ANDREWSPALLI CENTRE FOR INTEGRATED DEVELOPMENT

REPORT ON EARLY WARNING ASSESSMENT

The assessment aims to understand the gaps inherent in the four elements of the existing Early Warning System in Jogeshganj -Kalitala area of the Sundarbans

Acknowledgement

Special thanks to Mr. Saugata Bhattacharjee, Secretary of ACID for giving this opportunity and his DRR project team for providing ground level support in conducting this early warning study in Jogeshgunj and Kalitala Gram Panahcyat. Also heartiest thanks to Mr. Debnarayan Bej, Asia Regional Coordinator of Fondazione L' Albero Della Vita onlus (FADV) for mentoring, supporting and providing technical guidance for materializing this early warning study report.

Introduction

In a climate change hotspot like the Sundarbans which is prone to earthquakes, floods, tropical cyclones and storms surges, most of the recent disasters are weather related. This is further made critical by the fact that overtimes the unpredictability, magnitude and intensity of extreme weather events is likely to grow in the region. The two things that vulnerable communities need to be prepared so that these natural hazards do not get transformed into disasters are

- Effective early warning systems
- Timely response and early action.

The impact of any disaster is measured in terms of the extent of the damage caused by the hazard. This is related not just to its severity, but also to the capacity of people to prepare for and cope with it. Any disaster risk reduction initiative therefore needs to develop strong community based early warning systems that help the concerned community to effectively manage the disaster through timely warning and early action that prevents loss of life and reduces the economic and material impact of disasters. The efficacy of any early warning system, therefore requires the need to involve communities at risk for efficient and timely dissemination of messages and warnings, promoting understanding of those messages and warnings and ensure that there is a constant state of preparedness.

A global target of the Sendai Framework (2015-2030), emphasizes the need for a substantial increase in, "the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030".

The traditional framework of early warning systems is composed of three phases:[1]

i. Monitoring of Risk (Measurement of Precursors)
ii. Forecast indicates sudden disaster event (catastrophic)
iii. Notification of a warning or alert, should an event of probable disaster/event take place

However, a people-centred early warning system needs to comprise of four key elements to be truly effective: knowledge of the risks; monitoring, analysis and forecasting of the hazards; communication or dissemination of alerts and warnings; and local capabilities to respond to the warnings received (BASHER, 2006).[2]

Out of these four elements it is generally recognized that, the communication and dissemination component is the one which lacks sufficient attention from stakeholders, thus usually resulting in tendering a gap between the information produced by the state and

[1] Establishing Community Based Early Warning System, Practitioner's Handbook, Mercy Corps and Practical Action 2010

[2] Basher, R. (2006) Global early warning systems for natural hazards: systematic and people-centred. Philosophical Transactions of the Royal Society A, 364: 2167-2182.

national level forecasting organizations and the information that might be received, understood and acted upon by the communities at risk.

Objective of Assessment: The study will identify the gaps in early warning and recommend for appropriate community based early warning system which can reach different sections of the society including children, women, people with disabilities and other vulnerable communities in the community.

The area of this assessment is the intervention area of ACID, in Jogeshganj-Kalitala in the Sundarbans (District: North 24 Parganas), with support from FADV.

Methodology

The overall study involves the following methods of data collection:

1. **Primary data**, to enable the integration of warning system components, emphasizing the importance of incorporating human and organizational factors into any warning system planning and development processes. It is collected through –
    a. **Key Informant Interview (KII)** with stakeholders throughout the systemic chain, responsible for channelizing and disseminating the early warning information. The interviews were conducted with the Disaster Management Officers at the State, District, Sub-Division and Block levels, the Block Development Officer and the Police stations nearest to and responsible for the field area. The objectives of such interviews are as follows:
        i. Identify methods and protocols that these stakeholders currently have available for receiving and/or communicating early warnings.
        ii. Identify perceived benefits and barriers to stakeholders' use of early warnings.
        iii. Identify the methods of communication for last mile connectivity currently in use and whether they differ by potential users
        iv. Identify methods and protocols that these stakeholders currently have available for receiving and/or communicating de-warning.
        v. Identify the time frame that these stakeholders currently have available for receiving and/or communicating de-warning.

    b. **Focus Group Discussion (FGD)** with primary and secondary beneficiaries of the warning information generated and / or communicated at any level. The two FGDs were conducted with a heterogeneous group in each GP, comprising of mutually non-exclusive representation from
        i. Fisher folk
        ii. Small farmers
        iii. Vulnerable dwellers, in terms of social, economic and geographical vulnerability
        iv. Forest dependents
        v. Representative of local government
        vi. Women / SHG members
        vii. Children
        viii. Anganwadi workers
        ix. ASHA workers

The objectives of FGD would be to

i. Identify methods, protocols and point persons that the community currently has available for receiving and/or communicating early warnings to each resident.
ii. Identify perceived benefits and barriers to people's use of early warnings.
iii. Identify the methods of communication for last mile connectivity currently in use and whether they differ by distance, social customs, or any other issue
iv. Identify methods and protocols that these villagers currently have available for receiving and/or communicating de-warning.
v. Identify any indigenous knowledge that these villagers currently have available for receiving and/or communicating early warning and de-warning.
vi. Identify the reaction / response mechanism that these villagers currently have available / employ after receiving and/or communicating early warning and de-warning.

2. **Secondary data**, to provide a general framework for describing the elements of a warning system that need to be defined. It is to be collected through –
    a. Desk Review and analysis of available references and policy documents.

The expected outcome of employing the study methods outlined above is in line with and derived from the study outcomes delineated in the ToR document, viz.

1. **Risk Knowledge**: To study the risk knowledge of the communities & different stakeholders.
2. **Monitoring and warning**: To study the systems with monitoring and predicting capabilities provide timely estimates of the potential risk faced by communities and the environment.
3. **Disseminating & communication**: To study the existing Communication systems including the indigenous practices for delivering warning messages to the potentially affected locations to alert local and governmental agencies. How much the messages are reliable, synthetic and simple to be understood by local authorities and community. How local government ensure last mile connectivity or 100% coverage of the EW message.
4. **Response capabilities:** To study the community response capabilities, Coordination between different stakeholders, evacuation plan if any, governance and appropriate action plans if any in the existing early warning system. Likewise, public awareness and education which are the critical aspects of mitigation strategies

Major Findings

In general, key informant interview with the Disaster Management Department and the Police Stations in and around the field area as well as FGD with the community level stakeholders at Jogeshganj Kalitala, were employed to get an idea of the area in question as well as regarding the four elements.

