

Community Based Early Warning Systems in South and South East Asia

Best Practice & Learning 2012





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The last decade has seen an unprecedented growth in the incidence of natural disasters. At the same time the potential for early warning systems (EWS) to limit their impacts has been acknowledged, with the development of national and regional EWS in Asia in particular.

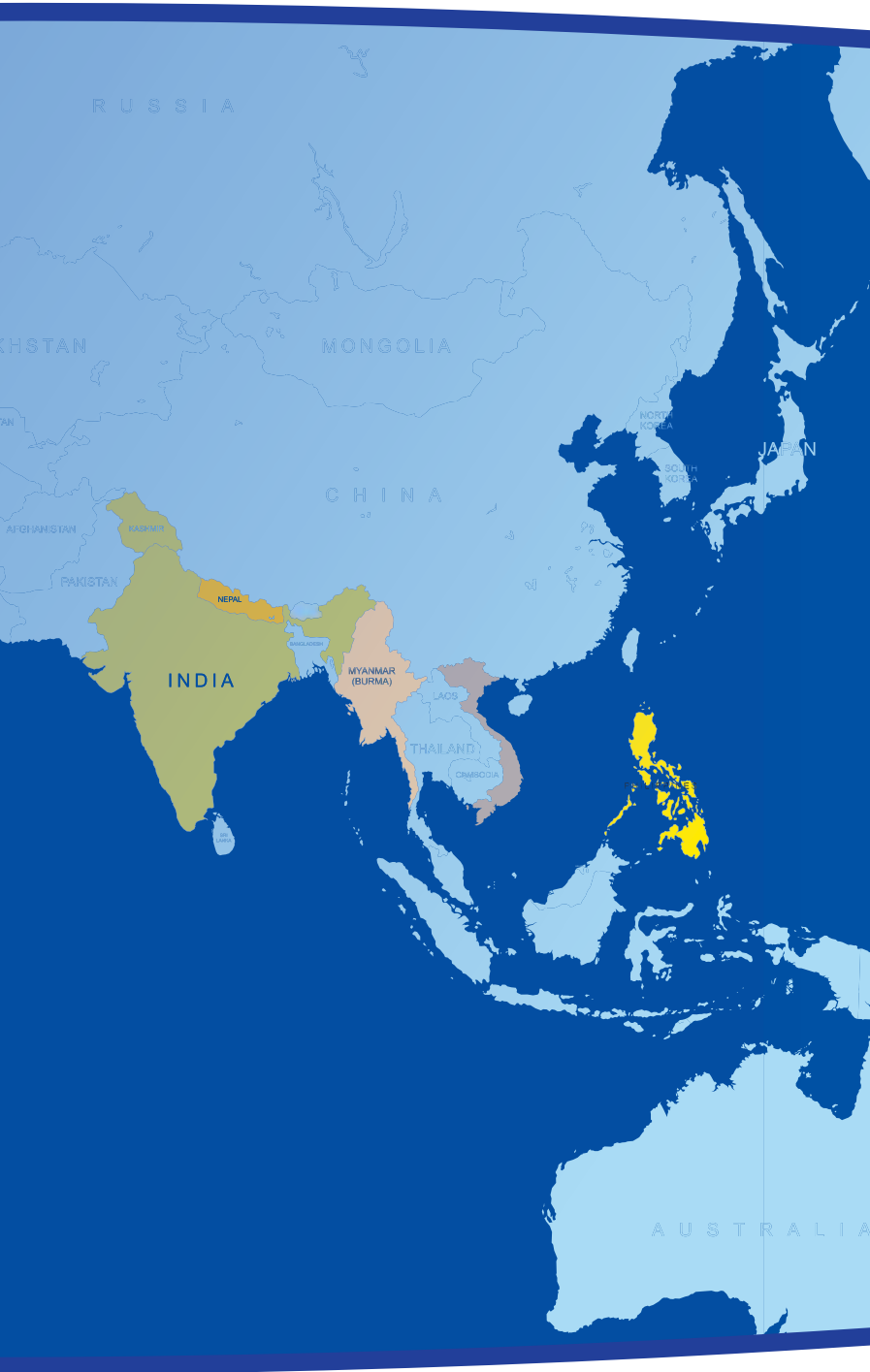
“Last mile” connectivity remains underdeveloped however, partly as a result of it being promoted as an “add-on” to national systems and partly due to a lack of understanding of community’s capacities and needs.

This publication highlights initiatives which demonstrate the critical contribution users have made

within systems, and as drivers of them. They show that where communities and the threats they face are taken as the starting point for system development that the last mile can be bridged, sustainably.

The projects highlighted have also been successful as they all form part of wider disaster risk reduction (DRR) programmes, in which increasing community knowledge and understanding have been central. While space does not allow these components to be covered fully within this publication the fact that none of the EWS highlighted have been established as standalone components is a critical factor in their success.





