of flood forecasts for different scales and enhance resilience to and preparedness for flood risk in Bangladesh.

Objectives:

1. Expand medium range (1-10 days) flood forecast to other basin (i.e. Megna) and dissemination system to larger pilot area (i.e. 15 Unions);
2. Piloting flash flood early warning system at Sunamgang & Cox'Bazar area;
3. Operationalize long range (1-3 month) forecasts to five pilot areas.

Milestones of Flood Forecasting – CARE

2000-2005

**USAID/ADPC-
CFAB**

72 hrs day lead
time

add predictive
skills to current
efforts

- Model Dev. and
Experimental
Forecasts
- improvements in
data availability,
predictive
modeling
- promote Int'l
cooperative efforts
for sharing data

2006-2009

USAID/SHO U-I

Expanded lead
time, 5 (five)
piloting unions

- 1-10 days
probabilistic flood
forecasts

- 20-25 days
medium range
seasonal forecasts

- Conducted
empirical study to
develop flood
forecasts model

Technology
Transferred to
FFWC, physical
supports, capacity
building

2011-2014

USAID/SHOU II

Expanded area
15 unions

- Continued 1-10
days probabilistic
flood forecasts

- 20 -25 days
seasonal flood
outlook

- 1-3 months long-
range seasonal
forecasts

- Enhance flash
flood early
warning

- Capacity
building of FFWC
and communities.

