



National Early Action Protocol for Cyclone in Bangladesh

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List of Abbreviation

AA	Anticipatory Action
ADCIRC	Advanced Three-Dimensional Circulation Model for Shelves, Coasts and Estuaries
AmRC	American Red Cross
AS	Arabian Sea
BAMIS	Bangladesh Agro-Meteorological Information Service
BDRCS	Bangladesh Red Crescent Society
BMD	Bangladesh Meteorological Department
BoB	Bay of Bengal
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CARIAA	The Collaborative Adaptation Research Initiative in Africa and Asia
CBO	Community-Based Organization
CCM	Cyclone Classifier Model
CPP	Cyclone Preparedness Program
CZ	Coastal Zone
DC	District Commissioner
DDM	Department of Disaster Management
DMC	Disaster Management Committee
DoF	Department of Fisheries
DPHE	Department of Public Health Engineering
DREF	Disaster Response Emergency Fund
EA	Early Action
ECMWF	European Centre for Medium-Range Weather Forecasts
EIMS	Environment and Infrastructure Solution Limited
FbF	Forecast based Financing
FGD	Focused Group Discussion
GFS	Global Forecast System
GRC	German Red Cross
IBF	Impact Based Forecasting
IFRC	International Federation of Red Cross and Red Crescent Societies
IMD	Indian Meteorological Department
INCOIS	Indian National Centre for Ocean Information Services

INGO	International Non-Government Organizations
IWFM	Institution of Water and Flood Management
JMA	Japan Meteorological Agency
JTWC	Joint Typhoon Warning Center
KII	Key Informant Interview
LGED	Local Government Engineering Department
MRI	Meteorological Research Institute
NCEP	National Centers for Environmental Prediction
NEAP	National Early Action Protocol
NFI	Non-Food Items
NGO	Non-Government Organization
RA	Readiness Action
RCCC	Red Cross Red Crescent Climate Center
RIMES	Regional Integrated Multi-Hazard Early Warning System
RSMC	Regional Specialized Meteorological Centre
SOD	Standing Orders on Disaster
STEP	Skills and Training Enhancement Project
TWG	Technical Working Groups
UDMC	Union Disaster Management Committee
UKMO	UK Met Office
UN	United Nations
UNO	Upazilla Nirbahi Officer
UNICEF	United Nations Children's Fund
UNRC	United Nations Resident Coordinator
UN-CERF	United Nations Central Emergency Response Fund
UzDMC	Upazila Disaster Management Committee
WASH	Water, sanitation, and hygiene
WFP	World Food Programme
WMO	World Meteorological Organization

1. Background

1.1. Introduction

The goal of National Disaster Management Policy, 2015 of Bangladesh highlights the disaster risk reduction for the vulnerable people having the capacity to take measures during large scale disaster for effective response. This is in line with 4th priority action in the Sendai Framework for Disaster Risk Reduction (2015-2030) for enhancing disaster preparedness for effective response. Besides, UN movement emphasizes on early warning for all. The computational capacity has been enhanced in many folds in past decades and the hydro-meteorological forecast modeling capacity has also substantially been improved. Hence it is not necessary to wait for disaster, better to act before the disaster in place based on available and reliable weather forecast.

In recent years, early action for reducing the risk of disasters has become one of the proven concepts. Early action promotes to prepare in advance and building resilience. The geography of Bangladesh makes it prone to tropical cyclones. Moreover, a large number of population as well its high density of population makes it more susceptible to the devastating impacts of natural disasters including tropical cyclone. An early action protocol for cyclone is therefore crucial due to its vulnerability to frequent visits of severe cyclonic events. The Early Action Protocol (EAP) refers to cyclone related early actions which are triggered by a skilled forecast.

In recent decades, though the preparedness program of cyclone by the government and development partners (CPP, BDRCS and other sectoral actors) has been improved substantially in saving lives, but cyclone is still caused for significant damage to livelihood, assets, and developments. Several organizations are working in Early Warning and Early Actions with the aim of reducing the damage through building resilience (Detail in Annex A), but there is no national EAP in place. Therefore, a National EAP is needed to facilitate a cohesive approach to early action through enhancement of coordination among stakeholders/actors for optimum utilization of available resources.

In this context, CPP has engaged Environment and Infrastructure Management Solution (EIMS) Limited to accumulate the knowledge and formulate a harmonize EAP. The National Early Action Protocol (NEAP) has been designed by providing the activities for the selected actors to be implemented in a particular lead time, at the time it is activated based on good forecast. The EAP defines clearly: who takes what action when, where, and with what funds. In the protocol, there must be pre-agreed trigger mechanism (activation thresholds with likelihood), early actions and funding to reduce forecasted impact of exposed vulnerable community. The successful implementation of the EAP needs a coordinated approach among various entities, including Government Authorities, Non-Governmental

Organizations (NGOs), humanitarian aid, International Organizations, such as the United Nations agencies, IFRC, Red Cross and Red Crescent societies, Local Communities, Meteorological Services and Weather forecasting agencies, Media and Communication Channels. The taskforce will lead the coordination and the protocol to harmonize different initiatives by different actors of different sectors. Mainly, the NEAP is a guideline for three categories of users:

- a) Actors of AA to guide to select actions, how to act, and where to act;
- b) TWG of FbF/A who are agreed with the principle and the criteria of the trigger mechanism
- c) Task force (with support from TWG) to screen new initiatives, give directives in term of locations and actions, and coordinated sector managers/Actors.

1.2. Purpose

The purpose of National Early Action Protocol is to ***develop a guideline for anticipatory actions using skillful forecast with defined coordination(s)*** for the ***taskforce and other partners***. The NEAP has been developed for the early actions and readiness actions at different stages of trigger mechanism for multi-sectoral use.

Therefore, the NEAP will help to reduce the cyclone impact and sufferings in the vulnerable coastal community of Bangladesh by ensuring synchronize efforts of multiple actors for consideration of anticipatory actions for cyclone risk management.

1.3. Approach

This EAP has been formulated by following two major elements of EAP that include setting up the threshold for trigger and harmonized early actions considering optimum resource allocation.

a. Triggers and threshold setting:

EAP needs a trigger model to activate the readiness and early actions. The trigger model has been developed based on risk analysis of natural hazards including exposure and vulnerability; defining extreme events as hazard, assessing the past impacts; and weather forecasts. Desk review has been conducted to understand the risk and impact of cyclone in different likelihood. In addition, the impact of thresholds and understand the demand of EA and its time need have been defined from literature (previous EAP), FGD and KII (Annex B). Then, the trigger model has been developed to understand ***when*** to act and ***where to act***? Furthermore, the trigger for activation of different threshold readiness of government, community, humanitarian additional assistance and considered. It is mentionable that the pre-agreed criteria in the trigger model may vary with sectoral perspective and likelihoods of impact.

b. Early actions:

Actions at different levels for different actors like government and other actors have been defined based on current practice and demand of the community and capacity of the actors. The readiness actions as well as the early action of government and other actors has been defined based on sectoral needs and effectiveness of early actions at different stages of cyclone forecast and likelihood of impact. The relevant capacity of the actors has also been explored along with their financial mechanisms from project(s)/programme(s) review.

The approach can be summarized below (Figure 1):

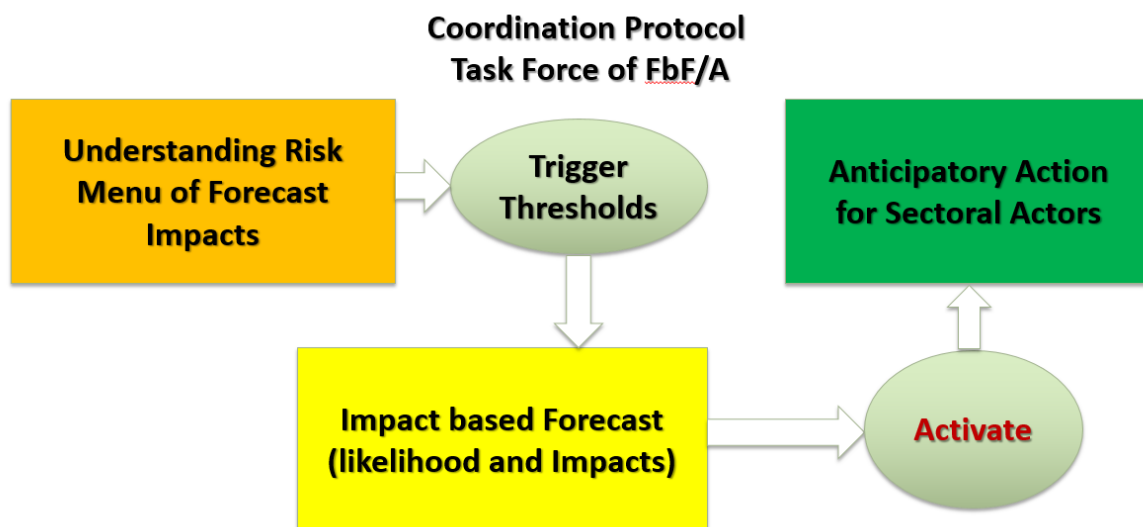


Figure 1: Approach for Early Action Protocol

2. Understanding Risk

One of the important components of EAP is to understand the risk of cyclone for an area as well as targeted communities and population. DREF- EAP is a proven method development for understanding cyclone risk, which has been followed here. In this method the risk of cyclone has been explained using two basic parameters of exposure and vulnerabilities of respective area.

2.1. Exposure and Impact

The coastal zone of Bangladesh consists of 19 administrative districts, which are close proximity of the Bay of Bengal. These districts are divided in two groups considering the impacts of cyclone such as exposed coast and interior coast as per the Coastal Development Strategy (2006). The districts which are directly coast facing or connected to be the Bay of Bengal (BoB) are considered as directly exposed to cyclone.