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Practical Action



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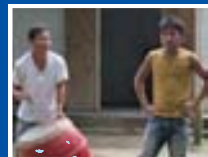
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Gauge reader of the Nepal DHM relaying real-time information to community EWS focal points. Nepal has a network of over 250 Stations throughout the country.

Making the connections: Upstream-downstream linkages in western Nepal

Background. Practical Action has been working on community based EWS in Nepal on some of the country's largest river systems. From 2002 it worked on the Rapti/Naryani system and since 2006 on the West Rapti and Karnali systems. With their tributaries in the foot hills of the Himalayas the flow of these rivers is multiplied many times from June to October, when monsoon rains are compounded by snow melt waters during the hottest months of the year. Flooding can be extensive and while it quickly dis-

sipates in some areas in others it can inundate large areas for several days at a time, cutting off communities and leaving them entirely submerged.

Intervention. While earlier EWS projects supported local level monitoring of river levels, using watch towers and intra-community warning, the project in Banke and Bardia (on the West Rapti and Babai rivers respectively) aimed to link communities to formal upstream monitoring stations operated by the DHM (Department of Hydrology and Meteorology).

Analysing community river level records in Banke district

While river flow and rainfall monitoring information was being actively gathered on these rivers at the time (2008) it was being used largely for national weather forecasting purposes only. With the help of this project this has now been turned into useful and useable information for communities and as the basis of a EWS.

During the initial stages of the project it became clear downstream communities had detailed records of previous flood episodes and the ability to understand and analyse the various risk factors they faced. Very clear pictures of previous flood episodes could be described in great detail and in some communities specific water lev-

els had been recorded, using simple river gauges (marked poles) which had been installed for irrigation purposes. Seeing that a high level of downstream knowledge existed the project facilitated interactions between upstream gauge readers of the DHM and downstream communities, so that historical data and records could be discussed. Through these discussions it was realized that it was possible for DHM staff and community members to calculate the upstream river levels at which downstream flooding would result, as well as how long it would take for flood waters to travel. The levels were calculated for multiple communities, as the flood levels varied from location to location. Though this





DDM gauge station on the West Rapti river.

was not 'scientific' it was found the levels varied little year on year, so that a high degree of accuracy could be achieved using these simple comparisons.

The priority for the project was to establish communications links between gauge readers and communities and response mechanisms within them. To this end low cost EWS hardware including hand megaphones and hand cranked sirens were distributed, as well as telephone handsets where necessary. As most of these communities were close to the Indian border numerous police and army post also existed, with robust HF radio systems. As such

they agreed to provide back-up warning channels in the case of telephone failure (it also being the case that security forces had similar stations close to the upstream monitoring locations). As part of this communication channel development a wide range of district level stakeholders were involved and as a result formal 'communications trees' were established. These covered both those involved in issuing and receiving warnings and those responsible for possible response.

Best Practice & Learning. The impact of the system established was almost immediate. During the

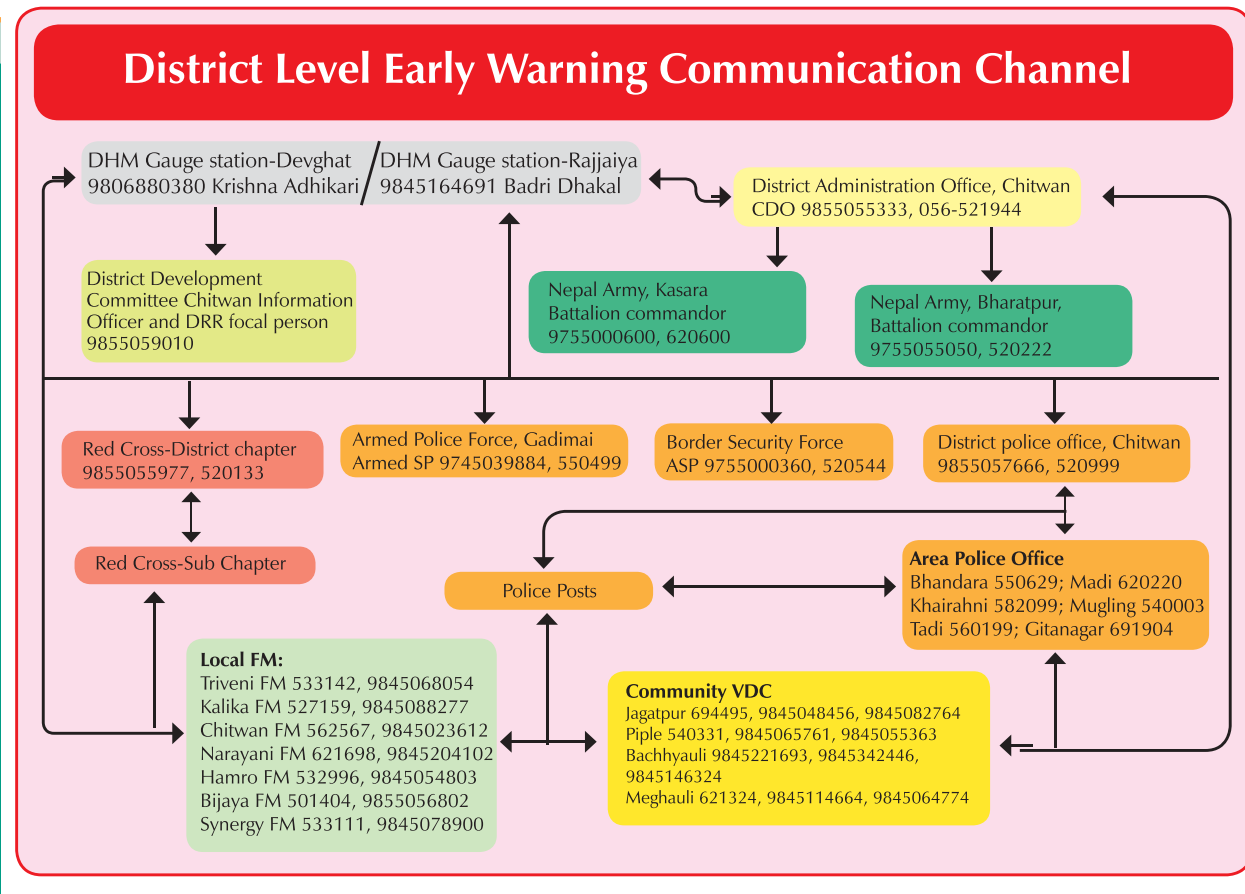
first years monsoon communities were constantly able to update themselves on the on-going situation by requesting information directly from gauge readers. While local FM radio stations also increased their warning coverage outlining not just current rainfall and river level conditions but their possible implicates for low lying communities (previously they had no knowledge of the latter).