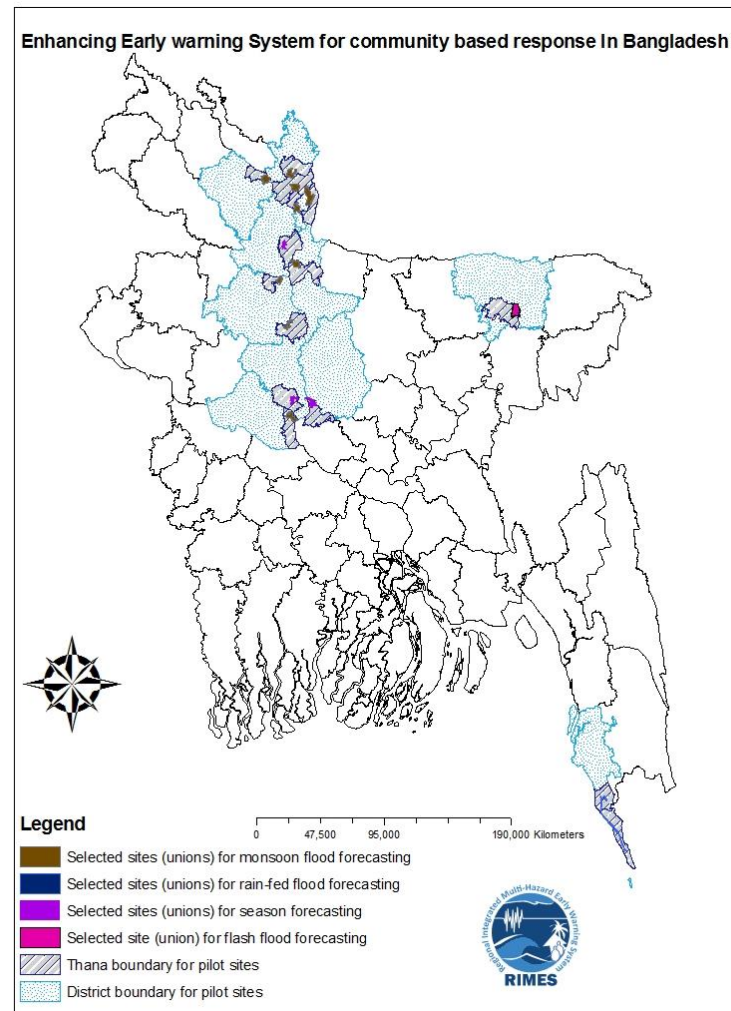
2014-2016

RIMES/FFWC

RIMES will
continue
support for
additional two
years

Project Locations

District	Upazilla	Union	Hazard type
Sunamganj	Derai	Jagaddal	Flash flood
Cox's Bazar	Teknaf	Baharchara	Rain fed flood
Cox's Bazar	Ukhiya	Jalia Palong	Rain fed flood
Jamalpur	Islampur	Kukandi	Monsoon flood
Bogra	Sonatola	Tekani Chulkainagar	Monsoon flood
Pabna	Bera	Haturia Nakalia	Monsoon flood
Kurigram	Chilmari	Chilmari	Monsoon flood
Kurigram	Kurigram Sadar	Mogalbachha	Monsoon flood
Kurigram	Ulipur	Hatia	Monsoon flood
Kurigram	Rowmari	Bondaber	Monsoon flood
Rangpur	Kaunia	Tepa Madhupur	Monsoon flood
Tangail	Nagarpur	Bekra	Monsoon flood
Gaibandha	Fulchhuri	Uria	Monsoon flood
Sirajganj	Shahjadpur	Kaizuri	Monsoon flood
Sirajganj	Kazipur	Maijbari	Monsoon flood



Major activities

- Extend the forecast boundary to Meghna Basin
- Extend the forecasts locations from 18 stations to 38 water level stations of FFWC
- Determination of rainfall intensity thresholds using historical rainfall and impacts data
- Integration of thresholds into flash flood model
- Dissemination of forecasts to the community
- Packaging 1-3 months forecasts
- Dissemination of forecasts product to different stakeholders and community
- Capacity building of FFWC professionals on forecasts technology
- Early Warning Audits at Pilot Districts/ Upazila/Unions

Forecasts Dissemination

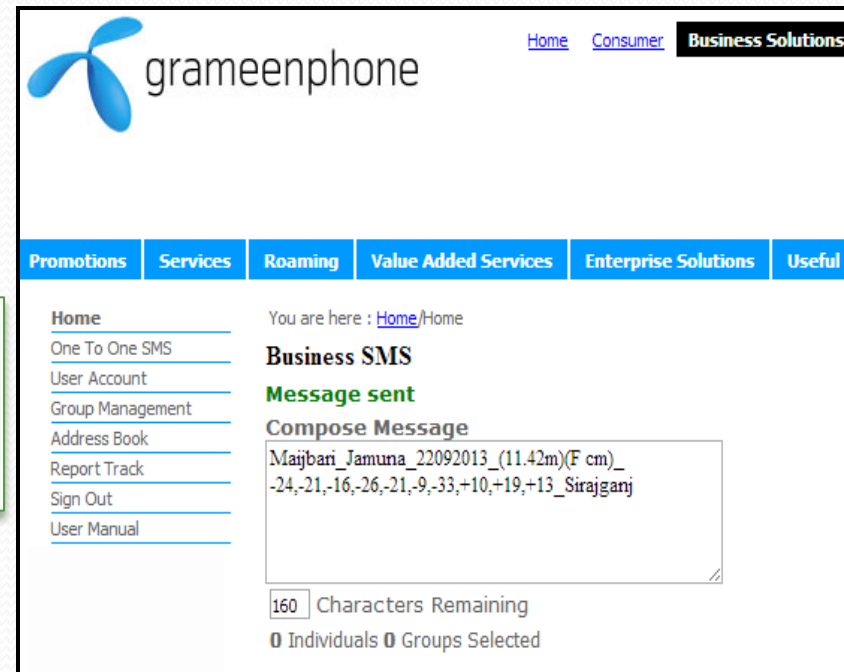
Website

E-mail (Nationals stakeholders, District and Union Information Centers)

SMS (SMS to DMC members in Pilot Unions)