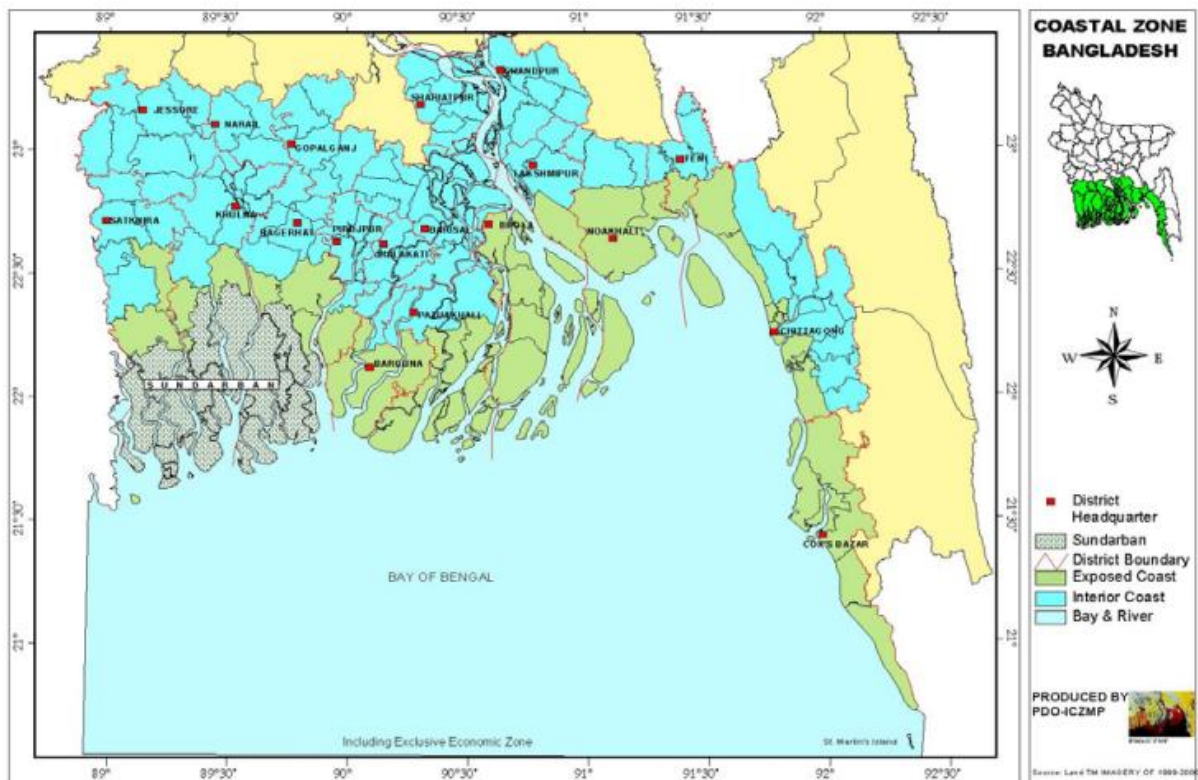
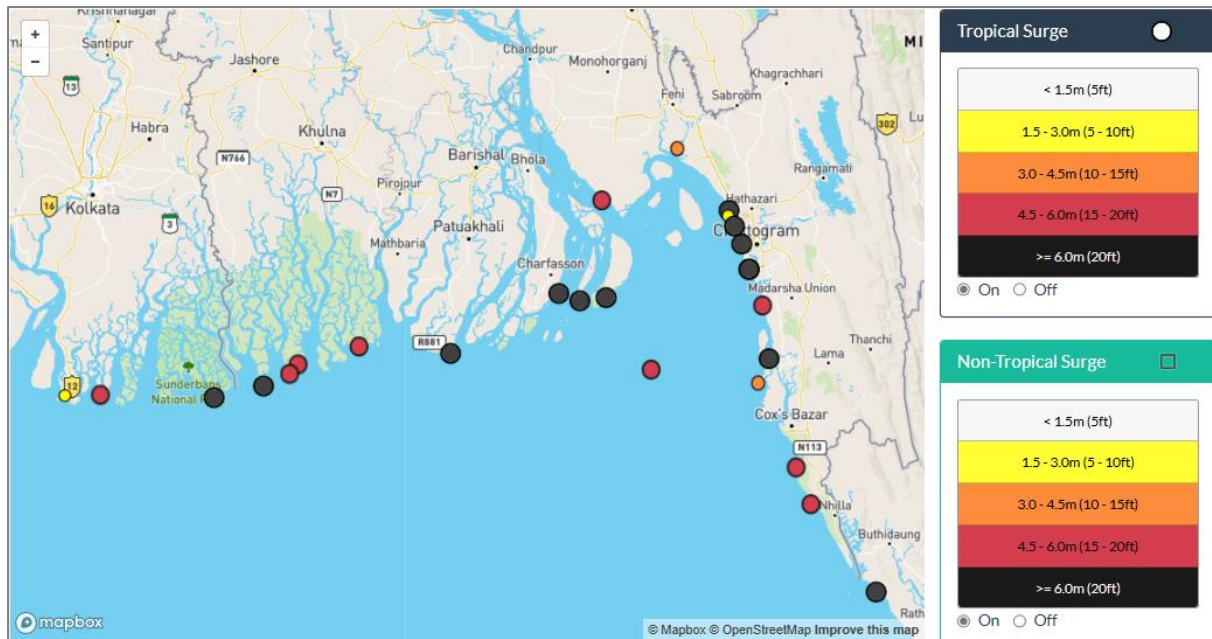


Figure 2: The coastal zone of Bangladesh (Coastal Development Strategy, 2006)

The exposed area is more vulnerable for higher storm surge and wind. The Global Peak Surge Map has developed an interactive map of world showing historical storm surge height of different cyclones (<https://surge.climate.lsu.edu/data.html#GlobalMap>). A snapshot of the storm surge map highlighting Bangladesh coast has been shown below (Figure 3).



Source: <https://surge.climate.lsu.edu/data.html#GlobalMap>

Figure 3: Historical Storm surge map of Bangladesh coast

In the National Water Management Plan (2001) the coastal area of Bangladesh has been divided into different hydrological zones like Southwest, Southcentral and Southeast; and accordingly, the coastal zone has been classified into three different zones such as western zone, central zone, eastern zone to understand the impact with different magnitude.

The tropical cyclone has various impacts (Detail in Annex C) depending on its intensity and time of the land fall on the vulnerable exposed area with sub hazards like wind, storm surge flooding, rainfall induced flash flood and landslides. This impact of sub hazards of cyclone varies with the location/zone of the impacted area. In the western zone, there is a sea facing Sundarban which will minimise the impact of wind. Besides, in central zone there are more numbers of rivers compared to the other zones, which has made this zone more vulnerable to storm surge. And in the eastern zone, due to hilly terrain risk of landslides are frequent. Zone wise severity of the impact of tropical cyclone is given in the following table.

	Western Zone	Central Zone	Eastern Zone
Wind	Moderate	High	High
Storm surge	Moderate	High	High
Rainfall	Low	Low	High

Strong wind and surge from tropical cyclone formed over the BoB effects the rural houses such as *Kutcha* and semi-pucca houses. Recent study by GRC/RCCC for BDRCS shows that the impact of wind speed on the rural houses at different zones also varies (Figure 4). The Figure 4 shows that, within the

wind speed of 150km/hr, the impact is less in western zone compare to the other two zones, as the Sundarbans contributes to reduce the wind impact. But, when the wind speed exceeds 150 km/hr, the impact is comparatively higher in the western zone.

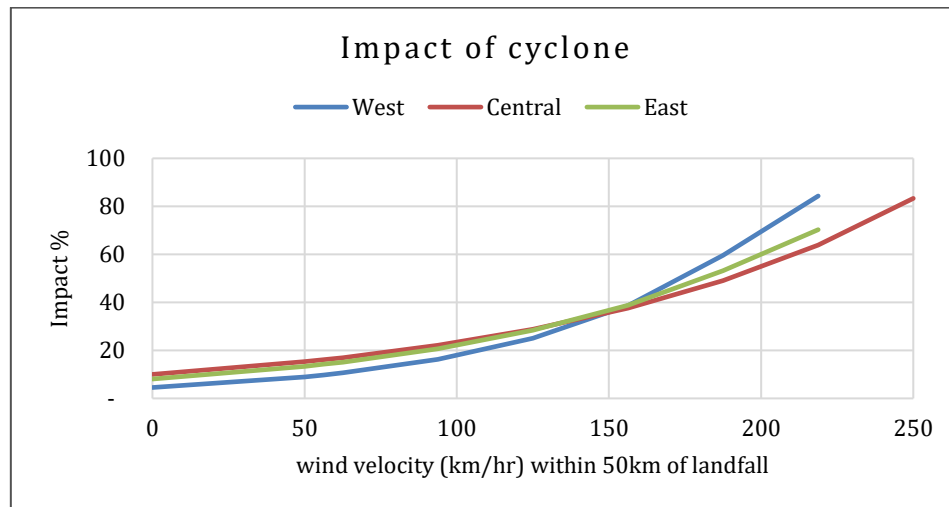


Figure 4: Impact of wind at different category at different zones (EAP Cyclone Bangladesh, BDRCS)

The combined effect of storm surge and wind is more destructive on rural infrastructures. Research has been conducted by IWFM to understand the combined effect of wind and storm surge on rural structure using mathematical model simulation (Zaman et.al. 2018). From the research it is found that about 46% rural houses (among the 100 sample houses from three zones) are with wooden frame. From the available data of structural failure due to wind for the rural houses, it is found that three types of structural failures occur during the cyclone wind effect. These are (a) uplift of the roof shed made by CGI sheet or any other local roofing materials (b) tilting of major structural elements especially vertical posts due to torsional effect with orthogonal wind action and (c) overturning of whole structure due to both combined effects.

Numerical models simulated result of the houses have been analyzed against wind speeds ranging from 25 kmph to 175 kmph with surge heights of 0.305 m (1 ft.) to 1.2 m (4 ft.) Under this modelling approach wind forces are applied at perpendicular to each principal axis of the structure in conjunction with a torsional moment and are considered separately for each principal axis. Once the design of all the houses is finalized, the damage level of houses has been defined and the result is given in the Table 1.

Table 1: Impact of wind and storm surge on wooden structure

		Wind Speed (km/h)					
		50	75	100	125	150	175
Surge Depth (m) from plinth level	>2.0	F	F	F	F	F	F
	1.0-2.0	F	F	F	F	F	F
	0.5-1.0	P	P	P	P	F	F
	No Surge	L	L	P	P	F	F
N.B: Where water velocities do not exceed 3.0 m/s, dynamic effects of moving water have been converted into equivalent hydrostatic loads by increasing still water depth							
L= Low Damage; P= Partial Damage; F= Full Damage							

From the analysis, it is indicated that, when there is no storm surge, and wind speeds lie ranging from 50 to 75 km/h damage does not occur to the wooden structure. However, when a storm surge occurs with a depth of 0.5 to 1.0 meters, the extent of partial damage happens even when the wind speed is 50-70 km/hr. The model result shows that the storm surge height over 1m on the land causes full damage of houses structure which are made with wood.

2.2. Vulnerability

There are several methods for vulnerability assessment. For the prioritization of the intervention, the vulnerability index is an important one at union level. An approach for the assessment of cyclone vulnerability has already been used by BDRCS (DREF funding for Cyclone EAP) and the vulnerability data base prepared by BDRCS for DREF EAP is available and useful up to union level. Besides, INFORM Risk Index method is available for all the upazilas in Bangladesh. Hence, for national EAP, the approach proven by DREF EAP Cyclone has been proposed to use for 14 coastal districts of Bangladesh, as it is simple, easy to use and an updated one. This vulnerability assessment includes the indicators of socio-economic condition of the respective areas, physical infrastructures, and institutional capacity. Vulnerability assessment has been conducted based on the information of dependent population, poverty level, structures of the houses, access to cyclone shelter and the ratio of CPP volunteers with respect to total population. It is important to mention that; the vulnerability assessment does not consider the exposure category; it only considers the above-mentioned indicators of the respective area.