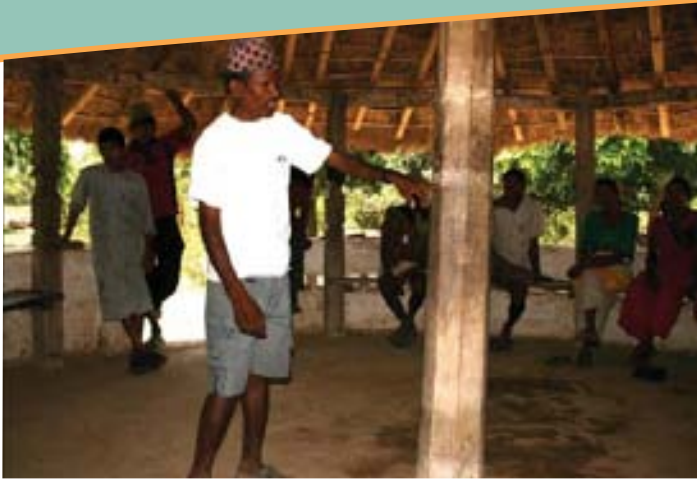
Similarly the District Authorities were able to keep themselves abreast of developing flood scenarios where previously they had been entirely reactive to events. During the initial year other interesting impacts of the system were also witnessed, such as farmers remaining in their fields even when river levels were very high (previously

they would have evacuated) due to having been forewarned of falling river levels by the gauge readers many miles upstream.

The major learning of this project has been that top-down, 'command' orientated EWS are not only undesirably, but unnecessary. When 'users' are made aware of an information source they are capable and willing to access it themselves. While a formal warning systems does exist, in reality what is now happening is that communities are regularly contacting upstream information sources and making their own, informed, decisions about when to issue warnings and evacuate. As such the whole process of setting up an EWS has empowered communities which previously were

A typical communications tree used at District level and hung on walls and by telephones





Discussion of historical flood levels

victims of flood, or passive recipients of warning and aid.

The most positive long-term impact of the project is that district authorities have seen how cheap and sustainable this system can be, being reliant as it is on pre-existing components. The project has simply connected existing elements and assisted with some basic hydrological analysis. This model is now being promoted across Nepal and has strongly influenced the National Early Warning Strategy.



FM radio is becoming increasingly important in EWS.



Making sense of it all

In discussion with community members from Balapur in Ward 6 of Gulariya they pinpointed 11 Bhadra 2063 (27th August) as the day the floods hit their village in 2006, with the waters first entering at 6.00am, reaching a peak at 10.00am and receding again by 6.00pm (in fact all time calculations were based on discussions as to how long after 'cock-crow' certain events took place, rather than specific times, due to limited access to watches/clocks, particularly among women).

When discussing conditions in 2007, community members in both districts identified 10th Shrawan 2064 (26th July) as the critical date. In Balapur the water first entered the village at 8.00am, reached its peak at noon, stayed constant for a further 3 hours, and by 7.00pm had receded one foot from its high water level.

On the same day the Rapti River station at Kusum recorded a level of 5.65 metres, the highest level recorded that year. From this analysis (comparing gauge stations figures with community flood histories) it was relatively easy to calculate

1. The upstream river level at which downstream inundation is first likely to occur (for each community)
2. The speed of flow between the gauge station and the community during peak flood periods.