Jogeshganj Kalitala is a riverine tract of land prone to earthquake, floods, tropical cyclones, tidal bores and bounded on one side by the Sundarban tiger reserves. The area is elongated in shape with cyclone shelter at one end of the GP.

The major findings of the assessment are divided into four sub-chapters, based on the four components of an effective early warning system.

1. Risk Knowledge:

Risks arise when hazards and vulnerabilities combine. The communities risk assessment is based on historic experience and human, social, economic and environmental vulnerabilities. It is evident from the FGDs that prior knowledge of the risks faced by the communities is existing, based on their, and their ancestors' experience and living in the area. They are well aware of the natural hazards and their own vulnerabilities related to access to safe shelter, information, and appropriate technology for coping. It seems from the discussions that the socio-economic dynamics within the community at risk also place an important role in their relative understanding of the various risks and the capability of response. In this regard, it may be mentioned that the capacity to respond, proportionately affects the interest in risk knowledge.

However, the existing risk knowledge is not dependent on institutional knowledge on disaster risk reduction, but rather on experiential data gather over time by facing hydro-meteorological disasters over time. Thus such knowledge is deep in understanding natural hazards like floods, erosions, tropical cyclones tidal bores etc. but not when the pattern deviates to include manmade disasters. Their coping mechanism is oriented towards this flood-responsive pattern, as well.

No formal risk assessment or map to help understand the situation, and to prioritize actions to be taken in anticipation and/or in the event of a disaster is existent to guide preparations or response measures.

Risk Knowledge at different level

At Different level	Findings in Sundarban area
Individual	• Children don't know their risk at all. • Adults know the knowledge of their potential risk however don't know the same scientific cause and effects • No knowledge of risk however old age people can assume risk through their superstitious beliefs
Family	• At family level the knowledge of risk is very limited however in few places of Jogeshgunj and Kalitala Gram Panchayat the risk are associated with few myths and superstitious beliefs • Few educated families have some knowledge of risk with scientific bases like knowledge of HFL, Timing of tidal bores and probability of rainy seasons and probabilities of flooding in Sundarban due to heavy rain and breach of embankments
Community	• At Community level the knowledge of risk is very limited however in few places of Jogeshgunj and Kalitala Gram Panchayat the risk are associated with few myths and superstitious beliefs • Few CBOs and Clubs are trying to learn on their community risk through different sources however still it's very limited. • Community always share their past lesson learnt of loss and damages due to Aila cyclone
Local Government	• Earlier the knowledge of risk was very less however due to different capacity building and training from different state

	level stakeholders these local Government has enhance their knowledge however they are not enough capable to transfer these knowledge to the community. • Also local government don't have enough fund allocated to capacitate the community. • No IEC like poster, banner or miking is supported by the local government for enhancing the knowledge of community in terms of risk knowledge

2. Monitoring and Warning:

The community at risk is primarily dependent on individual sources of information for formal forecasting and warning systems are not evident within the community. Radio, TV, newspapers and in a few instances, information from GP does come through although it is not general in nature. The community at large receives widespread risk information as well as alert messages and warnings only before major anticipated events like well-known cyclone systems in Bay of Bengal. However, in case of relatively minor events, like excessive downpour such warnings do not exist.

In most cases the monitoring done is a part of the individual's household level preparedness in readiness of an anticipated flooding, whether due to continued and excessive rainfall, cyclonic storm or embankment Bridge.

The community, in discussion, displayed no knowledge of any de-warning system in place.

The teachers in the schools monitor the weather situations and keep themselves updated accordingly. The students are local, and their attendance especially during the monsoon is also dependent on their parents' access to alerts and warnings.

Monitoring and Warning at different level

At Different level	Findings in Sundarban area
Individual	• Children are not at all involve in monitoring and warning system however few children participate in traditional warning system of early warning specially during earthquake by ringing bells, conches and utensils • Adults know the knowledge of monitoring through their local knowledge's of highest flood level, rising of river water level however in few places it comes into action through warnings. • Lack of technical knowledge how to calculate the time period, frequency, volume of water can flood the areas in how much time etc.
Family	• At family level the knowledge of monitoring is very limited mainly by the women however it mainly done through the myths and superstitious beliefs • Few educated families have some knowledge of monitoring the weather and rain water with their local knowledge however cannot link with the scientific bases and also listen to TV news and radio news particularly on weather forecast reports
Community	• At Community level the knowledge of monitoring and warning is very limited however in community participate in warning dissemination through local and traditional practices like miking, ringing of bells, blowing of conches and beating of drums

Local Government	• Earlier the monitoring and warning was very less however now a days due to different capacity building and training from different state level stakeholders these local Government have started monitoring the river water level, tidal calendars of rivers etc, listening to the wireless message received from the block and district level and start dissemination of warnings particularly through miking.

Given below are few traditional practises done by community having some scientific base

In **Sundarban traditional practices** are also very indicative particularly on early warning and monitoring.

Before the invention of these scientific tools of detecting probable hazards, generating early warnings and disseminating the message to the communities, there were some traditional methods through which people could guess about the coming disaster. These signs act as early warnings for the community.

1. Common Toad as Indicator

a. Common toads appear to be able to sense an impending earthquake and will flee their colony days before the seismic activity strikes

b. Toads sounds before heavy rain

Scientific reason	Expected event/s	Picture
Toads are able to detect pre-seismic cues such as the release of gases and charged particles, and use these as a form of earthquake early warning system	Earthquake and heavy rain	

2. Ants as Indicators

A variety of ant (Red wood ant) able to sense an impending earthquake and come out of the soil with their eggs and mitigate the entire area before the incidents strikes.

Scientific reason	Expected event/s	Picture
Red wood ants have high sensitivity for changes of the environment. They can detect and determine CO_2-concentrations – a precondition for an optimized regulation of oxygen concentration within their nest. Additionally, CO_2 arises from the deep crust. The gas amount and its composition can vary just before and after an earthquake happens. This is supposed to cause earthquake response by the ants.	Earthquake	

3. Plant/ trees as Indicator

The presence of flowers in bamboo plants after a long period indicates **heavy rainfall with associated flood**. The presence of higher than normal flowering intensity of the Nandi flame tree (Delonix regia), Mango tree (Magifera indica), Sausage tree (Kigelia ethiopica) indicates heavy rainfall during monsoon.The immature dropping of fruits by certain tree species, the shedding of leaves.