In the coastal districts, on about 17% people are dependent population whose age is more than 65 years or less than 5 years. Besides, in Pirojpur and Satkhira Districts about 30% population and in Khulna and Bagerhat districts about 23% population are living under the poverty line. In Patuakhali district about 83% houses and in Pirojpur, Laksmipur, Bagerhat, Noakhali districts about 80% houses are classified as *Kutcha* and *Jhupri* (BBS, 2011). Besides the number of cyclone shelter and the number

of CPP volunteers have been assessed to understand the vulnerability of the districts. And the final vulnerability map has been referred to Figure 5. And a detail vulnerability assessment has been shown for one district in Figure 6.

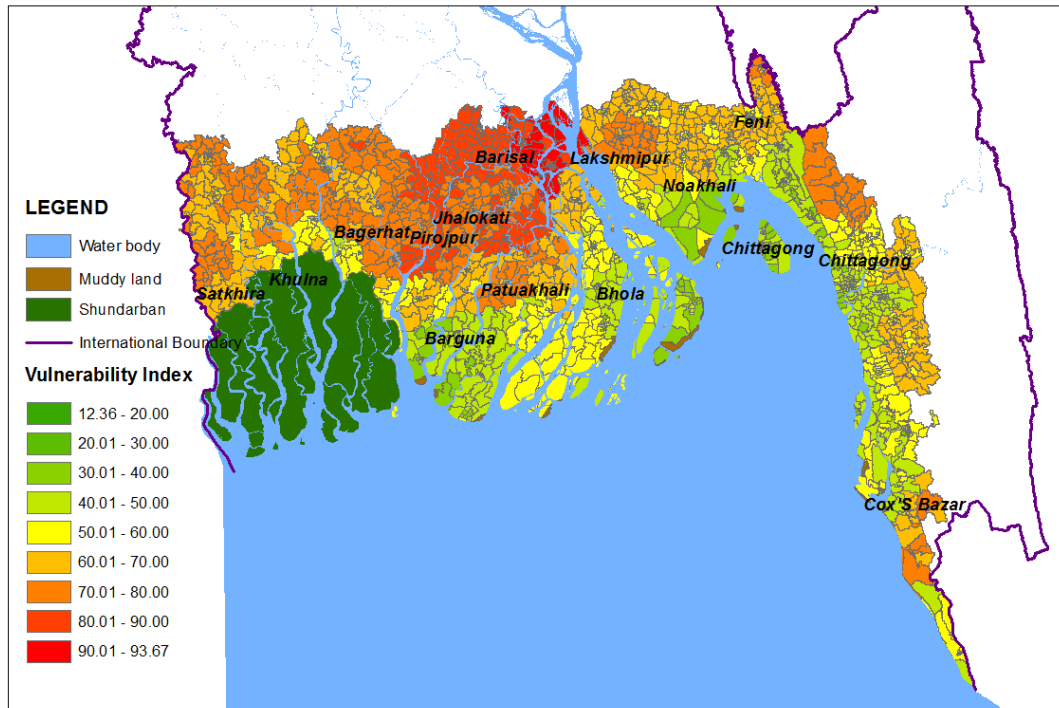
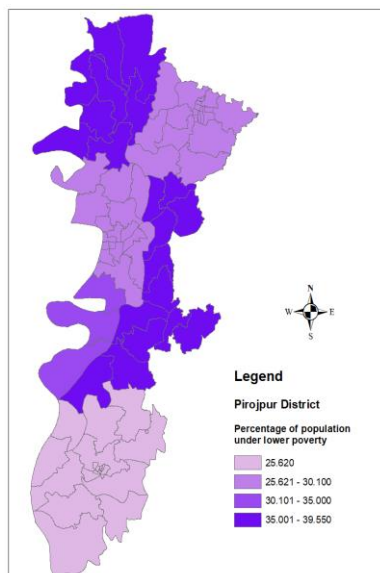
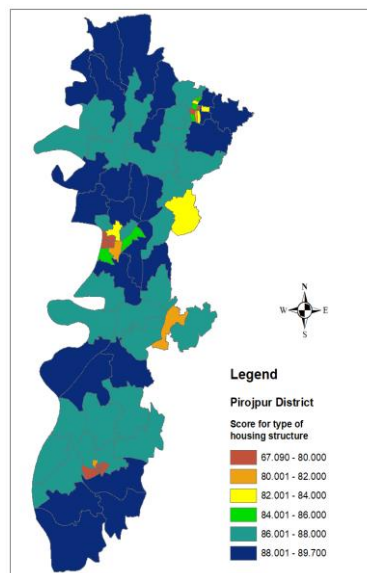


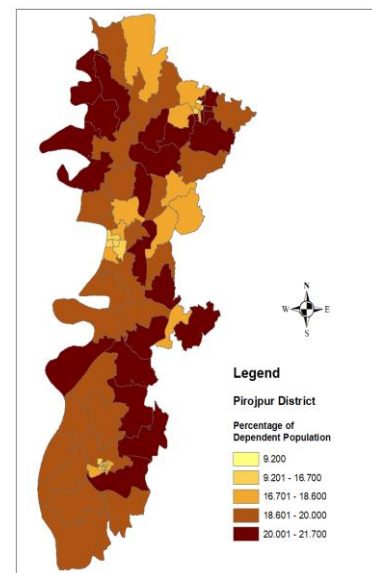
Figure 5: Vulnerability Index Map (FbF EAP Cyclone Bangladesh, BDRCS)



Lower poverty line (weightage 30%)



House structure (weightage 25%)



Dependent Population (weightage 15%)

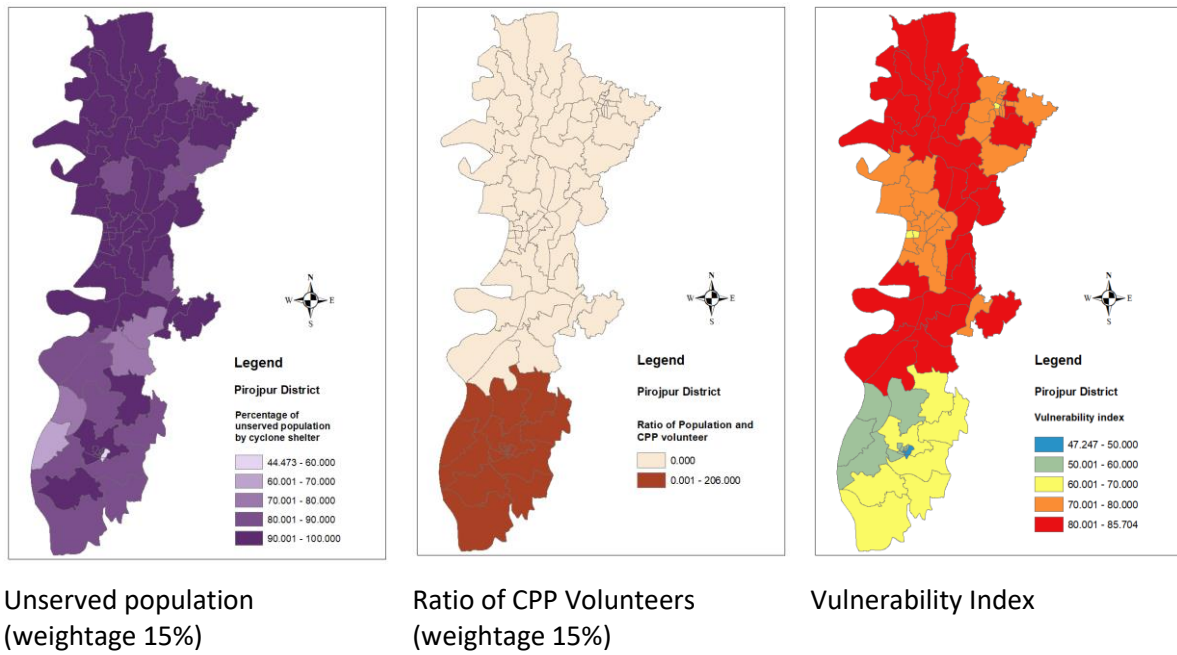


Figure 6: Vulnerability Index identification

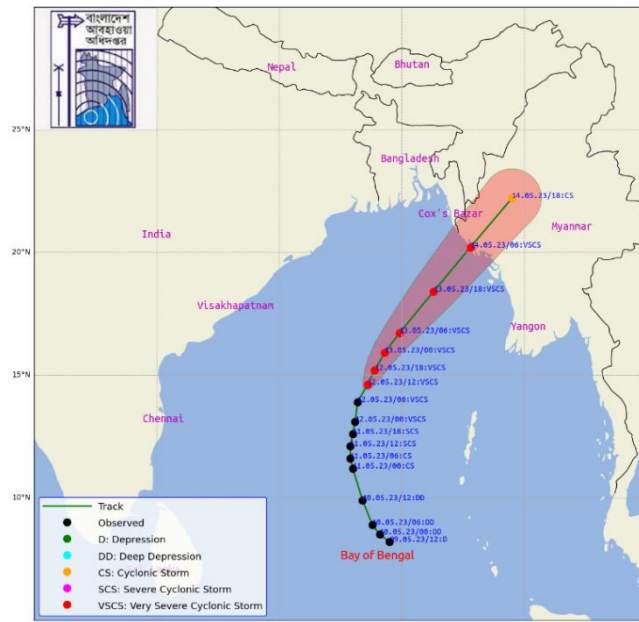
This map of vulnerability indexing needs periodic update to consider the changes in the socio-economic condition and the development.

3. Impact Based Forecast

3.1. Forecast

There are different national, regional and global models to forecast cyclone track and intensity, associated rainfall, wind and storm surge (see in Annex D) formed in the Bay of Bengal. All of these models are reviewed and proposed for the National Early Action Protocol (EAP) using WMO's impact-based forecast concept.

In Bangladesh, BMD is the national mandated authorized organization to provide impact information through warning message (known as 'Special Weather Bulletin' for more attention to stakeholders and others), once it becomes certain that the cyclone is making landfall to anywhere in the coastal region of Bangladesh or its direct influence to anywhere in the coastal region of Bangladesh. The impact information includes maximum wind speed during



landfall, amounts of rainfall with classification (in terms of the amounts of rainfall), storm surge height with inundation area and their impact on the locality (division and/or district level) in addition to the 'Danger Signal' and or 'Great Danger Signal'. BMD starts to provide the information of cyclone since its formation (usually as a low-pressure area) and keeps on providing this information with updates till the cyclone complete its life cycle. BMD releases their forecast approximately 36 hours before landfall, and at that time the uncertainty of landfall location is about 100 km. At 24 hours ahead, the forecast uncertainty of landfall location is about 50km, which is also varying from cyclone to cyclone. Time of land fall forecast uncertainty is in the range of about 3-6 hours. The storm surge forecast is quite uncertain, because storm surge height is dependent on the time of landfall of cyclone as well as astronomical tides.