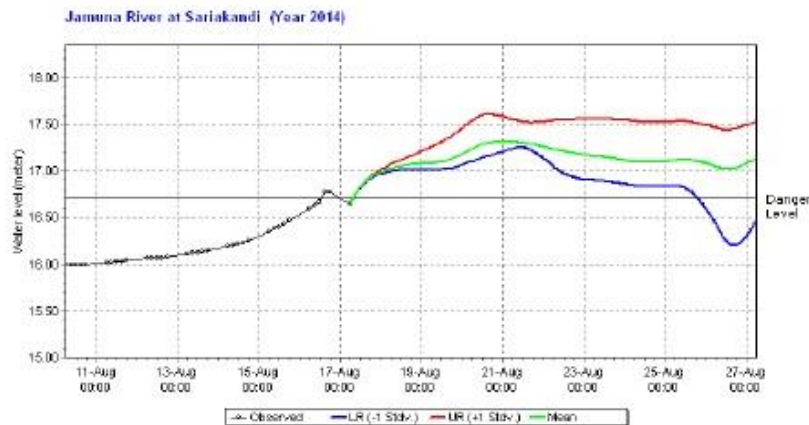
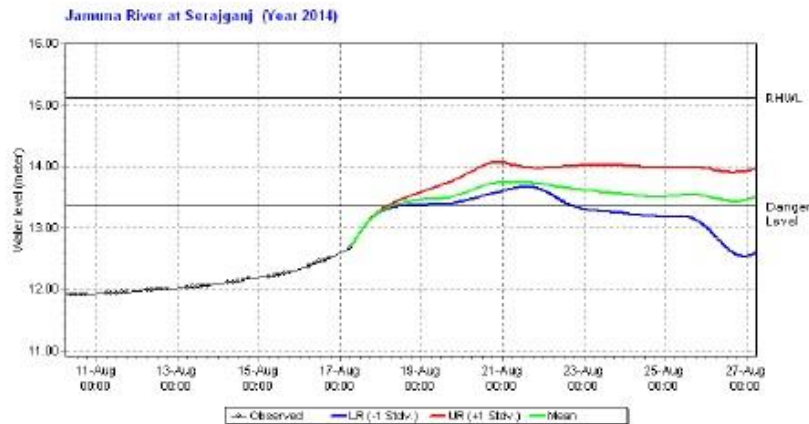
400 stakeholders received flood early warning during monsoon through SMS

120 UISCs and 100 different stakeholders received flood early warning through e-mail in Bangla



The screenshot shows the Grameenphone website interface. At the top, there is a logo for Grameenphone and navigation links for Home, Consumer, and Business Solutions. Below the logo, there is a horizontal menu with categories: Promotions, Services, Roaming, Value Added Services, Enterprise Solutions, and Useful. The main content area is divided into two columns. The left column contains a list of links: Home, One To One SMS, User Account, Group Management, Address Book, Report Track, Sign Out, and User Manual. The right column displays the current page path: You are here : Home/Home. Below this, there is a section for Business SMS, followed by a green message status: Message sent. Underneath, there is a Compose Message section with a text input field containing the message: Majbari_Jamuna_22092013_(11.42m)(F cm)_-24,-21,-16,-26,-21,-9,-33,+10,+19,+13_Sirajganj. At the bottom of the compose message section, there is a character count: 160 Characters Remaining, and a selection indicator: 0 Individuals 0 Groups Selected.

Medium Range Forecasting System



ilistic forecasts (51 ensemble series) on
Hardinge Bridge point)and ECMWF rainfall

tandard Deviation from the Mean and -1

rge and the mean rainfall forecast of all

it Board (BWDB) is acting as a background
rought out in FFWC model for this 10-day

with extreme care.

arning Center
lopment Board
com; ffwcbwdb@gmail.com

technical support from RIMES

Forecasts Dissemination.. Contd.

Webmail | Contact Us | Feedback
বাংলা | English

Updated On: 28 Apr 2014
Beta version! Information may vary with actual

Home About Us Data Forecast & Warning Map Reports Hydrograph Important Links Definitions

Pankha
Water Level : 13.48
Danger Level : 22.50

Severe

Monsoon

Basin

South Eastern Hill

Station Name	River Name	Station Name
Chiringa	Matamuhuri	Chank
Lama	Matamuhuri	Thakl
Dohazari	Sangu	Talbai
Bandarban	Sangu	Mawa
Panchpukuria	Halda	Pathe
Narayanhat	Halda	Dasm
Ramgarh	Feni	Rayer
Parshuram	Muhuri	Daula
		Mongl
		Kalige
		Shakr

1-10-Days-Forecast.pdf

Flood outlook of the following unions under Kurigram, Rangpur, Gaibandha, Bogra, Sirajganj and Tangail for next 10 days as on 19.08.2014:

এক নজরে কুড়িগ্রাম, রংপুর, গাইবান্ধা, বগুড়া, সিরাজগঞ্জ এবং টাঙ্গাইল জেলার নিম্নলিখিত ইউনিয়ন সমূহে ১৯/০৮/২০১৪ হতে আগামী ১০ দিনের সম্ভাব্য বন্যা পরিস্থিতি:

- হাতিয়াঃ বন্যা পরিস্থিতির অবনতি হতে পারে (+) (Flood situation may deteriorate)
- চিল মারীঃ বন্যা পরিস্থিতির অবনতি হতে পারে (+) (Flood situation may deteriorate)
- বন্দাবেরঃ পানি বাড়তে পারে এবং বিপদসীমা অতিক্রম করতে পারে (+) (Water level may rise and may cross danger level)
- মোঘল বাসাঃ পানি বাড়তে পারে এবং বিপদসীমা অতিক্রম করতে পারে (+) (Water level may rise and may cross danger level)
- টেপা মধুপুরঃ পানি বাড়তে পারে (+) (Water level may rise)
- উরিয়াঃ বন্যা পরিস্থিতির অবনতি হতে পারে (+) (Flood situation may deteriorate)
- টেকানি চুকায়নগরঃ পানি বাড়তে পারে এবং বিপদসীমা অতিক্রম করতে পারে (+) (Water level may rise and may cross danger level)
- মাইজবারিঃ পানি বাড়তে পারে এবং বিপদসীমা অতিক্রম করতে পারে (+) (Water level may rise and may cross danger level)
- হাটুরিয়া নাকালিয়াঃ পানি বাড়তে পারে (+) (Water level may rise)
- কুলকান্দিঃ বন্যা পরিস্থিতির অবনতি হতে পারে (+) (Flood situation may deteriorate)
- কৈজুরীঃ পানি বাড়তে পারে এবং বিপদসীমা অতিক্রম করতে পারে (+) (Water level may rise and may cross danger level)
- বেকড়াঃ পানি বাড়তে পারে (+) (Water level may rise)

বিস্তারিত জানতে www.ffwc.gov.bd ওয়েবসাইট টি দেখুন। (Please visit www.ffwc.gov.bd for details)। প্রধান প্রধান নদ+নদীর বন্যা পরিস্থিতি সম্পর্কে জানতে যে কোন মোবাইল ফোন থেকে ১০৯৪১ নম্বরে ফোন করে ৫ চাপুন।(To know the flood situation of major river, dial 10941 from any mobile and press 5)

Community Capacity Building

Step 5: Report preparation

Step 4: Data compilation and analysis

Step 3: Field survey: Workshop with UDMC, House hold survey, information from organization, visit to vulnerable areas

Step 2: Preparation of check list: Literature review and consultation

Step: 1 Problem analysis

Sectoral Preparedness Plan

Sl.	Sector	Early warning effect on flood preparedness
1	Agriculture	<ul style="list-style-type: none">• steady starting of crop harvesting• UDMC could do meeting with the head of Para (segment of village) regarding preparation to rescue the assets and life from flood• arrangement of seed bed on high land
2	Fisheries	<ul style="list-style-type: none">• repairing and heightening the pond dyke• harvesting and selling of fish in the market• no immediate new recruitment
3	Livestock and poultry	<ul style="list-style-type: none">• raising of farm house plinth• stocking of fodder for emergency period• arrange higher and safer places to shift their lives
4	Households & Homestead	<ul style="list-style-type: none">• making arrangement of shifting the valuable assets to higher and safer places (e.g. embankment, school /madrassa)• raising the plinth level of dwelling house