4. Animals as Indicator

Sometimes it has been found that Goat or sheep are on the roof of the house instead of grazing. Even abnormal crying of dogs and cats indicates certain disasters. In Sundarban it has been found that climbing trees by Goat or sheep resembles cyclone with heavy rain which may also led to flood

5. Birds as Indicators

Abnormal crowing of crows or birds of similar species

Scientific reason	Expected event/s	Picture
There is no such scientific reason behind this.	Earthquake or flood	

Fish and Crab movements as Indicators

Some variety of deep water fish come to the superficial layer and some variety of crabs come out during low tides. This has been observed mostly during the full moon or in no moon.

Scientific reason	Expected event/s	Picture

There are several factors:- • Changes in water temperature • Increase in volume of water during full moon and no moon which results in variation of gravitational force. • Changes in the O_2 and CO_2 level inside the water	Flood/ Earthquake 	

Bee as Indicator

Bees generally build their hives in the direction of wind. Bees can predict the average wind direction of a season. Old aged people of Sunderban speak about the behavioral change of bees before cyclone.

Scientific reason	Expected event/s	Picture
Bees can sense the wind and starts flying in clusters and spirally	Cyclone and High speed wind	 White arrow marks the direction of wind

3. Disseminating and Communication:

The importance of a community based dissemination and communication system lies in the fact that

a) All members of the community may not be able to receive and/or understand the message and
b) They might not be able to respond to the message adequately;

Which is readily known by the community in question but it may not be so with any outsider.

Although there is some intra-community communication that exists, there does not seem to be any established method or formal mechanism for last mile connectivity.

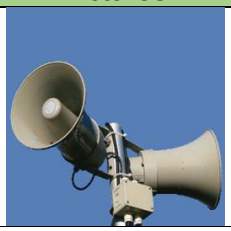
Indigenous method of Disseminating EW messages in Sundarban

There are lots of traditional methods of EW message dissemination in Sundarban which has been revealed from the field based research studies from practical experience during flood due to tidal surge and earthquake.

Appliance used for dissemination	Pictures

Conch blowing- Blowing of conch by women are very common during the earthquake.	
Ringing of gongs and bells- Ringing of bells and gongs in temples and by the children and women are common in Sunderban during any natural disaster like Earthquake, Cyclone and flood.	
Beating of drums- Generally seen before any flood like situation or Earthquake. Men used to beat drums and vitiate the village	
PAS of Mosque- The microphone of mosques is also used as a message disseminating device for early warning.	

Government initiatives

Appliance used for dissemination	Pictures
Public Addressing system from Panchayat and Block Department	
Using of Megaphone- Megaphones are also used nowadays which are kept in the Village Information KIOSKS	

Disseminating and Communication at different level

At Different level	Findings in Sundarban area
Individual	• Children are not at all involve in monitoring and warning system however few children participate in traditional dissemination system of early warning specially during earthquake by ringing bells, conches and utensils. Also sometimes participates in disseminating message targeting the catchment area through bicycling • Adults know the knowledge of disseminating and communicating through their local knowledge's through milking and sounds of danger in few places of Jogeshgunj Gram Panchayat.
Family	• At family level the knowledge of dissemination is very strong

	mainly by the women to protect their family and know their places of evacuation however lack of knowledge in calculating the time, what to take along with to the nearest evacuation site and how to move their (shortest possible time and route) • However families are unable to communicate to their neighbours and others relative due to lack of knowledge
Community	• At Community level the knowledge of dissemination and communication is very strong and is done by participating in warning dissemination through local and traditional practices like miking, ringing of bells, blowing of conches and beating of drums
Local Government	• Now a day's dissemination and communication was very strong however now a days due to different capacity building and training from different state level stakeholders these local Government have started disseminating the message through miking and using other devices however weak in communicating in all the catchment area and reaching last mile connectivity due to non availability of resources like bad roads connectivity, technological barriers etc.