Regional Specialized Meteorological Centre (RSMC), India is a WMO affiliated body responsible to facilitate the most effective tropical cyclone warning system for the region. RSMC has been issuing cyclone advisories in real time basis for the Bay of Bengal (BoB) and the Arabian Sea (AS) and their surrounding countries for the benefit of the region after formation of a Low-Pressure System over the BoB and AS.

Joint Typhoon Warning Centre (JTWC) is responsible for the issuing of tropical cyclone warnings in the North-West Pacific Ocean, South Pacific Ocean, and Indian Ocean for all branches of the U.S. Department of Defense and other U.S. government agencies. The warnings are intended for the protection of primarily military ships and aircraft as well as military installations jointly operated with other countries around the world. Its area of responsibility covers 89% of the world's tropical cyclone activity in addition to the BoB.

Besides, the global European Centre for Medium-Range Weather Forecasts (ECMWF) Model shows credible performance. ECMWF also forecast at regional level with 32 hrs lead time or more. It has a high credibility in cyclone intensity and landfall time forecasting.

NCEP-GFS Model guidance is also a very useful for cyclone monitoring over the BoB. It has high credibility of early detection of cyclone formation as well as intensity and landfall.

As per the record, BMD has not yet been operating any Cyclone Track and Intensity model of its own. BMD is mainly dealing with the real time surface and upper air observation in addition to radar and satellite observations for detection of tropical cyclone. BMD has also been utilizing ECMWF forecasts as a main guidance for this purpose. Moreover, BMD has been utilizing RSMC guidance to compare and adjust cyclone and intensity forecasts. As BMD has not been operating any specific model for cyclone forecasting, BMD is not in a position to provide landfall coordinate and as such BMD mentioned the name of coastal district(s) as a landfall area in 'Special Weather Bulletin'.

But the cyclone forecast performance of BMD is improving and its acceptance level to the society level has been increasing. Moreover, BMD is haunting for suitable model(s) through different development programmes. Similarly, BMD has switched over to MRI (Meteorological Research Institute (MRI), Japan) Storm Surge Model, which is having better skill for prediction of storm surge height and inundation. MRI model forecast is more qualitative than the earlier models. At this situation BMD's forecast will contribute more in anticipatory action in the upcoming days. So, the highest preference can be given to BMD's forecasts for formulating anticipatory actions relevant to cyclone formed over the BoB and make landfall to Bangladesh coast.

Depends on the availability, accessibility and skill of the forecast, the forecasting models have been proposed for the national EAP as described below.

Storm surge guidance

BMD is running MRI Storm Surge Model since 2010 and recently has started to run Advance Circulation (ADCIRC) model experimentally. MRI Storm Surge Model is having better skill for prediction of storm surge height and inundation. For anticipatory action this forecast is likely to contribute more than earlier models.

Heavy rainfall guidance

Rainfall forecasts over coastal region of Bangladesh are consistent for BMD, ECMWF, NCEP-GFS models. These model predictions can be tracked for heavy rainfall. Provision can also be kept for utilizing RSMC guidance. The performance of BMD's WRF forecast and ECMWF forecast (received at BMD) are quite acceptable and performance of these models are increasing as observed during last few years. So, BMD's forecast can be given higher priority in prediction of heavy rainfall associated with cyclones.

Cyclone track, landfall point and time, intensity

For this case BMD and RSMC Guidance are the best. In this case JTWC, NCEP-GFS and JMA models are very useful. Other mentioned models can be taken into consideration.

3.2. Impact Based Forecast (IBF)

The IBF developed by BMD with the support of UK Met Office and in collaboration with WMO has been suggested for the National EAP. Though this IBF has not yet been operationalized in BMD, the capacity for using the matrix has been developed. The impact-based forecast was developed by BMD with the support from UKMET office which has been adopted from the developed methodology of WMO as shown below.

IMPACT				
LIKELIHOOD		LOW	MEDIUM	HIGH
	HIGH			
	MEDIUM			
	LOW			
	VERY LOW			

In this matrix, likelihood of being impacted by cyclone has been classified in four categories and the impact has been classified in three categories. This matrix has been considered as a base to develop EAP based on impact-based forecast. But, instead of 3x4 matrix, NEAP has proposed a 4x4 matrix for

trigger and threshold setting. The matrix of likelihood of impact made small change in defining thresholds (high and low likelihood) from BMD-IBF as stated in the following table.

Matrix Likelihood Label	Best Practice Likelihood %	Word/Phrase used in statement
High	>75 %	Definitely Certain Will happen Almost Certain Very likely Expected
Medium	51 – 75 %	Anticipated Good chance Likely Probable (probably)
Low	26 – 50 %	Possible Might Potential Maybe Perhaps Could happen Chance
Very Low	<=25 % (BMD IBF 20%)	Small chance/slight Not likely Unlikely

The impact thresholds for rainfall, wind and storm surge are proposed on the available BMD IBF, consultations from fields, DREF EAP cyclone, WFP pilot study for flash flood & storm surge flooding, research findings and STEP initiatives for sectoral EAP. Besides historical impact data for different categories of cyclone has been considered to define the threshold.

In the following section, the impact from three hazards has been categorized based four categories of impact considering different threshold value.

Table 2: Impact of wind at different category

Low Speed: 62-88 kph	Medium Speed 89 – 117 kph	High Speed: 118 – 221 kph	Very High Speed: ≥ 222 kph
Minor injuries may occur	Major injuries may occur	Life changing injuries and loss of life	Life threatening injuries and high probability of loss of life
Minor damage of vulnerable rural houses (jhupri/kacha- 20-30%)	Severe damage of jhupri/kacha (40-60%) & Moderate damage of semi pukka houses (20-30%)	Severe damage of vulnerable rural houses jhupri/kacha/Semi-pukka & Moderate damage of pukka house	severe damage of vulnerable rural houses (jhupri/kacha/Semi-pukka/Pukka)
Days to week disruption of food supply and	1-2 weeks' disruption of food supply and communication. Also,	Two to four weeks' disruption of food	More than one-month disruption of food supply and

Low	Medium	High	Very High
Speed: 62-88 kph	Speed 89 – 117 kph	Speed: 118 – 221 kph	Speed: ≥ 222 kph
communication. Also, minor disruption to livelihoods	moderate disruption to livelihoods	supply and communication. Also high disruption to livelihoods	communication. And sever disruption to livelihoods
Major damage of standing crops (land fall in October - November)	Major damage of standing crops (land fall in October - November)	Severe damage of standing crops (land fall in October - November).	Severe damage of standing crops (land fall in October - November).
Isolated loss primarily of small livestock and shade for farming	Localised loss of livestock of all kinds	Widespread loss of livestock of all kinds	Severe loss of livestock of all kinds
Closure of seaports and sea transportation	Short term closure of seaports and sea transportation	Medium-term closure of seaports and sea transportation	Long term closure of seaports and sea transportation

Table 3: Impact of storm surge with different height

Low	Medium	High	Very High
<1.5 m	1.5-3.5 m	3.6 – 5.0 m	> 5.0 m
Minor injuries	Moderate injuries	High probability of loss of life	Very high probability of loss of life
Moderate damage of vulnerable rural houses (Jhupri/Kutchra)	Severe damage of Jhupri/Kutchra & moderate damage of semi pucca houses	Severe damage and destruction of vulnerable rural houses Jhupri/Kutchra /Semi-pucca & moderate damage of pucca house	Destruction of vulnerable rural Jhupri/Kutchra /Semi-pucca houses and significant damage of Pucca house
Minor damage of weak spots of embankments/road	Moderate damage of weak spots of embankments and roads	Significant damage to embankments/roads	Significant dame to the embankment and roads. Destruction to weak spots of embankments
Isolated and minor damage to livestock, plants and crops	Substantial damage to livestock, plants and crops	Severe damage to livestock, plants and crops and land productivity. And moderate damage of the forest	Destruction to livestock, plants and crops and sever loss of land productivity. And sever damage to forestry.
Few days or no disruption of food supply and communication.	Days to week disruption of food supply and communication. Also minor to moderate disruption to livelihoods.	1-2 weeks' disruption of food supply and communication. Also high disruption to livelihoods	About a month disruption of food supply and communication. And sever disruption to livelihoods
Some minor and very short time (days to	Days to weeks' disruption of	Two to four weeks' disruption of	Severe and very long periodic (more than

Low	Medium	High	Very High
<1.5 m	1.5-3.5 m	3.6 – 5.0 m	> 5.0 m
week) disruption of some transportation, utilities & tourism	transportation, utilities & tourism	transportation, utilities & tourism	one month) disruption of transportation, utilities & tourism
Minor chance of water borne diseases	Moderate chance of water borne diseases	High chance of water borne diseases	Very High chance of loss of life from water borne diseases
Minor damage of shrimp farming & fishing ponds	Moderate damage of shrimp farming & fishing ponds	High damage of shrimp farming & fishing ponds	Severe damage of shrimp farming & fishing ponds
Minor damage of sea ports and small sized vessels may capsize	Substantial damage of sea ports and medium sized vessels may capsize	High destruction of sea ports and large sized vessels may capsize	Severe destruction of sea ports large sized vessels will capsize

Table 4: Impact of rainfall with different ranges

Low	Medium	High	Very high
72 hrs accumulated rainfall: <150mm	72 hrs accumulated rainfall: 150mm – 200mm	72 hrs accumulated rainfall: 200-250 mm	72 hrs accumulated rainfall: >250 mm
Isolated/ minor flooding	Localized flooding & isolated landslides	Widespread flooding & localized severe landslides	Extreme flooding & isolated locations / hotspots severe landslides
Minor damage to road infrastructure & communication networks	Moderate damage to road infrastructure & communication networks	Considerable damage to road infrastructure & communication networks	Significant damage to road infrastructure & communication networks
No or low damage to fishing equipment & loss of livestock	Minor damage of fishing equipment & loss of livestock	Moderate damage and minor loss of fishing equipment & loss of livestock	Significant damage and moderate loss of fishing equipment & loss of livestock
Minor damage to crops & agricultural activities	Moderate damage and some loss of crops & agricultural activities	Significant damage to crops & agricultural activities	Widespread damage to crops & agricultural activities

4. Triggers and Threshold Setting

Trigger means when and where to activate the anticipatory action based on good (accurate and reliable) forecast. Trigger model for cyclone EAP has been developed for the three component of wind speed, storm surge and heavy rainfall. The impact of wind, storm surge and rainfall has been considered separately as most of the time they are not impacted in the same area. Moreover, for developing combined trigger matrix, combined impact data of field level is mandatory which is scarce at present. In the next update of EAP, the weights may be incorporated with in depth combined impact data from field level.