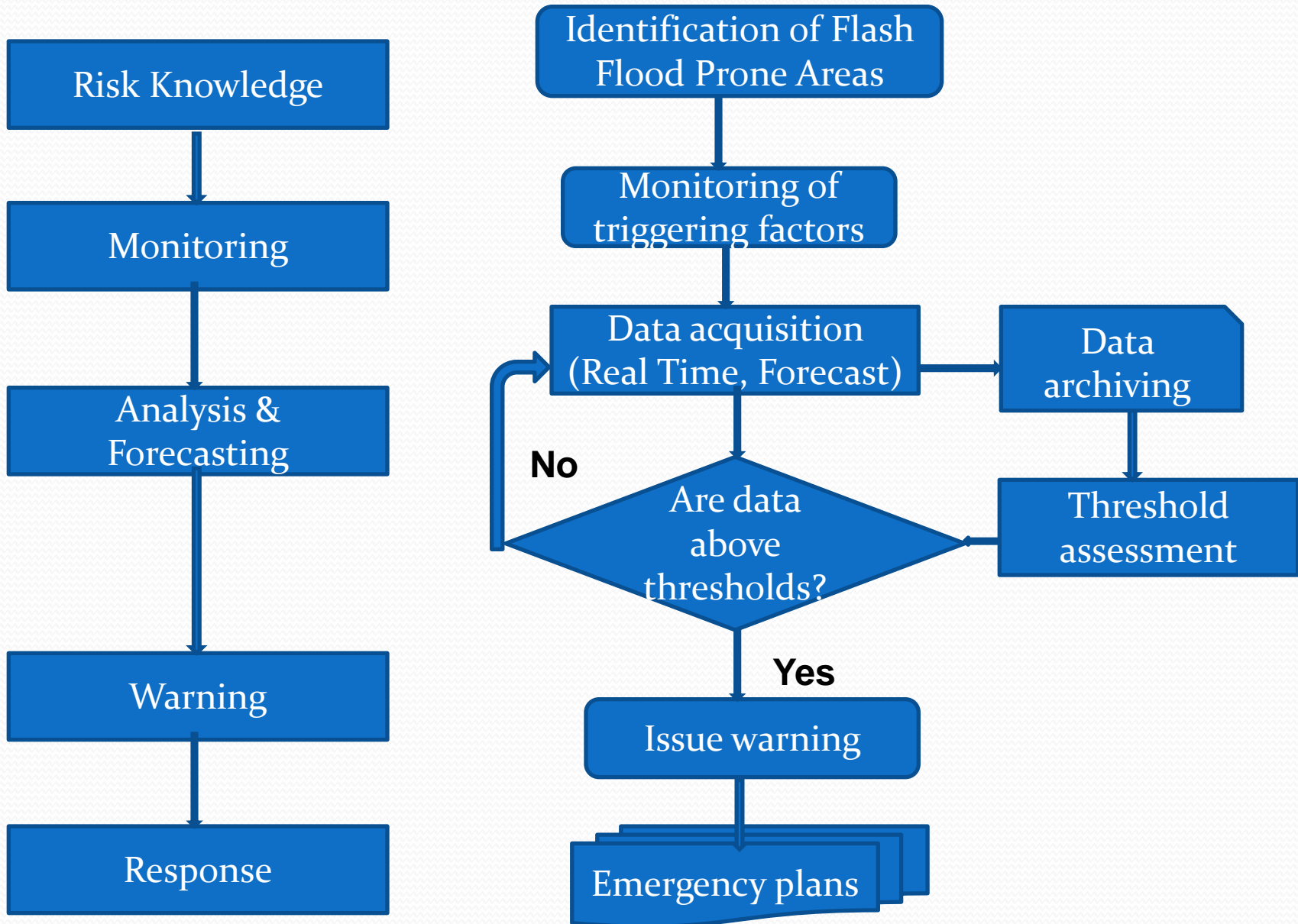
Sectoral Preparedness Plan ... Contd.

Sl.	Sector	Early warning effect on flood preparedness
5	Business	<ul style="list-style-type: none"> • steady storage of daily commodities (e.g. rice, pulse, salt, oil, etc.) • repairing the shops and heightening the godown/warehouse • arrangement of boat for carrying goods • regular selling of goods
6	Health and life	<ul style="list-style-type: none"> • formation of medical team by NGO • collection of emergency and medicine
7	Drinking water sources	<ul style="list-style-type: none"> • steady arrangement of more water reservoirs • heightening the tube well head by adding extra pipes • collection of water purification tablet (Halotab) and potash alum
8	Sanitation	<ul style="list-style-type: none"> • arrangement of bamboo chati /jute carpet, rope, steel wire, spike, bamboo, etc. for making temporary latrine • arrangement of sanitary facility at nearby safer places (e.g. embankment) • arrangement of boat
9	Communication	<ul style="list-style-type: none"> • arrangement of bamboo to construct bridge from one house to another and to connect high land • arrangement of small boat

Damage Reduction Based on EWS

Item	Lead time	Damage reduction (%)	Actions taken to reduce damages
Household items	24 hrs	20	Removal of some household items
	48 hrs	80	Removal of additional possessions
	Up to 7 days	90	Removal of all possible possessions including stored crops
Livestock	24 hrs	10	Poultry moved to safety
	48 hrs	40	Poultry, farm animals moved to safety
	Up to 7 days	45	Poultry, farm animals, forages, straw moved to safety
Agriculture	24 hrs	10	Agricultural implements and equipment removed
	48 hrs	30	Nurseries, seed beds saved, 50% of crop harvested, agricultural implements and equipment removed
	Up to 7 days	70	Nurseries, seed beds saved, fruit trees harvested, 100% of crop harvested, agricultural implements and equipment removed