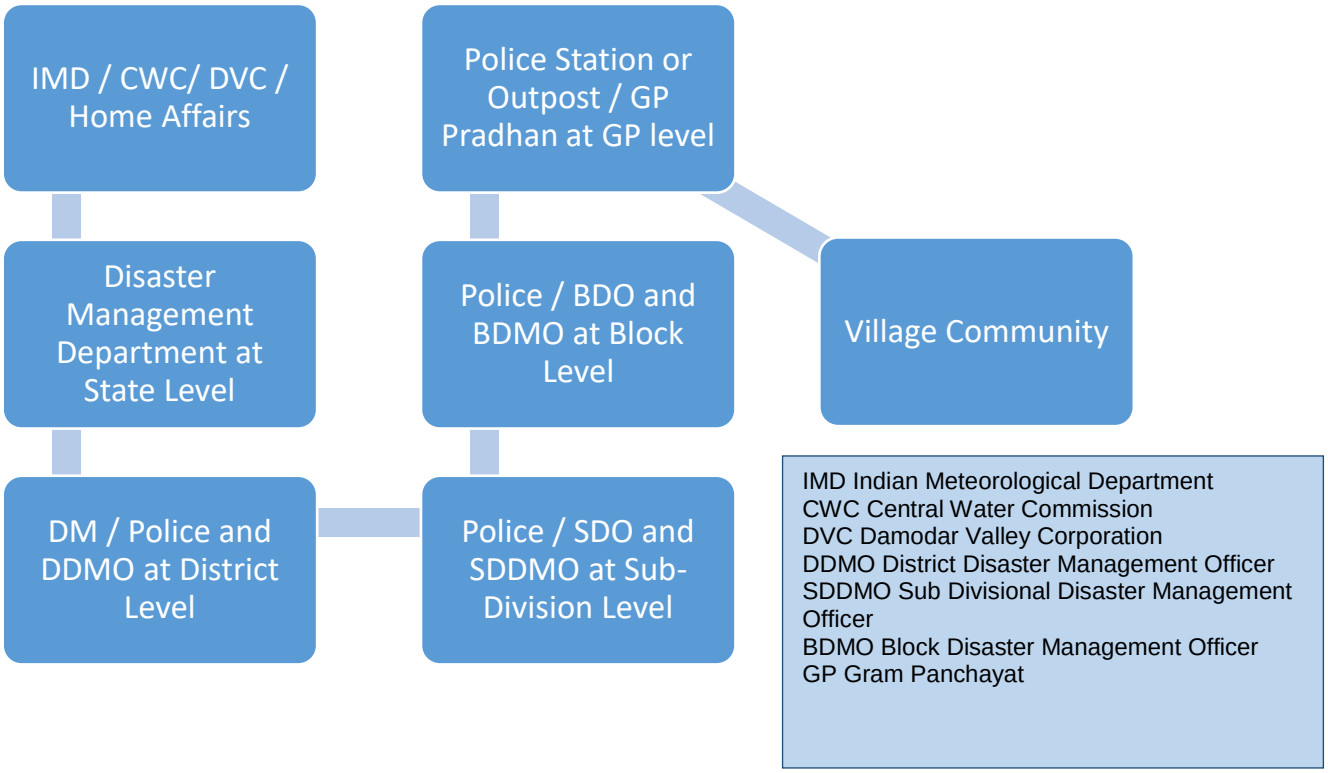
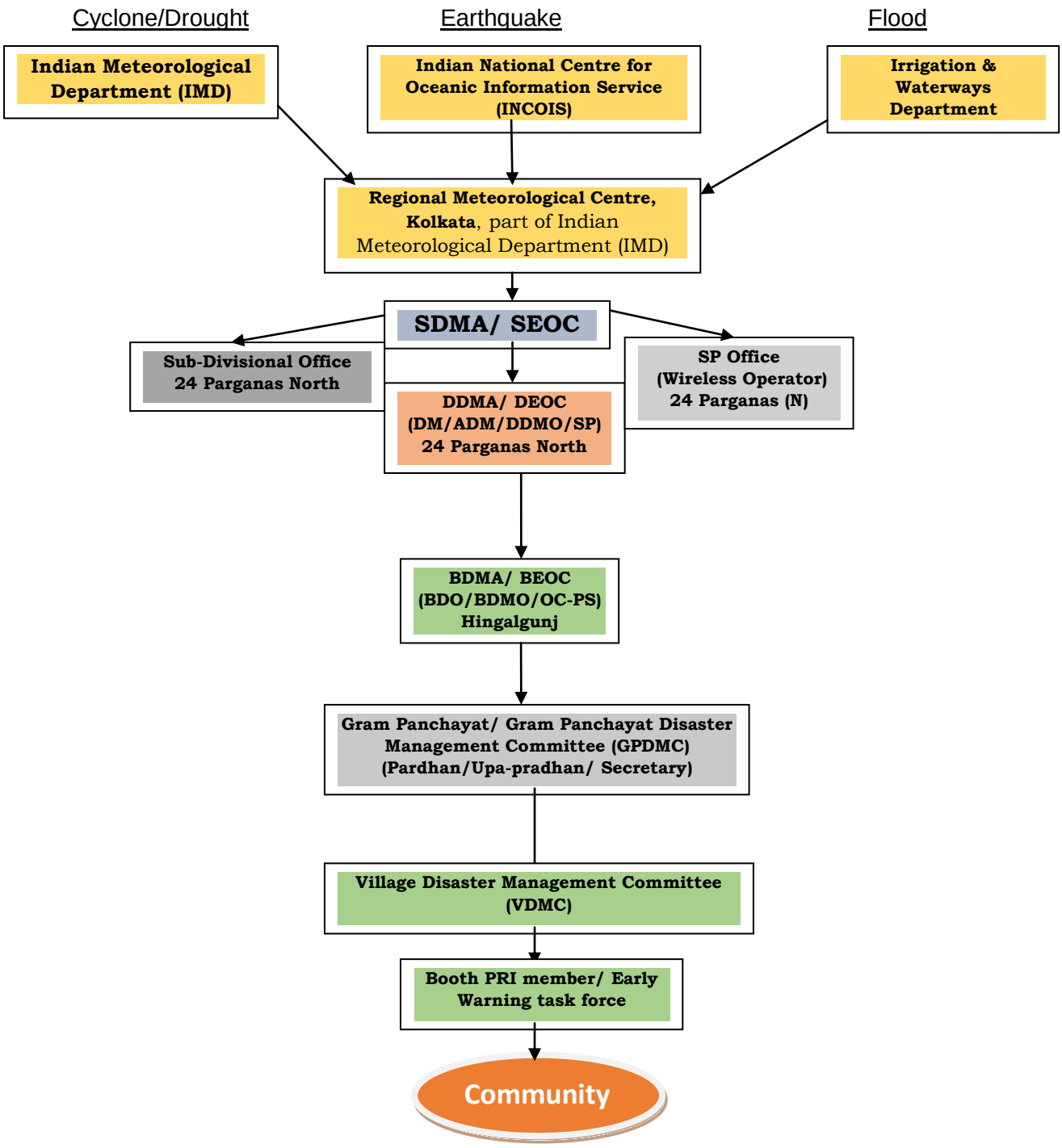


Fig1: The dissemination mechanism currently existing according to Govt. Sources

The dissemination mechanism that starts two-pronged from the state level through the disaster management and the police department ensures that the information travels down to the GP level. However further dissemination of that information is critical in ensuring the effective preparedness and efficient response of the community to any disaster event. There does not seem to be any institutional early warning system in place within the community. Although sporadic messages and alerts do get communicated to a few members of the community, but it is neither consistent nor fully encompassing in nature.

Existing Flow chart of Early Warning in Sunderbans



Tidal Calendar issued from Kolkata Trust Port for the year of 2016

Tidal Bores predicted & issued by Kolkata Port Trust for the year 2016 in all most for all the rivers merging to Bay of Bengal. This tidal calendar is also practiced by the Jetties and big vessel/ships in these rivers and move/park accordingly

KOLKATA PORT TRUST

Information regarding **Bore-Tides**, period during which Mooring & Jetties are to be vacated, **bore restrictions** and other general information.

PREDICTED BORE TIDES FOR THE YEAR 2016.