The threshold for three components has been set up for the readiness action and early actions for the actors in different sectors. Besides, thresholds of likelihoods of impacts for triggering the readiness action and early actions have also been defined for the government, the community and other actors in the region. For triggering, the probability of impact is the prime concern. But, as the probabilistic forecast is yet to be developed by BMD, the likelihood/probability of impact has been connected with the lead time of the BMD forecast.

4.1. Trigger Decision Matrix

4.1.1. Wind Speed

Wind speed distribution is generally uniform around a cyclone wind varies with the distance from the landfall point of the cyclone, landcover and socio-economic condition. So, the effect of a cyclone is different places of the coast. It is mentionable that, the wind speed is reduced by 20% due to afforestation (western zone and part of central zone). BMD, IMD and other organizations provide forecast for wind speed associated with the cyclones formed over the BoB.

Impact of wind speed has been defined in four categories: (i) low (with the wind speed of 62-88 km/hr), when the system is considered as Cyclonic storm; (ii) medium (with the wind speed of 89-117 km/hr), when the system is considered as Severe cyclonic storm; (iii) high (with the wind speed of 118-221 km/hr), when the system is considered as Very severe cyclonic storm; (iv) very high (with the speed of greater than or equal to 222 km/hr), when the system is considered as Super cyclonic storm (according to WMO 2012 and BMD). At the same time, the likelihood of impacts has also been defined in four categories such as- (i) high (probability of occurrence is higher than 75%, and 30-48 hrs lead time), (ii) medium (probability of occurrence is 50-75%, and 48-72 hrs lead time), (iii) low (probability of occurrence is 25-50%, and 72-120 hrs lead time), and (iv) very low (probability of occurrence is less than 25%, and lead time >120 hrs).

Based on the above information, the defined trigger matrix for wind speed is shown below.

Lead time and Likelihoods of Impacts		Wind Speed (km/hr)			
		62-88	89-117	118-221	≥ 222
		Low	Medium	High	Very High
36-48hr	High (> 75%)	6	10	14	16
48-72hr	Medium (50-75%)	5	9	13	15
72-120hr	Low (25-50%)	2	4	11	12
>120hr	Very Low (<25%)	1	3	7	8

Color Code	Actions on likelihood of impacts
	Activate Anticipatory Action, all actors (14, 15, 16)
	Readiness Anticipatory Action, all actors (11, 12, 13)
	Only Govt. Early Action (support from partners, if required) (9, 10)
	Only Govt. Readiness (support from partners, if required) (7, 8)
	Community Early Action (5, 6)
	Community Readiness (3, 4)
	Regular monitoring (1, 2)

In the trigger matrix, the forecasted wind speed at the time of landfall has been considered. At current state, signal is provided for the present condition. If the forecasted signal can be given at the time of landfall, then the forecasted wind speed can be related with the signal system which will be like, for 62-88 km/hr (signal no. 5,6 or7), for 89-117 km/hr (signal no. 5,6 or7), for 118-221 km/hr (signal no. 8,9 or10), and for ≥ 222 km/hr (signal no. 8,9 or10).

4.1.2. Storm Surge

BMD is recently using MRI Storm Surge Model, which is having better skill for prediction of storm surge height and inundation. For anticipatory action this forecast is likely to contribute more than earlier models.

It is important to note that, the height of the storm surge will vary with the tide level during the landfall, angle of approach, forward movement, size of the cyclone and some other issues. Additionally, the land fall time usually varies from 3 to 6 hours against the forecast models with 24 hours lead time or more. So, depending on the landfall time the tide level also varies and thus the surge height is also varied.

In coastal regions, the old embankments are usually of 3.5 to 4-meter height and the new embankments are of 4.5-meter height to protect the land from high tide and low to moderate storm surge. Currently, under the pilot project in Teknaf, WFP is using 4.5 meter as threshold for storm surge impact. The impact of storm surge depends on the topography, land cover, local geo-morphology and local socioeconomic context.

Impact has therefore been defined in four category (i) Low (surge height of <1.5 m), (ii) Medium (surge height of 1.5-3.5 m), (iii) High (surge height of 3.6-5m), (iv) Very high (surge height of >5m). The storm surge of more than 3.5m start to affect the community, where there is no embankment. But, when there is an embankment, the threshold will be about 4.6m. The likelihood of impacts has been defined in four category (i) High (Probability of occurrence is > 75%, and 30-48 hrs lead-time), (ii) Medium (Probability occurrence is 50-75%, and 48-72 hrs lead-time), (iii) Low (Probability occurrence is 25-50%, and 72-120 hrs lead-time), (iv) Very Low (Probability occurrence is <25%, and >120 hrs lead-time). Decisions has therefore been taken based on the following matrix.

Likelihood of Impacts and lead time		Storm surge			
		<1.5 m	1.5-3.5 m	3.6 - 5.0 m	> 5.0 m
		Low	Medium	High	Very High
36-48hr	High (>75%)	4	10	14	16
48-72hr	Medium (50-75%)	3	9	13	15
72-120hr	Low (25-50%)	2	8	11	12
>120hr	Very Low (<25%)	1	5	6	7

Color Code

Actions on likelihood of impacts

	Activate Anticipatory Action, all actors (14, 15, 16)
	Readiness Anticipatory Action, all actors (11, 12, 13)
	Only Govt. Early Action (support from partners, if required) (9, 10)
	Only Govt. Readiness (support from partners, if required) (5, 6, 7, 8)
	Community Early Action (3, 4)
	Community Readiness (2)
	Regular monitoring (1)

4.1.3. Heavy Rainfall

Heavy rainfall results local flood/flash flood in the low-lying area and/or urban areas, while the heavy rainfall from the cyclonic storm may trigger landslides and flash flood situation. Further research is needed for urban flash flood. The EAP has developed trigger for the flash flood in the eastern region of Bangladesh.

In this case impact has been defined in four categories (i) Low (when the amount of rainfall is <150 mm), (ii) Medium (when the amount of rainfall is 150-200 mm), (iii) High (when the amount of rainfall is 200-250 mm) and (iv) Very high (when the amount of rainfall is >250 mm) for the accumulation in 72 hours. Research result has shown that, when the amount of rainfall exceeds 150mm (in 72hr accumulation) the probability of landslide become high. The likelihood of impacts is also assumed in four categories of (i) High (Probability of occurrence is > 75%, and 2-3 days' lead-time), (ii) Medium (Probability of occurrence is 50-75%, and 3-5 days' lead-time), (iii) Low (Probability of occurrence is

25-50%, and 5-7 days' lead-time), (iv) Very Low (Probability of occurrence is <25%, and 7-10 days' lead-time). Decisions has been suggested to be taken based on the following matrix.

Likelihood of impacts and lead time		Rainfall in 72hr accumulated			
		<150 mm	150-200 mm	200-250 mm	>250 mm
		Low	Medium	High	Very high
2-3 days	High (<75%)	7	12	14	16
4-5 days	Medium (50-75%)	6	10	13	15
6-7 days	Low (25-50%)	2	8	9	11
> 7 days	Very Low (<25%)	1	3	4	5

Color Code	Actions on likelihood of impacts
	Activate Anticipatory Action, all actors (12, 13, 14, 15, 16)
	Readiness Anticipatory Action, all actors (8, 9, 10, 11)
	Only Govt. Early Action (support from partners, if required) (6, 7)
	Only Govt. Readiness (support from partners, if required) (3, 4, 5)
	Community Readiness (2)
	Regular monitoring (1)

4.2. Trigger Activation

Trigger will be activated if any one of the above components reach to its trigger threshold. Accordingly, the respective sectors will take respective readiness actions and early actions for reducing the impact of that component.

No regret

The EAP will be activated in vulnerable areas, which will cross the pre-agreed impact limits of the respective sub-hazard of cyclone. There is no stop mechanism envisaged in this EAP due to the short lead time. It might be possible that people will be transported to cyclone shelters and receive necessary assistance through the EAP, but the cyclone finally may not landfall in Bangladesh or the thresholds of respective sub hazard may not be reached in target districts. There is a potential risk of act in vain that the target community might not take early action against future warnings/trigger about an impending cyclone and will not evacuate to the evacuation shelters.

5. Early Actions

5.1. Early warning system

Presently, the Cyclone Preparedness Programme (CPP) plays a vital role in Bangladesh's coastal communities by building their disaster response capacity and enabling effective preparedness, response, and recovery efforts during cyclones (Detail in Annex E). Using the BMD forecast, CPP inform the community and provide inclusive early warning following different flagging system.

CPP employs signal propagation methods for timely dissemination of cyclone-related information. Various communication channels and volunteers are utilized for effective communication. HF and VHF wireless stations are used at field levels. CPP head office has communication channels for coordination. CPP follows specific processes based on the cyclone signal numbers issued by the authorities.

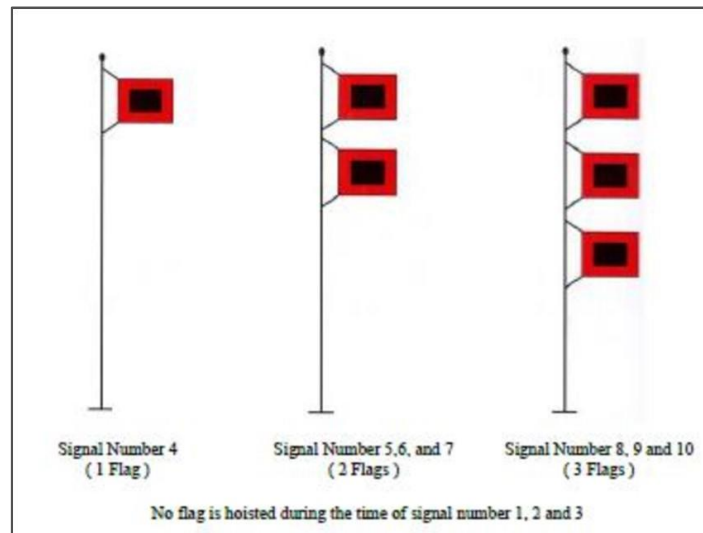


Figure 7: Guidelines for hoisting flags

Table 5: Activity at different signal numbers

Signal Number	Activity
Signal Numbers 1-3	- Cyclone formation: Volunteers spread word-of-mouth cyclone signals, informing each other and assisting the public in being prepared. - Regularly listening to radio and watching television for the latest news on cyclones.
Signal Number 4	- Informing local people loudly: Megaphones and microphones are used to relay information. - Hoisting of 1 signal flag. - Emergency meetings of the Cyclone Preparedness Program Implementation Board, CPP Upazila, Union, and Unit Committees are convened.