Elements of Flash Flood Warning System



Methodology

- Assessment of rainfall intensity-duration thresholds
- Analysis of flash flood potential using observed and forecasted rainfall and thresholds
- Development of web-based system for flash-flood advisory by integrating thresholds with rainfall forecast


Assessment of rainfall intensity – duration thresholds

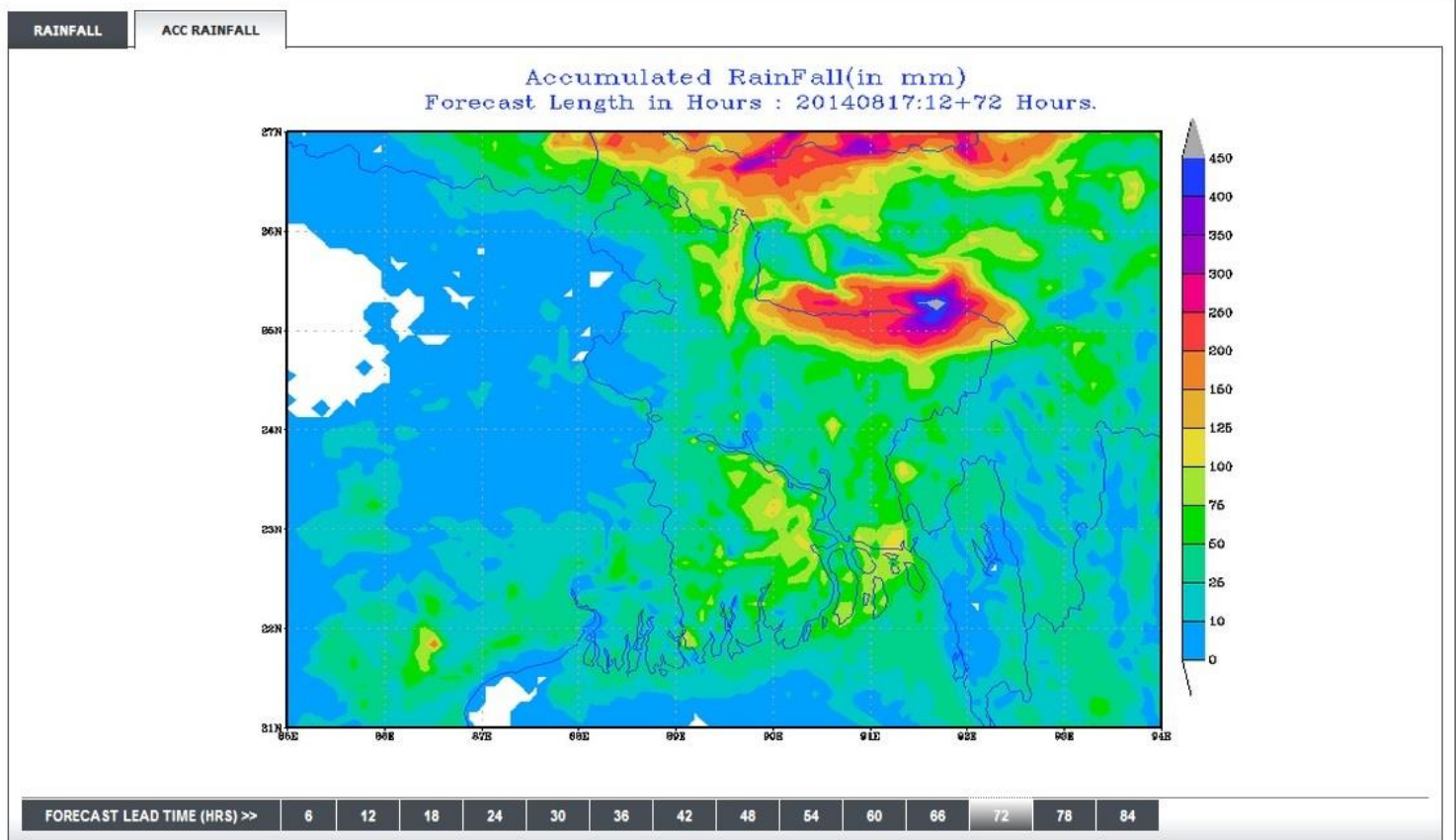
- Collection of historical flash flood event data
- Matching of historical flash flood event with rainfall event
- Finding peak rainfall intensities that have initiated flash floods in the area
- Plotting intensity-duration values in log-log scale
- Finding the lower limit of intensity-duration relationship as threshold intensity