Sl. No	BORE EXPECTED		No. of Days	Max. Range	MOORING AND JETTIES TO BE VACATED			Day/Night	Strength of Bore
	FROM	TO			From	To	No.of Days		
1.	10.01.16	13.01.16	3½	4.19	P.M. 11th	P.M. 12th.	1½	Night	Moderate
2.	08.02.16	13.02.16	5½	4.69	PM 8th	A.M. 13th	5	Day/Night	Heavy
3.	07.03.16	13.03.16	6½	4.97	A.M. 8th	P.M. 13th	6	Day/Night	Heavy
4.	05.04.16	11.04.16	6½	5.19	AM 6th	PM 11 th	6	Day/Night	Heavy
5.	23.04.16	24.04.16	1½	4.01	-	-		Day	Slight
6.	05.05.16	10.05.16	6	5.11	AM 5th	PM 10th	6	Day/Night	Heavy
7.	22.05.16	24.05.16	2½	4.14	-	-	-	Day	Slight
8.	03.06.16	08.06.16	5½	4.71	AM 3rd	AM 8th	5½	Day/Night	Heavy
9.	21.06.16	23.06.16	2½	4.08	-	-	-	Day	Slight
10.	02.07.16	07.07.16	5½	4.48	AM 3rd	AM 6th	4½	Day	Heavy
11.	19.07.16	24.07.16	6	4.46	AM 20th	AM 23rd	3½	Day/Night	Heavy
12.	01.08.16	05.08.16	4½	4.40	AM 2nd	AM 5th	3½	Day	Heavy
13.	17.08.16	23.08.16	7	4.90	AM 18th	AM 23rd	5½	Day/Night	Heavy
14.	31.08.16	03.09.16	4	4.12	-	-	-	Day/Night	Slight
15.	15.09.16	21.09.16	6½	4.98	AM16th	AM21st	5½	Day/Night	Heavy
16.	14.10.16	20.10.16	6	5.15	AM 15th	AM 20th	5½	Day/Night	Heavy
17.	12.11.16	17.11.16	5½	4.90	AM 13th	PM 17th	5	Day/Night	Heavy
18.	12.12.16	16.12.16	4	4.43	AM13th	PM15th	3	Night	Heavy
	Total days		**89**				**70**		

GENERAL INFORMATION

Max-Length (OA) & Breadth of vessels acceptable at Kolkata / Baj Baj

KPD K.P. Docks 157m x 21.35m (515' x 70')
No.1 KPDD 155.45m x 19.50m (510' x 64'), No.2 KPDD 153.90m x 19.50m (505' x 64')
No.3 KPDD 102.10m x 14.70m (335' x 48')

NSD N.S. Docks 172m x 24.30m (565' x 80')
No.1 NSDD 172m x 22.90m (565' x 75'), No.2 NSDD 172m x 22.90m (565' x 75')

BAJ BAJ : **189m x 26.2m (620' x 86') with effect from 01/02/2016**

Operational offices at KPD, NSD and Tuckta Ghat maintaining V.H.F. Watch on channel 12 for KPD / NSD and Channel 13 for Tuckta Ghat and Channel 12 for Dy. Harbour Master (Port & river). Messages are exchanged as per agreed channel after contact.

The **Emergency caisson** is likely to be scuttled at KPD during tides rising above 6.8m. The dates will be conveyed later. The shipping movements through KPD Lock will be affected on those dates.

BORE RESTRICTIONS.

i. Vessels, which cannot be held in the Port during bore period must be in readiness to proceed out and remain at Sand heads till berths are available (By-Law 14A).
ii. VPP vessels not acceptable in Moorings including at Baj Baj.

Date. (A. AHMED)
Harbour Master (Port)

cc.: D.M.D / T. M / C. M. E for information please.
cc.: H.M (R) / Dy. H.M (P) / C.H / S.D & D.S / M. M / A.H.M, BAJ BAJ for information please.
cc.: All Shipping Agents.

4. Response Capabilities:

The community is usually reluctant to respond in time as the alerts and messages are not general or widespread and thus not recognized to be useful in saving lives. An efficient response requires the community to understand the alerts and warnings and act accordingly in a timely fashion. It also requires that the community has the capability to prepared itself and know what to do in a given disaster situation. Thus community level awareness generation and preparedness activities play a critical role in increasing resilience.

Response Capabilities at different level

At Different level	Findings in Sundarban area
Individual	• Adults know where to evacuate and do accordingly by shifting their family in the nearest evacuation and safer site however lack of knowledge in calculating time and other factors
Family	• At family level the response capacities are very strong mainly by the women to protect their family and know their places of evacuation however lack of knowledge in calculating the time, what to take along with to the nearest evacuation site and how to move their (shortest possible time and route)
Community	• The community in discussion demonstrated that the current response mechanism is ad hoc in nature and does not follow any set pattern with reference to standard practices, allocation of resources, contingency planning, and clearly defined roles and responsibilities of each community member. An efficient response mechanism requires effective governance and institutional arrangements as well as the involvement of local communities and consideration of gender perspective and other diverse cross-section of society.
Local Government	• Earlier Government was doing the relief distribution after any disaster however now a days by the initiatives of Disaster Management Departments lots of activities are performed through the local governments by response capacities along with joint effort of all the other lone departments like health, fire and rescue etc through providing first aid and preliminary health care support, rescuing and establishing of temporary evacuation sites

Recommendations and Conclusions

The risk knowledge of the community is individual household based and centred on their past experience in dealing with hydro-meteorological disasters which results in a significant gap with reference to other types of disasters. Moreover, the current monitoring of hazard parameters and contributing factors is also at an individual level. As such clear warning messages either do not percolate throughout the community or are not understandable when they do. This adversely affects the response mechanism as currently practiced by the community.

The recommendations are as follows:

- **Coordination** between community level institutions, the community at risk and involved agencies is imperative to ensure warning messages from different institutional and communication networks are channelled through all relevant stakeholders.
- **Strengthening** the **existing DRR structure** for creating connection and disseminating warnings instead of a parallel system.
- **Utilising** a team of local level **volunteers** including the children and youth to act as communication agents and assist in dissemination of warning messages.
- **Capacity development** trainings on recognizing gaps in the current early warning system and how to receive, interpret and respond to warnings.
- **Increase awareness** raising activities among children and youth to develop risk knowledge.

- **Ensure** that early warning is **institutionalized** and reaches the furthest person in terms of social, economic and geographical distance.
- A **parallel de-warning system** needs to be in place.