Signal Number	Activity
Signal Numbers 5-7	• Informing local people: Megaphones, microphones, and public address systems are utilized. • Hoisting of 2 signal flags. • A warning signal indicates that the cyclone is about to hit. Instructions may include strengthening house walls, providing safe shelter, safe water, and dry food.
Signal Numbers 8-10	• Informing local people: Megaphones, microphones, public address systems, and sounding hand sirens are used. • Hoisting of 3 signal flags. • A distress signal is issued as the cyclone is about to make landfall. Instructions may include staying safe and relying on radio and television for updates.

For strengthening the Early Warning system, BMD along with other relevant organization(s) should develop the situation map of the impacted area based on the Impact based forecast matrix and deliver it to CPP and other relevant sectors. Then the CPP Headquarter will circulate the information to the respective areas of potential impact. Then the Early Warning Message dissemination should be initiated about cyclone and storm surge from the CPP, mosques or volunteers, messages from radio or mobile phone for the evacuation based on the localized/areas specific impacts.

5.2. Early actions

In the following tables, the sector specific Readiness actions and Early actions has been defined. Additionally, sector wise Readiness action and Early actions has been grouped based on the impact/severity level of the components of cyclone (detail in Annex F).

5.2.1. Agricultural Sector

Table 6: Readiness action and Early action for agriculture sector for different actors

Sector	Sub Sector	Readiness Action (RA) <i>(Before 72 hours of landfall)</i>	Early Action (EA) <i>(Before 36 hours of landfall)</i>	Organization
Agriculture Sector	Crop	Community level (C-RA)	Community level (C-EA)	
		1. Follow the guidelines provided in the special bulletin issued by BAMIS. 2. Stay alert and keep ready about early crop harvesting or preservation. 3. Harvest crops early (If ripened) ahead of cyclone landfall. 4. Keep the harvested crop at safe storage. 5. Early assessment of crop damage 6. Elevate the plinth level of the grain storage. 7. Avoid planting new crops.	a. Follow the guidelines provided in the special bulletin issued by BAMIS. b. Keep the list of agriculture Block supervisor. c. Support the harvesters to harvest the ripe crop from the field.	UDMC CPP BDRCS
		Institutional level (I-RA)	Institutional level (I-EA)	
		8. Provide timely updates on the cyclone's intensity, and potential impacts on agriculture. 9. Issue crop-specific advisories guidance, such as early harvesting. 10. Store farmer's seeds for preservation. 11. Arrange to safeguard recently harvested crops	d. Provide timely updates on the cyclone's intensity, and potential impacts on agriculture. e. Ensure timely and targeted support to affected farmers. f. Arrange vehicle to transport harvested crop to safe storage	BAMIS DAE DDM CPP BDRCS NGO's

Sector	Sub Sector	Readiness Action (RA) (Before 72 hours of landfall)	Early Action (EA) (Before 36 hours of landfall)	Organization
		Community level (C-RA)	Community level (C-EA)	
Agriculture Sector	Fisheries	- Follow with instructions from the Department of Fisheries (DoF). - Secure fishing boats, nets, and equipment to minimize damage. - Protect the security shed of Ghers to prevent it from being blown out by strong winds. - Install protective nets to prevent fish from being washed out of ponds. - Take protective measures to repair vulnerable parts of embankments. - Create a list deep-sea fishing vessels with names and phone numbers.	- Follow with instructions from the Department of Fisheries (DoF). - Return from deep sea after receiving the cyclone signal - Harvest fish prior to the cyclone hit - Seek shelter in designated Cyclone Shelter.	UDMC CPP BDRCS
		Institutional level (I-RA)	Institutional level (I-EA)	
		- Alerting fishing communities about the potential cyclone threat and damage. - Alert the Artisanal fishermen about the cyclone warning - Organize a market for fish farmers to sell their cultured fish. - Provide location-specific information to fisheries, and dissemination of "what to do" guidelines. - Coordination with BWDB to repair the weak points of Embankment. - Repair weak point of pond/gher.	- Alerting fishing communities about the potential cyclone threat and damage. - Conducting campaigns on safety measures and preparedness	Upazila Fisheries office (DOF) UDMC CPP BDRCS DDM BDWB LGED

Sector	Sub Sector	Readiness Action (RA) (Before 72 hours of landfall)	Early Action (EA) (Before 36 hours of landfall)	Organization
Agriculture Sector	Shrimp Farming & Fishing ponds, Salt Farming, Forest/ trees	Community level (C-RA)	Community level (C-EA)	UDMC
		Institutional Readiness Action (I-RA)	Institutional Early Action (I-EA)	UZDMC UDMC Upazila administration Upazila Fisheries office (DOF) Upazila Forest Office Veterinary hospital
		1. Follow with instructions from the Department of Fisheries (DoF). 2. Secure small fishing boats, nets, and equipment to minimize damage. 3. Protect the security shed of Ghers to prevent it from being blown out by strong winds. 4. Install protective nets to prevent fish from being washed out of ponds. 5. Take protective measures to repair vulnerable parts of embankments. 6. Taking measures to keep salt storage safe. 7. Give soil to the base of weak plants (roadside).	a. Follow with instructions from the Department of Fisheries (DoF). b. Harvest fish and shrimp prior to the cyclone hit. c. Seek shelter in designated Cyclone Shelter.	
		8. Alerting fishing communities about the potential cyclone threat and damage. 9. Organize a market for fish farmers to sell their cultured fish. 10. Provide location and sector-specific information to the concern person and dissemination of "what to do" guidelines. 11. Coordination with BWDB to repair the weak points of Embankment. 12. Repair weak point of pond/gher. 13. Taking measures to keep salt storage safe. 14. Cutting down the branches of trees upon the pond/gher/salt farming land. 15. Tie weak trees of the roadside with stick and rope.	d. Alerting fishing communities about the potential cyclone threat and damage. e. Conducting campaigns on safety measures and preparedness.	

Sector	Sub Sector	Readiness Action (RA) (Before 72 hours of landfall)	Early Action (EA) (Before 36 hours of landfall)	Organization
		Community level (C-RA)	Community level (C-EA)	
Agriculture Sector	Livestock	1. Identify the secure sites for livestock to shift and make an evacuation plan. 2. Prepare the Killa or shelter more accessible. 3. Store feed and straw securely, ensure fresh water supply. 4. Establish communication with the veterinarian.	a. Ensure the Livestock is Safely relocated	UDMC
		Institutional Readiness Action (I-RA)	Institutional Early Action (I-EA)	
		5. Ensure livestock transportation vehicles are prepared. 6. Move livestock to secure locations during emergencies. 7. Veterinary team prepared to provide assistance.	b. Prepare the Vehicles for Transfer c. Safely Relocate Livestock to Secure Locations in Emergency Situations d. Ensure the Veterinary Team is Present and Ready to Provide Assistance.	UZDMC, UDMC Upazila administration Upazila Livestock Office Veterinary hospital

5.2.2. Humanitarian Sector

Table 7: Readiness action and Early action for humanitarian sector for different actors

Sector	Readiness Action (RA) (Before 72 hours of landfall)	Early Action (EA) (Before 36 hours of landfall)	Organization
	Community level (C-RA)	Community level (C-EA)	
Humanitarian Sector	Life: 1. Awareness and miking in the community about the coming cyclone. 2. Get ready to move to the safe place/ near shelter depending on the severity of the risk. 3. Persons with vulnerabilities are assisted during evacuation, like to shift the elderly, children, pregnant women and lactating women, persons with disabilities.	Life: a. Everyone in the community to move to the shelter. b. Young people to help others to move to the shelter (if needed) Food Security: c. Dry foods to bury in the ground and some food to take with them to cyclone shelter. Assets:	CPP BDRCS

Sector	Readiness Action (RA) (Before 72 hours of landfall)	Early Action (EA) (Before 36 hours of landfall)	Organization
	Food Security: 4. Store dry food, rice, lentil, oil, salt and common spices. Assets: 5. Secure important documents (property deeds, and financial records) 6. Anchor the kaccha house with rope. 7. Stock emergency supplies (non-perishable food, drinking water, flashlights, batteries) Household Vegetation and Trees: 8. Tie weak trees/ HS vage with stick and rope. Gender-Based Violence: 9. Aware the community and specially the female group about GBV Child Protection: 10. Conduct community sensitization programs on child protection risks during cyclones (separation, exploitation, trafficking, and psychosocial distress).	d. Valuable documents, jewelry, money to bury in the ground. Gender-Based Violence: e. Ensure protection and security at cyclone shelters. Child Protection: f. Ensure that children reach shelter safely. g. A guardian must accompany children at all times.	
	Institutional level (I-RA)	Institutional level (I-EA)	
	Life: 11. Continuous announcement in the community about the coming cyclone. 12. Getting ready to move the vulnerable group to the safe place/ nearest shelter. 13. Assist to shift the elderly, children, pregnant women and lactic women. Food Securities: 14. Aware community people on preservation of dry food, medicine, cattle feed.	Food Security: h. Provide dry food, rice, pulse, cooking oil, salt, common spices, ready baby food, sugar etc. to the most cyclone shelter. Livelihood (Wage & Expenditure): i. Provide unconditional cash support Gender-Based Violence: j. Ensure security at cyclone shelters. k. Separate place for male and female Child Protection: l. Ensure volunteers are active for child protection, psychosocial support, children are in safe place.	CPP BDRCS NGO'S UNICEF Upazila Health office

Sector	Readiness Action (RA) (Before 72 hours of landfall)	Early Action (EA) (Before 36 hours of landfall)	Organization
	15. Arrange dry food, rice, pulse, cooking oil, salt, common spices, ready baby food, sugar etc. for vulnerable community. Assets: 16. Awareness the community people to secure important documents and stock emergency supplies. Gender-Based Violence: 17. Collaboration with law enforcement agencies or deploying Gram Police/Ansar to work during the time of cyclone. 18. Ensure Breast feeding corner Child Protection: 19. Arrange accessible child-friendly spaces in cyclone shelters. 20. Assign volunteers and humanitarian actors for child protection and psychosocial. Livelihood (Wage & Expenditure): 21. Arrange unconditional cash support for the vulnerable family.	And inclusive information or communication would be needed.	