Critically these calculation could be made by communities without the external assistance of 'experts'. All they needed access to was the upstream data.



Organization Name : Practical Action

Local Partner: CSDR & RKJS

Project title: SEWIN (Scaling up Early Warning in Nepal)

Country/Geographic area: Nepal. Banke and Barida Dsitrcets, western plains region.

Donor: European Commission (DIPECHO)

Active project period: 2007-8

Address: House no. 2677, Narayan Gopal Sadak,

Phone: + 977.1.4720.803/4720.804

Email: info@practicalaction.org.np

Weblink: www.practicalaction.org



Turning the tides in West Bengal.

Background. The Sunderban's form part of the world's largest delta system, created through the confluence of the Meghana, Ganges and Brahmaputra rivers. The area is intersected by a complex network of tidal waterways, mudflats and small islands, and characterized by extensive salt-tolerant mangrove forests. These cover an area of more than 10,000 square kilometers, within both India and Bangladesh.

The Sunderbans are an inherently high risk area, experiencing multiple environmental and manmade hazards including riverine floods, cyclones, storm surges, river bank erosion and tornadoes. Typical of these events was Cyclone Aila which made landfall on 25th May 2009, affecting both India and Bangladesh.

A storm surge of 3 m (10 ft) impacted eastern India and western regions of Bangladesh, submerging numerous villages, and resulted in hundreds of rivers breaking through

GPS readings being taken by CKS. Photo CKS.

embankments, causing widespread inland flooding. Tens of thousands of people were displaced and made homeless in West Bengal.

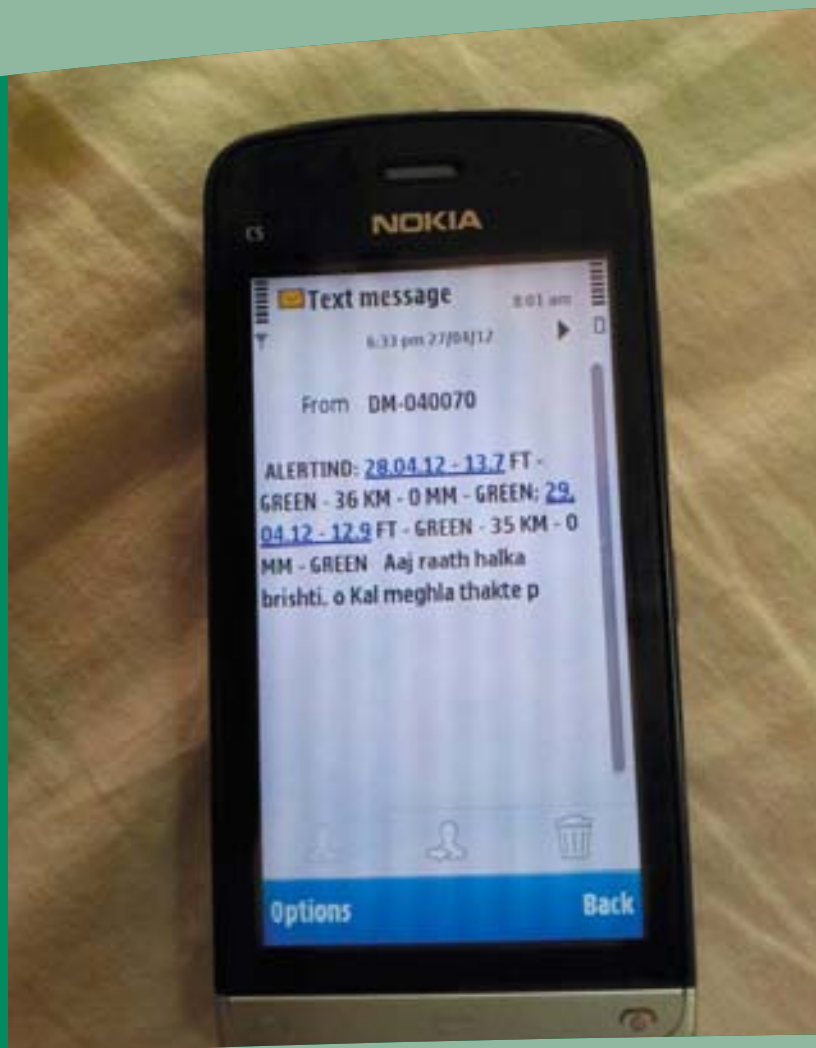
The cyclone and its consequences clearly highlighted gaps in the early warning system, as while the Joint Typhoon Warning Center (JTWC) issued a general warning, days earlier, nationally the warning that was issued was “generic” only, and non-action oriented. People received general updates on the cyclone, but they received neither information on the possible impacts of the winds likely to be experienced, nor the height of possible tidal

surges at vulnerable low lying points and ferry ghats.