Flash Flood Analysis



- Station Details
- Rainfall Data Analysis
- Flash Flood Analysis ▾
- User Details
- Advisory Composition
- Logout

Select Rainfall Type: WRF 3 Days Forecast ▾ Select Stations: Sylhet ▾ Date of Forecast: 18 August 2014 



Flash Flood Analysis

Accumulated Rainfall of Sylhet (mm)			
Duration (hrs)	18-08-2014	19-08-2014	20-08-2014
24	28	87.91	56.78
48	56	115.91	144.69
72	56	143.91	172.69
120	56	143.91	200.69
168	56	143.91	200.69
240	56	143.91	200.69
Advisory	NFF	FRW	FRW

Flash Flood Advisory	
FRW: Flash Flood Warning	Flash Flood Warning on 19-08-2014 to 20-08-2014
FFA: Flash Flood Alert	-
NFF: No Flash Flood	No Flash Flood on 18-08-2014

Create Advisory

Web-based Dissemination System



Station Details

Rainfall Data Analysis

Flash Flood Analysis

User Details

Advisory Composition ▾

Logout

Select Station: Sylhet ▾

Select Users: Md. Javed Hossain ▾

Select Date: 10 September 2014 

SUBMIT

Create Advisory

Name:	Md. Javed Hossain
Email:	javed@rimes.int
Mobile:	8801746482207
Station:	Sylhet
Weather Update:	Rainfall : mm Temperature Min : °C Temperature Max : °C Source : Bangladesh Meteorological Department
Advisory: Built from model Char :: 142/160	No Flash Flood on 10-09-2014 to 19-09-2014 Based on ECMWF Forecast. No Flash Flood on 10-09-2014 to 12-09-2014 Based on WRF Forecast.
<input type="button" value="Send Email"/> <input type="button" value="Send SMS"/> <input type="button" value="Update Information"/>	

Capacity Building of FFWC

- Training on 20-21 August 2013 at FFWC
- Secondment Training on 12 January – 11 March 2014 at RIMES, Bangkok
- Training on 28-29 April 2014 at FFWC



Training and Capacity Building at Community Level

- Community consultation meeting on 18 July 2012 at Jagdal
- Training workshop on 26 February 2014 at Sunamganj
- Training workshop on 15 June 2014 at Sunamganj
- Training workshop on 17 June 2014 at Jaliapalong, Cox's Bazaar



Community Capacity Building



About 150 people trained on flood early warning system including community representatives (LGI) and NGO representatives

Major Outcomes: SHOUHARDO II

- Expansion of medium range (1-10 days) probabilistic forecast coverage
 - Modification of forecast models
 - Extension of forecast stations (18 to 38 points)
 - Calibration and validation of models
 - Automation of model
- Development of Flash flood forecasting system
 - Rainfall threshold analysis in flash flood pilot areas
 - Establishment of Real Time rainfall station in Sylhet and Cox's Bazar
 - Web based flash flood guidance and dissemination system development
- Innovative seasonal flow outlook generation system development
 - Use of ECMWF seasonal rainfall forecast to generate seasonal flow outlook
 - Web-based decision support system for advisory generation and dissemination
- Enhanced capacity of FFWC/BWDB in operational medium and long range flood forecasting
 - Technology transferred for improved computation (models, equipments e.g server)
 - Training on newly evolved technologies and refresher training before monsoon
- Extended reach of flood forecast
 - Dissemination of forecast through FFWC website, e-mails (Bangla & English) and text SMSs to LGIs, UDMC, UDC, NGO representatives and volunteers
 - Training of LGIs, UDMC, UDC, IP representatives on new probabilistic forecast products
- Strengthening of community preparedness and response
 - Guidance on the use of probabilistic forecasts in making decisions to reduce flood risks to livelihoods
 - Trainings and Refresher trainings before the monsoon season and transfer of knowledge on how longer lead forecast can add value and building confidence over time