5.2.3. Health Sector

Table 8: Readiness action and Early action for health sector for different actors

Sector	Readiness Action (RA) <i>(Before 72 hours of landfall)</i>	Early Action (EA) <i>(Before 36 hours of landfall)</i>	Organization
Health	Community level (C-RA)	Community level (C-EA)	
	1. Prepare a basic first aid kit such as saline, Napa tablet, Cotton bar, bandages, antiseptic solutions, pain relievers, and any specific items needed for individual. 2. Store medical records, prescriptions, in a safe place. 3. Ensure that the shelter addresses the specific health requirements of elder, pregnant women, and disables. 4. Plan for proper waste management to prevent the spread of diseases. 5. Plan to maintain cleanliness in and around the shelter. 6. Collaborate with local health authorities.	a. Bring medications to the shelter. b. Provide mental health support and counseling services.	UDMC CPP BDRCS
Health	Institutional level (I-RA)	Institutional level (I-EA)	
	7. Pre-position medical supplies and essential medications, first aid kits, assistive devices and other necessary medical resources. 8. Establish temporary medical facilities to handle injuries, illnesses. 9. Assign healthcare workers and their working areas. 10. Coordinate with other agencies such as disaster management authorities, emergency services, and non-governmental organizations (NGOs). 11. Conduct pre-cyclone inspections and reinforce vulnerable infrastructure. 12. Take initiatives to protect the weak (infrastructure) medical centers.	c. Ensure the provision of necessary medication in all cyclone shelters. d. Provide emergency medical care to affected individuals. e. Community clinic doctors prepared and deployed. f. Ensure the presence of medical professionals (doctors/nurses/paramedics), who are trained in emergency response procedures. g. Set up medical camps for immediate healthcare needs.	Upazila Health office Upazila Administration UNICEF DPHE NGO's

Sector	Readiness Action (RA) (Before 72 hours of landfall)	Early Action (EA) (Before 36 hours of landfall)	Organization
Water, Sanitation, and Hygiene (WASH)	Community level (C-RA)	Community level (C-EA)	
	1. Stockpile emergency supplies (such as Water Purifier, soap, disinfectants, hygiene kits (women and adolescents)) 2. Secure the Latrine with Rope, GI Wire, and Other Fastening Materials.	a. Protect tube wells by preserving the heads and covering pipes with plastic. b. Tie the latrine with rope GI weir etc. c. Secure Toilet Pan to Prevent Waste Spillage	UDMC
	Institutional level (I-RA)	Institutional level (I-EA)	
	3. Stockpile emergency supplies (water purified tablets, medicines, saline, essential sanitation items and accessible toilet seat) 4. Implement Plinth Raising for Latrine and Water Point in the Cyclone Shelter. 5. Take proactive measures to the major water sources like Deep TW or Pipe network system. 6. Establish emergency Deep TW in their premises for supplying clean water during the critical period. 7. Help to elevation & strengthening of the bank of the pond with soil and mud.	d. Distribute emergency supplies (water purified tablets, medicines, saline, essential sanitation items). e. Distribute and ensure menstrual kit & other hygiene kit.	DPHE UNICEF Upazila Health Office UDMC NGO's

5.2.4. Other Sector (Utility service, Education, Shelter Management, Cash-Based Assistance)

Table 9: Readiness action and Early action for other sectors for different actors

Sector	Readiness Action (RA) <i>(Before 72 hours of landfall)</i>	Early Action (EA) <i>(Before 36 hours of landfall)</i>	Organization
	Community level (C-RA)	Community level (C-EA)	
	1. Shelter community to get ready with necessary support, to ensure minimum accessible facilities.	a. Coordinate with emergency services b. Shelter community to look after if the shelter is well managed or not.	
	Institutional level (I-RA)	Institutional level (I-EA)	
Utility services	Telecommunication: 2. Ensure backup power supply. 3. Strengthen network infrastructure. 4. Stockpile essential equipment, spare parts, and supplies necessary for restoration and repair efforts. Electricity: 5. Trim trees near power lines. 6. Arrange for repair crews and necessary equipment 7. Disseminate safety instructions to customers and the public Transport: 1. Secure & use of transportation (rickshaw/ auto-rickshaw, van, other) to evacuate vulnerable people. 2. Develop evacuation plans	c. Ensure backup power supply d. Activate emergency communication channels e. Execute of the evacuation plans	

Sector	Readiness Action (RA) (Before 72 hours of landfall)	Early Action (EA) (Before 36 hours of landfall)	Organization
	Community level (C-RA)	Community level (C-EA)	
	N/A	N/A	N/A
	Institutional Readiness Action (I-RA)	Institutional Early Action (I-EA)	
Shelter Management	1. Activate shelter management committee to ensure accessible shelter. 2. Small scale repair/maintenance of cyclone shelters including WASH, lighting facilities. 3. Build temporary cattle shed at cyclone shelters and embankment 4. Store and ensure emergency rescue equipment (S & R, first Aid) 5. Ensure of the usability of the cyclone shelter. 6. Ensure backup power supply. 7. Small scale repair of the community infrastructures 8. Repair/maintenance community boat and other local transport 9. Arrange wheelchair, stretchers etc. for persons with disabilities at cyclone shelters to ensure accessibility. 10. Arrange separate accommodation for male, female, lactating women and adolescent girls) at cyclone shelters.	a. Monitor the management of the shelter. Including data and information management of on people moving into shelters, while people are in the shelters, and during shelter closure. b. Equitable distribute dry food, drinking water, baby food and NFI's. c. Distribute hygiene and menstrual kit. d. Transportation support in case of any emergency patient and other any emergency. e. Ready boats and banana raft. f. Ensure the use of wheelchair, stretchers etc. for persons with disabilities at cyclone shelters g. Monitor and ensure Livestock has been shifted to the safe place/ cattle shed.	Shelter management committee UNO NGO's

Sector	Readiness Action (RA) (Before 72 hours of landfall)	Early Action (EA) (Before 36 hours of landfall)	Organization
	Community level (C-RA)	Community level (C-EA)	
	N/A	N/A	N/A
	Institutional Readiness Action (I-RA)	Institutional Early Action (I-EA)	
Education	1. Evaluate the structural integrity of school buildings, especially in cyclone-prone areas. 2. Identify vulnerable structures and take immediate steps to reinforce or relocate them if necessary. 3. Need to locate a safe place to keep the books, documents and lab instruments.	a. Replace the important documents, books and other valuable things to a safe place.	Education department DC/UNO office

Sector	Readiness Action (RA) (Before 72 hours of landfall)	Early Action (EA) (Before 36 hours of landfall)	Organization
	Community level (C-RA)	Community level (C-EA)	
	1. Make arrangements to ensure the safety and security of house, cattle, and livestock. 2. Prepare emergency supplies of dry food. 3. Facilitate community participation in the distribution of cash assistance to ensure fairness and minimize risks.		CPP BDRCS
	Institutional Readiness Action (I-RA)	Institutional Early Action (I-EA)	
Cash-Based Assistance	4. Beneficiary targeting criteria, distribution mechanisms, and accountability measures. 5. Activate coordination among relevant agencies and organizations to ensure the timely and transparent delivery of cash-based assistance to affected populations.		UDMC DDM CPP BDRCS NGO'S IFRC/Donors

6. Coordination Mechanism

The coordination mechanism for the Task force of FbF/A and AA is essential. For that TWG has to be developed to harmonize the early actions and also to guide the new initiatives and plans for different actors of the respective sectors.

The objective of the protocol is to avoid duplication, sharing and implementing best practices, efficiently using resources, timely delivery of finance to target community and finally effective measures advise/take action for minimizing risk of vulnerable community through rule of procedure in preparing trigger, choosing anticipatory action and the financial mechanism.

A monitoring framework (Figure 8) has been proposed for the activation of anticipatory action. When a disturbance in the BoB is formed, monitoring should be strengthened with situation report and disseminate it to the concerned institute depending on the severity of cyclone. Continuous checking should be conducted against the impact matrix for pre-activation and activation for all the actors as well as for government and community.

The coordination mechanism explains the coordination of task force, technical committee and working group, DMCs, partners and local community. The Task force is required to form a committee which will be the focal for overall coordination.

Besides, the Task force will form a Technical Committee comprised of scientific institutes that will be headed by BMD. This technical committee will be responsible to monitor the forecast, review and advise for considerations in triggering mechanism (thresholds - impacts and likelihood following the trigger/impact matrix) to activate pre-activation and activation of early action(s).

Then, the representative from task force of FbF/A with the technical working group/CPP will decide to activate the Early Actions Protocol as per pre-agreed criteria and thresholds. Besides, the working group will be coordinated by CPP for screening the effective early actions of different sectors/actors with prioritization in terms of actions and locations using predefined funding. Furthermore, DDM and other respective sectoral managers will coordinate local level DMCs as per SOD.

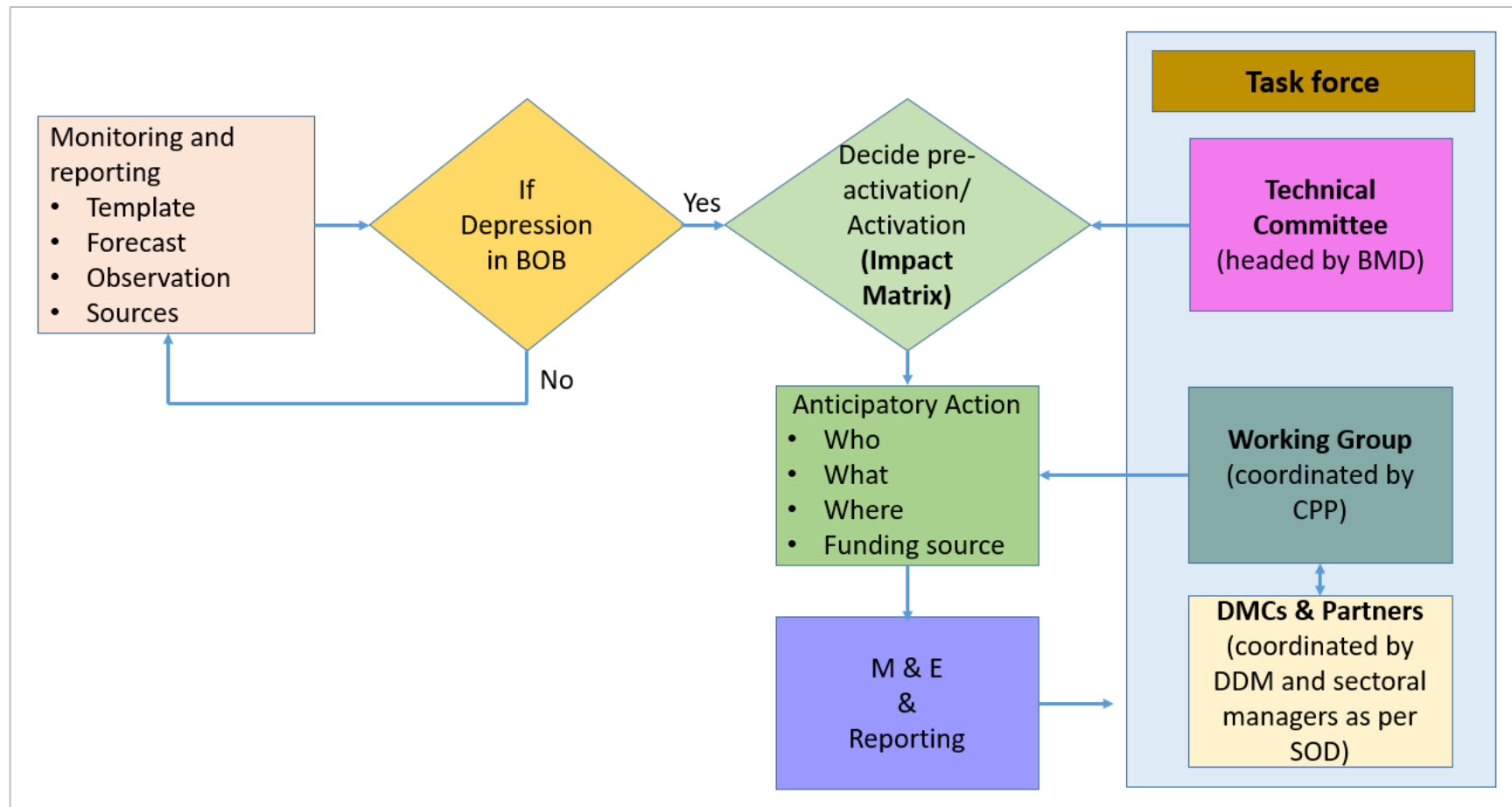


Figure 8: Monitoring and decision support protocol

Finally, after the event, third party evaluation will be made to assess the learning from the activation and update the EAP and also share the report with the stakeholders.