Intervention. As a result Concern Worldwide and its local partner Sabuj Sangha are supporting a programme to ensure that in future vulnerable communities get access to as much scientifically accurate information as possible, in ways that are both rapidly communicated and easily understood. The Center for Knowledge and Skills, with Concern and Sabuj Sangha, has been the resource agency working most directly with communities in streamlining the sys-

School children sounding the all clear.





tem, which is being piloted in Brajaballavpur Panchayat of Patharpratima, South 24 Parganas District, West Bengal. The system is based on the principal of linking communities to national level information sources with a local level intermediary translating and interpreting that information for locally useful purposes.

The programme began with early warning task force members, boatmen, fisher folk and other particularly vulnerable groups being oriented to the principals and capabilities of handheld global positioning systems (GPS). Having received training and guidance

the coordinates of specific vulnerable locations, on which it was known from past experience information would be required, were taken. These coordinates were then sent, as priority locations, to the Indian National Center for Ocean Information Services (INCOIS) for analysis and incorporation into their own satellite information management system.

This process normally takes between 7 and 10 days, at INCOIS level, but once completed results in site specific information being available, applicable to individual at risk locations and communities. As such information for a three

day 'window', for both the entire coast of West Bengal, and for identified locations along it, are sent on to the resource agency for TWIS, Center for Knowledge and Skills (CKS), for further dissemination.

In this role, every evening, CKS send SMS messages on to identified volunteers within communities (often a shop keeper, a school teacher, or a member of the Ghat committee) who are known to the wider community as the persons responsible for this task. The messages sent give details of the wind speed and tide level for the next 3 days and are updated on manually

Alert Messages to task force members through SMS. Photo CKS

Warning conveyed through red flags; photo Sushant, Resource Person Civil defence.

operated display boards, placed at ferry ghats and market places (the collectively most important and frequented locations within communities). The manually operated display boards, currently operating in 10 locations, display the following information, which is colour coded.

- The period the information covers
- The expected height of the highest high – tide
- The warning level (Green/ Yellow/Red) for the location (in terms of tide height)
- The maximum expected wind speed
- The direction of the wind
- The warning level (Green/

Yellow/Red) for the location (in terms of wind speed)

Once the information is posted on the boards, it is further disseminated by the early warning committee members to schools and community members through the use of flags, sirens and megaphones. This is done when elevated risk levels are forecast.

Best Practice & Learning. Supported through the Sixth DIPECHO Action Plan for South Asia, this pilot project hopes to stimulate replication of this approach throughout the Sunderbans, where large scale hydro-meteorological events require site specific information.



Initial learning indicates that communities involved to date are easily capable of interpreting the information provided and of developing their own locally appropriate warning and response plans. The challenge now is to replicate this system further, further develop intra-community warning mechanisms, and work more closely with the INCOIS to institutionalize the approach.



Training to DRR facilitators and team on updating the display boards.



CONCERN
worldwide



Organization: Concern Worldwide, India.

Local Partner: Sabuj Sangha in West Bengal, Center for Youth and Social Development(Odisha) & Society for Women Action Development(Odisha)

Project title: Building disaster resilience of vulnerable communities in Orissa and West Bengal, India.

Country/Geographic area: India West Bengal & Odisha

Donor: European Commission (DIPECHO)

Active project period: 2011-12

Address: A/7 Ashok Nagar, Bhubaneswar -751009. Odisha, India.

Phone: + 91 6742533485/2394238/239420

Email: info@concern.net

Weblink: www.concern.net

People-centered Early Warning System in Myanmar

Introduction: Myanmar is vulnerable to natural disasters which have claimed numerous victims in the past, especially along coastlines of the Ayeyarwaddy Delta and Rakhine State. The “Hazard Profile of Myanmar” in 2009 reported 35 cyclones between 1947 and 2008, with Rakhine State having the highest likelihood of being affected. Lying on the Bay of Bengal, with a 2,400 km coastline, it is particularly prone to tropical cyclones. Annually there are approximately 10 storms, with two peaks of activity between April and May and October to December.

Cyclone Nargis, which struck in May 2008, is by far the most devastating natural disaster in the country's history, and brought to the fore its extreme vulnerability. Claiming 84,537 lives and 53,836 missing, out of whom 61% were women, losses to livelihoods were estimated at nearly \$2,918 million. According to the findings of the “IPCC Fourth Assessment Report” such cyclones are likely to increase, since a 1°C increase in sea surface temperature is estimated to lead to a 31% increase in the global frequency of Category 4 and



A school cyclone shelter.

5 cyclones. The same report predicts that South East Asia will see some of the greatest increases.

Amongst other things the devastation caused by cyclone Nargis revealed a lack of infrastructure, information, awareness and preparedness, and indicated the need for a comprehensive Disaster Risk Reduction (DRR) programme of which EWS would form an integral part.