Community Preparedness and Response

- ❖ Plan to evacuate and identify high grounds
- ❖ Plan to store dry food and safe drinking water
- ❖ Secure cattle, poultry birds, homestead vegetables, protect fishery by putting nets in advance
- ❖ Secure cooking stove, small vessels, firewood and animal dry fodder
- ❖ Plan for alternative livelihood options immediately after flooding (e.g. Small scale fishing, boat making)



Sustainability

- **Sustainability of transferred technology:** RIMES is going to assist FFWC through a handholding approach until these systems and tools are fully integrated into FFWC's operational systems.
- **Sustainability of transferred equipments:** FFWC/BWDB has taken the responsibility of operation and maintenance of equipments like telemetry rain gauges and server system.
- **Sustainability of data management system:** Besides other assistances to FFWC, RIMES will be backing up with necessary data in their own server to support any operational failure at FFWC
- **Sustainability of community linkage:** The email addresses of the 172 union digital center of the SHOUHARDO-II working area has been incorporated in the FFWC system by RIMES to ensure continued future dissemination of forecast.
- RIMES shall integrate support for monitoring of local level application activities into ongoing and pipeline projects.
- RIMES shall advocate for up-scaling of project initiatives to cover larger areas in Bangladesh.

Areas of Improvements

- **More frequent calibration of models at FFWC is required for better forecast**
 - yearly calibration is required to keep pace with the river dynamics
- **Limited capacity of flash flood forecasting system**
 - requires research and development for incorporating factors other than rainfall and considering transboundary basin properties
 - requires consideration of basin average rainfall rather than point rainfall
 - bias-correction of forecast rainfall
- **Downloading different data for models was tedious**
 - enhancement of internet capacity at FFWC
- **Unable to interpret forecast messages by some receivers at local level**
 - illiteracy & language: voice and Bangla SMS is preferred
 - more vigorous and longer term training required for potential message receivers
 - stronger linkage and interaction between FFWC and volunteers/Digital Center entrepreneurs working at the root level is necessary
- **Limited application of forecast at some areas**
 - generation of advisory based on the forecast products is necessary
 - stronger involvement of other government stakeholders like Department of Agricultural Extension (DAE) is required
 - adequate time is required for piloting seasonal forecast and storm surge inundation model results
- **Limited monitoring and documentation of community responses**

Major Challenges

- **Retaining trained personnel** is a major challenge in capacity building
 - trained professionals from other relevant divisions of BWDB in addition to FFWC professionals
 - motivated young professionals to get involved in research in the newly evolved probabilistic flood forecasting
- **Continuous training and capacity building of FFWC professionals**
- **Downloading large volume of data** required for models with limited internet capacity is another major challenge
 - one dedicated internet connection is provided exclusively in the server provided by RIMES at FFWC
 - alternate downloading options have been explored depending on the data availability
- **Frequent change of mobile phone numbers** of the stakeholders receiving forecast/early warning message in the pilot areas
- **Communicating uncertainty** associated with the probabilistic forecast to the end users

Recommendations

- Continuous improvement of flood forecasting system model based on regular evaluation and addition of alternative computational schemes
- Development of decision support system involving multiple models and on a more localized scale and generation of flood maps
- Develop institutional mechanism to retain staff whom capacity built within FFWC a
- FFWC to technically and technologically equipped to respond to user needs
- Explore the use of preferred dissemination mechanisms like Bangla voice message broadcast/SMS broadcast, community radio etc.
- Continuous training of local level disaster managers before monsoon onset
- Testing of seasonal flow model results for several years
- Increase access of women to forecasts and undertake special awareness program on flood early warning targeting women
- Improve infrastructural (e.g. flood/cyclone shelters) and resource (e.g. rescue boats) capacity of the community to make quicker response and utilize the maximum lead time
- Advisory generation for different sectors (e.g. agriculture, livestock, fisheries, health) at upazila level based on medium range flood forecast or seasonal flow outlook to increase practical implication
- Improve linkage of FFWC/BMD and Department of Disaster Management with the grass root communities throughout the year

Thank You !

For Technical Clarifications:

Mr. Amirul Hossain, Executive Engineer, FFWC

Email: amirulbd63@yahoo.com

Bangladesh Water development Board

Ministry of Water Resources