Detailed recommendations under each elements of Early Warning system for Sundarban

Key element-1 RISK KNOWLEDGE

Aim: Establish a systematic, standardized process to collect, assess and share data, maps and trends on hazards and vulnerabilities

Key Actors

International, national and local disaster management agencies; meteorological and hydrological organizations; geophysical experts; social scientists; engineers; land use and urban planners; researchers and academics; organizations and community representatives involved in disaster management; international and UN agencies

1. **Establishing Organizational Arrangements**
   - Key national/Sate government agencies including NDMA/SDMA and nodal agencies like IMD, INCOIS involved in hazard and vulnerability assessments
   - Identifying and clarifying the roles (e.g. agencies responsible for economic data, demographic data, land use planning, social data etc).
   - Responsibility for coordinating hazard identification, vulnerability and risk assessment assigned to one State organization.
   - Legislation or government policy mandating the preparation of hazard and vulnerability maps for all communities in place.
   - National standards for the systematic collection, sharing and assessment of hazard and vulnerability data developed, and standardized with neighboring or regional countries, where appropriate.
   - Process for scientific and technical experts to assess and review the accuracy of risk data and information developed.
   - Developing strategy to actively engage communities in local hazard and vulnerability analyses developed.
   - Preparing the process to review and update risk data each year, and include information on any new or emerging vulnerabilities and hazards established.

2. **Identifying Natural Hazards**
   - Characteristics of key natural hazards (e.g. intensity, frequency and probability) analyzed and historical data evaluated.
   - Developing Hazard maps to identify the geographical areas and communities that could be affected by natural hazards.
   - Developing an integrated hazard map (where possible) to assess the interaction of multiple natural hazards.

3. Analyzing Community Vulnerability
   - Conducting community vulnerability assessments for all relevant natural hazards.
   - Considering Historical data sources and potential future hazard events in vulnerability assessments.
   - Considering factors such as gender, disability, access to infrastructure, economic diversity and environmental sensitivities
   - Mapping of Vulnerabilities documented (e.g. people or communities along river line and coastlines identified and mapped).

4. Assessing Risks
   - Interaction of hazards and vulnerabilities assessed to determine the risks faced by each region or community.

- Conducting community and industry like brick kiln consultation to ensure risk information is comprehensive and includes historical and indigenous knowledge, and local information and national level data.
- Evaluating and identifying activities that increase risks.
- Results of risks assessment to be integrated into local village DRR plans and warning messages.

5. Information Stored and Accessible

- Establishing Central 'library' or GIS database to store all disaster and natural hazard risk information.
- Hazard and vulnerability data available to government, the public and the international community (where appropriate).
- Developing maintenance plan to keep data current and updated.

Key element-2 MONITORING AND WARNING SERVICE

Aim: Establish an effective hazard monitoring and warning service with a sound scientific and technological basis.

Key Actors

National meteorological and hydrological services; specialized observatory and warning centers (e.g. for IMD, INCOIS); universities and research institutes; private sector equipment suppliers; telecommunications authorities; quality management experts; regional technical centers; UN agencies such as UN/ISDR, WMO, FAO, UNESCO, UNEP, UNOSAT, OCHA, etc.

1. **Establishing Institutional Mechanisms**

- Standardized process, and roles and responsibilities of all organizations generating and issuing warnings established and mandated by law including of EW task force working at ground zero level.
- Establishing agreements and interagency protocols to ensure consistency of warning language and communication channels where different hazards are handled by different agencies.
- Establishing an all-hazard plan to obtain mutual efficiencies and effectiveness among different warning systems.
- Warning system partners, including local authorities, aware of which organizations are responsible for warnings.
- Protocols in place to define communication responsibilities and channels for technical warning services.
- Preparing communication arrangements with international and regional organizations agreed and operational.
- Preparing regional agreements, coordination mechanisms and specialized centers in place for regional concerns such as tropical cyclones, floods in shared basins, data exchange, and technical capacity building.
- Warning system subjected to system-wide tests and exercises at least once each year.
- A national all-hazards committee on technical warning systems in place and linked to national disaster management and reduction authorities, including the national platform for disaster risk reduction.
- Establishing system to verify that warnings have reached the intended recipients.
- Warning centers staffed at all times (24 hours per day, seven days per week).

2. **Developing Monitoring Systems**

- Documenting measurement parameters and specifications documented for each relevant hazard.

- Plans and documents for monitoring networks available and agreed with experts and relevant authorities.
- Technical equipment, suited to local conditions and circumstances, in place and personnel (Task force like representatives of Gram Panchayat or at Village level trained in its use and maintenance.
- Applicable data and analysis from regional networks, adjacent territories and international sources accessible.
- Receiving, processing data and available in meaningful formats in real time, or near-real time.
- Preparing strategy in place for obtaining, reviewing and disseminating data on vulnerabilities associated with relevant hazards.
- Archiving data routinely and accessible for verification and research purposes.

3. **Establishing Forecasting and Warning Systems**

- Data analysis, prediction and warning generation based on accepted scientific and technical methodologies.
- Issuing of data and warning products within international standards and protocols.
- Imparting trainings of warning analysts to appropriate international standards.
- Equipping Warning centres with appropriate equipment needed to handle data and run prediction models.
- Fail-safe systems in place, such as power back-up, equipment redundancy and on-call personnel systems.
- Generating and disseminating of warnings in an efficient and timely manner and in a format suited to user needs.
- Implementing plan to routinely monitor and evaluate operational processes, including data quality and warning performance.

Key Element 3: DISSEMINATION AND COMMUNICATION

Aim: Develop communication and dissemination systems to ensure people and communities are warned in advance of impending natural hazard events and facilitate national and regional coordination and information exchange.

Key Actors

International, national and local disaster management agencies; national meteorological and hydrological services; military and civil authorities; media organizations (print, television, radio and online); businesses in vulnerable sectors (e.g. tourism, aged care facilities, marine vessels); community based and grassroots organizations; international and UN agencies such as UN/ISDR, IFRC, UNDP, UNESCO, UNEP, WMO, OCHA etc.

1. **Institutionalization of Organizational and Decision-making Processes**

- Warning dissemination chain enforced through government policy or legislation (e.g. message passed from government to emergency managers and communities etc).
- Empowering recognized authorities to disseminate warning messages (e.g. meteorological authorities to provide weather messages, health authorities to provide health warnings).
- Functions, roles and responsibilities of each actor in the warning dissemination process specified in legislation or government policy (e.g. national meteorological and hydrological services, media, NGOs).
- Roles and responsibilities of regional or cross border early warning centers defined, including the dissemination of warnings to neighboring countries.
- Volunteer network trained and empowered to receive and widely disseminate hazard warnings to remote households and communities.