Intervention: Malteser International has supported local early warning systems in targeted villages in the Labutta township (Ayeyarwaddy Delta) and in Rakhine State since 2008. Due to their remoteness and top-down political dynamics in the country, the process of

community engagement has proved challenging with the establishment of EWS seen as a process of empowering communities to seek greater access to decision making tools. To do this Village Disaster Management Committees (VDMCs) have been supported

through holistic Community Based Disaster Risk Reduction (CBDRR) approaches. These have involved capacity building, activities to assist in understanding weather conditions and forecasts, and translating these into non-

technical terminology as the core of the EWS.

In the system established the early warning is initially derived from public radio weather alerts, based on information from the national DMH



(Department of Meteorology and Hydrology). These concern primarily the movement of weather fronts. The VDMCs are then responsible for communicating this information on to the wider community which is assisted through the provision of radio sets and megaphones.

The main innovation has been to implement an easily understandable EWS derived from complicated hydro-meteorological data. A series of community consultations were convened to test the translation of information into simple, locally understandable, terms. The result of this was a warning system based on the use of colored flags. This has proven relatively simple and understandable to everyone.

Identifying safe places on a community risk map.



As an example, when the intensity of a cyclone is aired on the television or radio, it is referred to as a tropical depression, small storm, cyclone or strong cyclone.

These have little meaning for community members. As such a process was gone, whereby these technical terms were translated into tangible impacts at community level.

A Small Storm (categorized as having a wind velocity of between 18 and 33 miles per hour) is thus explained as likely to result in the following;

- Twigs and branches of small trees may be broken
- Rice in flowering stage may

- suffer significant damage
- Some houses of very light construction may be partially unroofed
- Small boats can be carried away

By presenting climatic conditions in this way they rapidly become understandable

A further level of understanding has been added by color coding the depressions, storms and cyclones, ranking them by their present likely threat. Yellow means a threat is developing but is not expected to move towards Myanmar. Orange that one is heading towards Myanmar, and red that one may cross the coastline within 12 hours. Green means the threat has





Community Disaster Preparedness Training in Rakhine State

passed.

Using these two measurements - the strength and intensity of the event (depression being the least harmful and a strong cyclone being the most destructive) and its likelihood to impact the community - the flag system has been developed. The color of a flag denotes the likelihood of the weather event, and the number of flags its likely intensity (and the damage it can cause) should it materialize.

As an example one orange flag hoisted means a tropical depression is heading towards Myanmar. One red flag indicates it will cross the coast within 12 hours. At the other end of the spectrum two

orange flags indicate a cyclone or strong cyclone is heading for Myanmar, and three red flags that one will cross the coast within 12 hours.

This system has been worked out through discussion with communities, in which women have played a major role. Based on the analysis carried out, women were found to be in the forefront of responding to disasters and saving family

members and assets. Because of this, from the initial phases of the project, the decision making capacity of women was increased through special women's empowerment workshops and by ensuring their participation in the various trainings and learning activities traditionally dominated by men.

Best Practice and Learning. Based on



Early warning in action.

the experiences in Labutta and Rakhine, the key lessons learned have been that involvement of local authorities has to start at an early stage. For vulnerable communities EWS must be simple and include visual and symbolic elements (such as flags, maps or photographs) but there remains a need to develop standard systems and procedures to make messages and alerts more consistent. In Rakhine information and warning comes from both national (Myanmar) and Bangladeshi radio, which can be confusing.

Regular community consultations and testing of the systems through mock drills are important to promote community ownership, while



Zee Kaing Village DRR planning.

the effectiveness of the system can be increased only if proper feedback on the system and its performance take place.

The major challenges have been the complex local sources of information, lack of resources and the difficulty of accessing remote communities. There is also a continued need to carry out participatory exercises to ensure state and community level actors are all actively involved in the development of the systems, as the links between the village level disaster management committees and the regional and national level early warning authority are still inadequate.



Organisation Name: Malteser International

Project Title: Reduced vulnerability of the Myanmar population living in coastal areas most affected by recurrent natural hazards

Country/Geographic area: Ayeyarwaddy Delta and Rakhine State, Myanmar

Donor: BMZ, European Commission (DIPECHO)

Active Project Period: Jan 2008 – ongoing

Local Street Address : 14/15 (6F), Pyi Taw Aye Ave. Street, Ward (7), Yankin Township, Yangon.

Phone- +95 1 657122, +95 9 8622851

Email: malteser.myanmar@malteser-international.org

Website: www.malteser-international.org

Fishing is the life blood in Tamil Nadu



Voicemail Brings Safety To The Seas

Background: Highly prone to sea-borne disasters, the 1,076 km coastline of Tamil Nadu is situated in the most vulnerable zone for tropical storms and cyclones. It represents 15% of the Indian coastline, and is home to nearly 600 fishing villages. Between 1891 and 1990 nearly 262 cyclones (92 severe) have occurred along one 50 km wide strip alone, with a moderate to severe cyclone expected every two years.

Pulicat Lake, India's second-largest coastal lagoon, lies

parallel to the Bay of Bengal and is home to 52 fishing villages. Two major cyclone disasters are well remembered in recent years. In 1977 a cyclone raged for two days, destroying almost all of their fishing equipment and household materials and killing their cattle and goats. There were no warnings given by the government. In 1984, another powerful cyclone devastated the region, intensified by normal rainy season weather. Sand storms, rain and strong winds lashed the coast for three days destroying fishing boats and gear and creating

new estuaries and inlets which caused severe flooding in the villages.