The coordination process by different groups can be explained in the Figure 9.

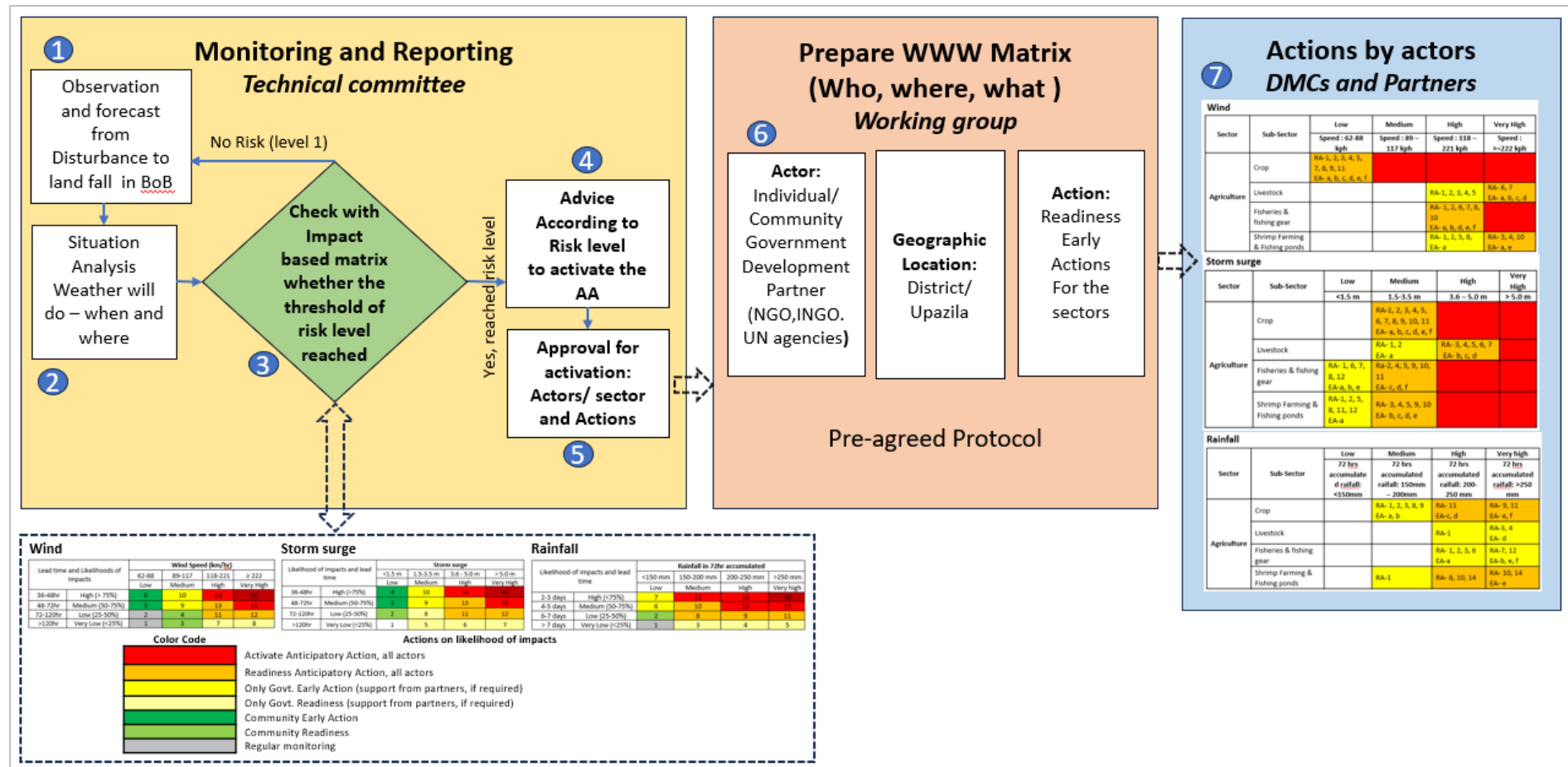


Figure 9: Key steps in the coordination including the key actors and actions

As per Figure 9, the technical committee (headed by BMD) will monitor and report on observation and forecast of cyclone from its formation to landfall. Situation analysis will be done to understand the associated weather, when and where the landfall will be. In this stage, continuous checking with Impact based matrix will be prepared whether the threshold of risk level is reached or not. If the threshold of risk level is crossed advice will be given to activate the AA based on risk level by Taskforce representative/CPP. Then approval will be given to the actors/sectors for readiness action and early action.

For readiness action and early action WWW matrix will be prepared to clearly identify (i) who will act? (ii) where to act with what action?; which is pre-agreed in the protocol. This matrix will be led by the working group, which will indicate the actors (individual/community, government, development partner (NGO, INGO, UN agencies)) with the actions according to risk level in impacted areas.

Following the WWW matrix, the actors/sectors will do the readiness action and early actions which will be implemented by DMCs and other partners at local level.

Three clusters of coordination protocol are (i) trigger (ii) actions and actors and (iii) financial and resource allocation. These clusters are described below:

6.1. Trigger

Trigger development will be done for the components of cyclone (wind, storm surge & heavy rainfall-flood and landslides) to define what action can be taken and where. This process will be led by scientific organization such as BMD with technical support from BUET and/or other organization (RCCC, RIMES, IWFM). Three different trigger matrixes will be developed for the three components. Trigger will be activated if any one of the components reaches to its trigger threshold.

6.2. Action(s) and Actor(s) (who, what, where and whom)

Actors (which include Government Authorities, Non-Governmental Organizations (NGOs), humanitarian aid, International Organizations, such as the United Nations agencies, IFRC, Red Cross and Red Crescent societies, Local Communities) in a coordination mechanism are the entities or participants that are responsible for performing particular actions at some defined locations for the vulnerable communities when the trigger is activated. Following predefined rules/protocols of the coordination mechanism, the actions of the actors will be coordinated. In the existing practice, the working group is working with the 4W matrix (who, what, where, whom). Recently UNRC along with the working group wants to include 'when' in the matrix to describe the extent of the trigger. This inclusion of 5W matrix would be a better initiative for EA. However, the 4W/5W matrix should be updated regularly before the onset of season.

6.3. Resource and Financing

To achieve a balanced Early Action Protocol (EAP), it is crucial to have a clear plan for obtaining resources and distributing them appropriately. Resources and financing are vital aspects of many projects, organizations, and initiatives. Financing refers to providing the necessary monetary resources to support and maintain an endeavor. It involves identifying funding sources, managing budgets, and making financial decisions to cover expenses, investments, and operational costs.

Here the source of resource can be- in kind, cash or goods. Which may also include physical materials, equipment, facilities, technology, human capital, expertise, and information. At present, there are financial arrangement from government (social safety net program, contingency fund, Disaster Management fund) along with other funds (UN-CERF, DREF). The utilization of the funds need to be more integrated by policy to act during EAP. Effectively managing and allocating resources is crucial for ensuring optimal utilization, productivity, and successful outcomes.

In 2020, the Bangladesh Red Crescent, with the support of IFRC and American Red Cross, piloted its 'decentralization of resources for anticipatory action' initiative in all 13 sea-facing coastal districts of Bangladesh. The goal of this initiative is to localize and decentralize resources to enable BDRCS and CPP enhance their anticipatory action efforts and prepare more effectively for natural disasters, with the aim to eventually reduce related deaths, injuries, and adverse socioeconomic impacts caused by natural disasters. This initiative enables BDRCS to extend reasonable and timely support at the branch levels, given the full mobilization depends on the central command structures at the country level and EAP for cyclones in partnership with the broader Federation, Global FBA DREF partners, such as the German Red Cross and Climate Centre.

Besides, the findings from the study of CARE Bangladesh titled 'Utilization of District Disaster Management Funds and Relevant Financing Mechanism for Forecast-based Action (AA)' can be considered as important base to formulate guidelines for the allocation and utilization of resources for EA.

For Target distribution plan, targeted population will be listed as per the possible landfall area of cyclone, vulnerable population of that area, economic stability and others. If humanitarian agencies (UN, INGOs, NGOs, BDRCS, CBOs) need any help from the government, that need to be identified.

Reference documents for the NEAP:

- Disaster Management Act, 2012
- National Disaster Management Policy, 2015
- Disaster Management Fund Administration Regulations, 2021
- Coastal Development Strategy, 2006
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- Forecast-based Financing in Mozambique/Peru/Bangladesh, Forecast Knowledge Base: Flood and Cyclone Bangladesh, Red Cross/Red Crescent Climate Centre, 2015
- Forecast based Financing Early Action Protocol Cyclone Bangladesh, Bangladesh Red Crescent Society, 2018
- Cyclone Impact Survey Report, German Red Cross, Climate centre, 2019
- Bangladesh: Cyclone Early Action Protocol 2022, STEP
- List of Anticipatory Action for Cyclone, STEP Project, 2022
- Cyclone Sidr in Bangladesh: Damage, Loss, and Needs Assessment for Disaster Recovery and Reconstruction, A Report Prepared by the Government of Bangladesh, 2008
- Cyclonic Storm Mora Situation, May 2017, Nirapad
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- Final Report, Bangladesh: Cyclone Amphan, International Federation of Red Cross and Red Crescent Societies, 2021
- Zaman M. W., Ali M. M., Mita K. S., Azad A. A., Ahsan R., Haque A., Rahman M. (2018). Structural response of Coastal Wooden Infrastructure to Cyclonic Wind and Surge Induced Thrust Force. ICDRM Conference at BUET-JIDPUS.