2. **Installation of Effective Communication Systems and Equipment**

- Communication and dissemination systems tailored to the needs of individual communities (e.g. radio or television for those with access; and sirens, warning flags or messenger runners for remote communities).
- Warning communication technology reaches the entire population, including seasonal populations and remote locations.
- International organizations or experts consulted to assist with identification and procurement of appropriate equipment.
- Multiple communication mediums used for warning dissemination (e.g. mass media and informal communication).
- Agreements developed to utilize private sector resources where appropriate (e.g. amateur radios, safety shelters).
- Consistent warning dissemination and communication systems used for all hazards.
- Communication system is two-way and interactive to allow for verification that warnings have been received.
- Equipment maintenance and upgrade programme implemented and redundancies enforced so back-up systems are in place in the event of a failure.

3. **Understanding and recognizing Warning Messages**

- Tailoring warning alerts and messages to the specific needs of those at risk (e.g. for diverse cultural, social, gender, linguistic and educational backgrounds).
- Targeting warning alerts and messages are geographically-specific to ensure warnings are to those at risk only.
- Messages incorporate the understanding of the values, concerns and interests of those who will need to take action (e.g. instructions for safeguarding livestock and pets).
- Warning alerts clearly recognizable and consistent over time and include follow-up actions when required.
- Warnings specific about the nature of the threat and its impacts.
- Mechanisms in place to inform the community when the threat has ended.
- Study into how people access and interpret early warning messages undertaken and lessons learnt incorporated into message formats and dissemination processes

Key Element 4: RESPONSE CAPABILITY

Aim: Strengthen the ability of communities to respond to natural disasters through enhanced education of natural hazard risks, community participation and disaster preparedness.

Key Actors

Community-based and grassroots organizations; schools; universities; informal education sector; media (print, radio, television, on-line); technical agencies with specialized knowledge of hazards; international; national and local disaster management agencies; regional disaster management agencies;

1. **Respects of Warnings**

- Generating and distributing warnings to those at risk by credible sources (e.g. government, spiritual leaders, respected community organizations).
- Public perception of natural hazard risks and the warning service analyzed to predict community responses.
- Building strategies to build credibility and developing trust in warnings (e.g. understanding difference between forecasts and warnings).
- Minimizing false alarms and improvements communicated to maintain trust in the warning system.

2. **Disaster Preparedness and Response**

- Establishing Disaster Preparedness and Response Plans
- Empowering disaster preparedness and response plans by law.

- Targeting disaster preparedness and response plans to the individual needs of vulnerable communities.
- Utilizing hazard and vulnerability maps to develop emergency preparedness and response plans.
- Developing, disseminating and practicing Up-to-date emergency preparedness and response plans to the community.
- Analyzing previous disaster events and responses, and incorporating lessons learnt into disaster management plans.
- Implementing strategies to maintain preparedness for recurrent hazard events.
- Regular testing and drills to undertaketo test the effectiveness of the early warning dissemination processes and responses.

3. **Strengthening & assessment of Community Response Capacity**
   - Assessing community ability to respond effectively to early warnings.
   - Incorporating response to previous disasters analyzed and lessons learnt into future capacity building strategies.
   - Engaging Community-focused organizations to assist with capacity building.
   - Developing and implementing community and volunteer education and training programmes
5. **Enhancing Public Awareness and Education**
   - Simple information on hazards, vulnerabilities, risks, and how to reduce disaster impacts disseminated to vulnerable communities and decision-makers.
   - Community educated on how warnings will be disseminated and which sources are reliable and how to respond to different types of hazards after an early warning message is received.
   - Community trained to recognize simple hydro-meteorological and geophysical hazard signals to allow immediate response.
   - On-going public awareness and education built in to school curricula from primary schools to university.
   - Mass media and folk or alternative media utilized to improve public awareness.
   - Public awareness and education campaigns tailored to the specific need of each audience (e.g. children, emergency managers, media).
   - Public awareness strategies and programmes evaluated at least once per year and updated where required.

Cross-Cutting Issue:

GOVERNANCE AND INSTITUTIONAL ARRANGEMENTS

Aim: Develop institutional, legislative and policy frameworks that support the implementation and maintenance of effective early warning systems.

Key Actors

Political leaders; policy makers (e.g. environment, development and planning departments); international, national and local disaster management agencies; meteorological and hydrological organizations; researchers and academics; non-government organizations; international and UN agencies

1. **Early Warning Secured as a Long Term National and Local Priority**
   - Highlighting economic benefits of early warning to senior government and political leaders using practical methods such as a cost-benefit analysis of previous disasters.
   - Disseminating examples and case studies of successful early warning systems to senior government and political leaders.
   - Early warning role models or “champions” engaged to advocate early warning and promote its benefits.
   - Identifying & establishing the priority natural hazard risk requiring an early warning system, and operational arrangements within a multi-hazard framework.
   - Early warning integrated into national economic planning.

2. **Establishing Legal and Policy Frameworks to Support Early Warning**
   - Developing national legislation or policies to provide an institutional and legal basis for implementing early warning systems.
   - Involving clear roles and responsibilities defined for all organizations (government and nongovernment) in early warning.
   - Overall responsibility and authority for coordination of early warning assigned to one national agency.
   - One political leader or senior government official empowered by law as the national decision maker.
   - Developing policies to decentralize disaster management and encourage community participation.
   - Local decision making and implementation of early warning systems placed within broader administrative and resource capabilities at the national or regional level.
   - Establishing regional and cross-border agreements to ensure early warning systems are integrated where possible.
   - Involving & mandating relationships and partnerships between all organizations in early warning institutionalization and coordination mechanisms.
   - Early warning integrated into disaster reduction and development policies.
   - Monitoring and enforcement regime in place to support policies and legislation

3. **Assessment & enhancing Institutional Capacities**
   - Resourcing and developing capacities of all organizations and institutions involved assessed and capacity building plans and training programmes.
   - Engaging and encouraging non-governmental sector to contribute to capacity building.

4. **Securing Financial Resources**
   - Developing and institutionalizing government funding mechanism for early warning and disaster preparedness.
   - Exploring and accessing for funding at the international or regional level.
   - Utilizing public/private partnerships to assist with early warning system development.