While these events demonstrate an underlying vulnerability the risks faced by the communities have actually increased in recent years, as dependency and over fishing have forced fishermen to venture further and further from the coast to meet their basic needs.



Intervention. In November 2009, SEEDS, in consultation with villagers, established a Village Information and Knowledge Centre (VIKC) equipped with two computers, internet access and a range of resource materials on fishing. In January 2010, an information dissemination

system using mobile phones was inaugurated, the concept building on an existing service used amongst farmers cooperatives across India. It was introduced to fishermen in the Pulicat region through an organisation called IFFCO Kisan Sanchar.

This early warning/information system was actually the second part of a 'resilient coast' initiative launched under a UNISDR funded Project - Selamat. In the first phase, a 'bio-shield' plantation had been established along

the coast which sought to counteract erosion and offer some supplements to falling fishing incomes. As such local people were already sensitised to many of the issues and open to new approaches.

Though fishermen tend to have an instinctive feel for fishing zones, wind patterns and wave movements, 'scientific' information from the government was also seen to be useful. As such, from February 2010, monthly village visits were conducted by IKSL representatives, with mobile micro-phones used to explain what they were proposing, and what the information facility could provide. At the same time free "Green" SIM cards were distributed and activated for those interested in taking part.

SEEDS were provided with a master SIM, which allowed the recording of messages, with the information coming initially from the Indian National Centre for Ocean Information Services (INCOIS). Decoded by the M S Swaminathan

Traditional boats are small and vulnerable



Research Foundation (MSSRF) and provided to SEEDS staff in Chennai to begin with, the messages were localised and recorded.

The free service, which is a joint venture between IFFCO and Aritel provides for five daily voice mails on dynamic wave heights and wind speeds for each fisherman's specific location. The use of voice mail ensures that low

literacy doesn't exclude the most vulnerable and allows the messages to be conveyed in specific, vernacular, terminologies. Potential fishing zone messages are provided, as well as weather information, with specific coordinates whenever possible.

Initially, the technicalities of the system permitted only those with the special SIM cards to receive messages. However, the system has now advanced to the point where existing Airtel numbers can be added. A person has been appointed as an ISKL representative and number collector, to expand this coverage. The technical aspects of the system have also now been taken over locally, by the animator at the





Boats are now able to put to harbour in advance of storm

Resource Centre, so SEEDS in Chennai need no longer be involved.

Several years on the programme is now in transition, as tie-ups with existing government and social sector organisations (including the MSSRF Village Knowledge network) are being explored, both for increased content development and sustainability, as such tie-ups would provide an ideal platform on which the communities can scale up the system.

Best Practice & Learning. In times of calamity the system has

already proved its worth. On the one hand fishermen have confidence in the information provided, as they know the source and the people who are providing it. While on the other, the emotional anxiety experienced by family members, through the previous unpredictability of cyclone information, has significantly reduced.

Anbu, a fisherman from Vairavan Kuppam village, helped save the lives of relatives in Andhra Pradesh through the system, during cyclone Laila in May 2010. The early warning message received confirmed his intuitive knowledge of sea conditions, so relatives in Andhra Pradesh who were about to embark on a fishing trip in Pulicat Lake





were immediately informed. As they were to discover, many others who carried on that day suffered severe losses and faced great difficulty in returning.

Frequent updates on the path of Cyclone Jal, in November 2010, ensured that villagers were aware of its trajectory towards Vairavan Kuppam. Fortunately the intensity of this cyclone reduced 300 kms south-east of landfall. Similarly

cyclone Thane, in December 2011, which devastated two districts in Tamil Nadu and had a significant impact on the Pulicat region, could be tracked through frequent voice mails. These provided some solace during this anxious time, and

crucially gave time to return from sea and to prepare.

Most recently, the tsunami threat caused by the Indonesian earthquake on 11th April 2012 earthquake, could have been a harrowing reminder of the devastation caused in 2004. However, by receiving up-to-date information on the rising and then falling tsunami warning threat, the fisherfolk of Pulicat were able to prepare and then stand down in full knowledge of what was going on. The implications and possibilities of this system are very clear to be seen.