Annexure 1

Open ended interview schedule for conducting FGD - Study on effectiveness of early warning system

a. **Focus Group Discussion (FGD)** with primary and secondary beneficiaries of the warning information generated and / or communicated at any level. The two FGDs would be conducted with a heterogeneous group in each GP, comprising of mutually non-exclusive representation from
   i. Fisher folk
   ii. Small farmers
   iii. Vulnerable dwellers, in terms of social, economic and geographical vulnerability
   iv. Forest dependents
   v. Representative of local government
   vi. Women / SHG members
   vii. Children
   viii. Anganwadi workers
   ix. ASHA workers

3. The FGD schedule would cover fully / partially the following components of Early Warning:
   a. Risk Knowledge
   b. Monitoring and warning

c. *Disseminating & communication*
d. *Response capabilities*

4. FGD Schedule

a. General Information

i. Please provide us with an overview of the disaster situation over the last 5 years?
ii. What has been the most significant impact and to whom or what can this attributed?
iii. What have been the challenges and successes during the current response?
iv. Are you aware of the risks associated if the alert is not received / responded to in time?
v. Is there any contingency plan in place?
vi. If yes, who is in charge of it?
vii. Is the VDMC active?
viii. Do you have any recommendations?

b. Identify methods, protocols and point persons that the community currently has available for receiving and/or communicating early warnings to each resident.

i. How frequently / in what way do you receive Early Warning messages?
ii. From whom / which department do you receive the warnings?
iii. Who are the end recipients of the early warning messages that you receive?
iv. What method do you have for communicating early warning messages to these recipients?
v. Is there any month in the year when you do not receive any alert?
vi. What are the hazards for which you receive alert?
vii. How community and other stakeholders are trained to respond to alerts?
viii. How alerts are tested (i.e. drills)?
ix. Do you play any part in responding to the early warning as a stakeholder / community institution? What is it?
x. What do the VDMC / TFG do in response to an early warning message?
xi. How is warning communicated to schools and the students?
xii. What is the response of schools on receipt of warning?

c. Identify perceived benefits and barriers to people's use of early warnings.

i. How people generally respond to the alerts?
ii. Is the alert in conveyed in technical terms or is it understandable in a language and form that the villagers can understand?
iii. Is there any problem that you face with the current alert system?
iv. What is the benefit of the current alert system?
v. Is the community aware of risks associated if there is no response to alerts?

d. Identify the methods of communication for last mile connectivity currently in use and whether they differ by distance, social customs, or any other issue

i. How is it ensured that the alert reaches the farthest corners of the village as well as all people concerned
ii. If yes, what are the methods used in alert communication?

e. Identify methods and protocols that these stakeholders currently have available for receiving and/or communicating de-warning.

i. How frequently / in what way do you receive de-warning messages?
ii. From whom / which department do you receive the de-warnings?
iii. Who are the end recipients of the de-warning messages that you receive?
iv. What method do you have for communicating de-warning messages to these recipients?

v. How is it ensured that the de-warning reaches the farthest corners of the village as well as all people concerned

vi. If yes, what are the methods used in de-warning communication?
vii. What do the VDMC / TFG do in response to a de-warning message?
viii. How is de-warning communicated to schools and the students?
ix. What is the response of schools on receipt of de-warning?

f. Identify methods and protocols that these villagers currently have available for receiving and/or communicating de-warning.

i. What is the maximum time between receiving a warning / de-warning and communicating it to the villagers?
ii. What is the maximum/ minimum time available from receipt of a warning / de-warning message and incidence of hazard?
iii. How far away is the flood shelter / high ground located in case of a cyclone / flood warning?

g. **Identify any indigenous knowledge that these villagers currently have available for receiving and/or communicating early warning and de-warning.**

i. Is there any evidence of indigenous knowledge in use?
ii. If yes, is it in early warning?
iii. If yes, is it in response?

h. Identify the reaction / response mechanism that these villagers currently have available / employ after receiving and/or communicating early warning and de-warning.

i. Please describe step by step what you do from when you receive the warning to when the hazard has finally occurred.
ii. Is there any contingency plan in place?
iii. Are you aware of the do's and don'ts in case of a hazard / disaster?

Annexure 2

Open ended interview schedule for conducting KII - Study on effectiveness of early warning system

5. **Key Informant Interview (KII)** with stakeholders throughout the systemic chain, responsible for channelizing and disseminating the early warning information. The interviews would be conducted with the Disaster Management Officers at the State, District, Sub-Division and Block levels, the Block Development Officer and the Police stations nearest to and responsible for the field area. The objectives of such interviews are as follows:
    a. General Information
        i. Tell us about your organization and what you're doing here in Jogeshganj / Kalitala?
        ii. Please provide us with an overview of the disaster situation over the last 5 years?
        iii. What has been the most significant impact and to whom or what can this attributed?
        iv. What have been the challenges and successes during the current response?
        v. Do you have any recommendations?

b. Identify methods and protocols that these stakeholders currently have available for receiving and/or communicating early warnings.

i. How frequently / in what way do you receive Early Warning messages?
ii. From whom / which department do you receive the warnings?
iii. Who are the end recipients of the early warning messages that you receive?
iv. What method do you have for communicating early warning messages to these recipients?
v. Is there any month in the year when you do not receive any alert?
vi. What are the hazards for which you receive alert?
vii. How community and other stakeholders are trained to respond to alerts?
viii. How alerts are tested (i.e. drills)?

c. Identify perceived benefits and barriers to stakeholders' use of early warnings.

i. How people generally respond to the alerts?
ii. Is there any Incident command System in place?
iii. Is the alert in conveyed in technical terms or is it understandable in a language and form that the villagers can understand?
iv. Is there any problem that you face with the current alert system?
v. What is the befit of the current alert system?

d. Identify the methods of communication for last mile connectivity currently in use and whether they differ by potential users

i. How is it ensured that the alert reaches the farthest corners of the village as well as all people concerned
ii. If yes, what are the methods used in alert communication?
iii. Is there any evidence of indigenous knowledge in use?

e. Identify methods and protocols that these stakeholders currently have available for receiving and/or communicating de-warning.

i. How frequently / in what way do you receive de-warning messages?
ii. From whom / which department do you receive the de-warnings?
iii. Who are the end recipients of the de-warning messages that you receive?
iv. What method do you have for communicating de-warning messages to these recipients?
v. How is it ensured that the de-warning reaches the farthest corners of the village as well as all people concerned
vi. If yes, what are the methods used in de-warning communication?

f. Identify the time frame that these stakeholders currently have available for receiving and/or communicating de-warning.

i. What is the maximum time between receiving an warning / de-warning and communicating it to the villagers?
ii. What is the maximum/ minimum time available from receipt of a warning / de-warning message and incidence of hazard?

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