The village information and knowledge center. Pulicat



Organization Name: SEEDS

Local partner: M S Swaminathan Research Foundation (MSSRF) and Iffco Kisan Sanchar Ltd. (IKSL)

Project Title: Building Resilience of Coastal Communities, Project Selamat

Country/Geographic area: India - Pulicat, Tamil Nadu

Donor: United Nations International Strategy for Disaster Reduction Secretariat (UNISDR), European Community Humanitarian Office (ECHO) and Asian Disaster Reduction and Response Network (ADRRN)

Active Project Period: 2007 onwards

Local Street Address : 15-A, Institutional Area, R.K.Puram, Sector IV, New Delhi-110022, India

Phone- +91-11-26174272

Email: shivangi@seedsindia.org

Website: www.seedsindia.org



Enhancing indigenous knowledge: The problems of isolation in the hills of northern Vietnam

Background. The communities in Kon Tum and Nghe An provinces are all within 30km of a city. Even so they are classified as isolated due to extremely poor road conditions, caused by regular landslides, streams flooding over roadways and in some cases by the destruction wrought by heavy equipment, operated by quarry and mining companies. In addition, ethnic minority communities are further disadvantaged through linguistic difference (only the very young know Vietnamese) and their vulnerability to pre-existing, complex, environmental conditions.

In this context CECI, through the support of ECHOs V DIPECHO Action plan for South East Asia and CIDA, has pioneered a community-based approach, providing vulnerable communities with training, simple, low-tech early warning systems, and support in linking to national hydrological and meteorological services. They have also developed appropriate communication and dissemination protocols.

Intervention. While in theory a warning structure already existed in this part



Women are particularly vulnerable.

of northern Vietnam, it relied on highly centralized communication channels which meant warning rarely filtered down to the local level. Central to this problem were linguistic difficulties, time delays and simple communication breakdowns in an area where power and equipment failures are endemic. These factors influenced the nature of the systems devised.

Time and effort were taken in understanding local circumstances, existing resources and practices, and in analyzing indigenous knowledge. This was important as it was realized from the outset that if the systems established were to be successful they would have to be self-monitored, with

Rain gauge. Hydrometeorology department Kon Tum.



community members being the key stakeholders.

The project worked with the provincial Departments of Hydrometeorology (DoH) to install rain and river gauges, on a pilot basis, in appropriate locations, with volunteer monitors receiving training and guidance on both their use and data recording. Boards were established by river gauges, detailing how to interpret what they were showing, while rain gauge

protocols were established indicating when monitors would switch, during severe weather periods, to sending SMS readings to the district DoH office.

This was important as the interpretation, by the DoH, of rainfall data from multiple sources is key to the broader system. When monitors send an SMS to the DoH office, they in turn send an SMS back, with guidance on the appropriate actions to be

An old lorry wheel used as a community bell.

taken (having taken multiple reports from other monitors in to account). Community risk and hazard maps were compared with other more 'scientific' information sources to interpret information and establish warning levels. Detailed assessment of all existing and functional communication platforms was also carried out. Options such

as SMS and 3G were examined. Given the prevailing technical environment basic mobile services such as SMS are viable in certain locations and can be used for volunteers to communicate with authorities. Based on the limitation of installing and maintaining communication technology in these remote areas, the prevalence of micro climates,



A typical river gauge in operation.

and indigenous knowledge of disaster signals, community centred monitoring was the most essential, negating the need for extended warning channels. As such, in terms of

warning and communication at community level, bells, drums, PA systems and handheld loudspeakers were selected in preference to anything more sophisticated.

Best Practice & Learning.

The project has demonstrated that community-based approaches are definitely the best when working in

1 am. Worried by the intensity the local monitor checked his gauge again and by 4am, seeing a constant increase, sent the reading via SMS to the district Department of Hydrometeorology office as was the agreed arrangement. The hydrometeorology office responded immediately, telling the monitor the next critical level to check, which was reached and duly reported by SMS, less than 2 hours later. This triggered a weather warning notice to neighboring communes in the district, many of which were not CEI

sites, and a resultant general risk warning. This simple example illustrates how cooperation between villagers and local authorities is key to this EWS and how a simple communication protocol chart used in conjunction with multiple monitoring locations can insure that there is enough overlap and assistance available to ensure that hazards are quickly detected and relayed on. In this case national level systems would not have identified such a site specific risk.





Organization Name: CECI (Centre for International Studies and Cooperation)

Project Title: Vietnam. Kon Tum and Nghe An provinces. BCRD (Building Community Resilience to Disasters) in Uplands Areas of Vietnam

Country/Geographic area: Vietnam. Kon Tum and Nghe An provinces.

Donor: European Commission (DIPECHO), CIDA and private donors.

Active Project Period: 2010 - 2011.

Local Street Address : 3000, Omer-Lavallée St, Montréal (Québec) , Canada H1Y 3R8

Phone- (514) 875-9911

Email: kathleenm@ceci.ca

Website: www.ceci.ca

Helicopter evacuation in Lalbohji VDC, Kaillai 2008.



Short on distance: Short on time. The problems of Flash-flood in Western Nepal.

Background. The plains of Nepal are affected by monsoon floods annually. On longer rivers many monitoring points may exist, but in Kailali the Mohana River and its tributaries are short. Rising in the Siwalik hills a few miles distant, the Mohana experiences regular flash floods, destroying lives and livelihoods where monitoring is a major challenge.

Intervention. While communities have traditionally monitored the clouds, the smells and colour of rivers and the behavior of animals, these have never proved reliable. The initial stages of Mercy Corps' work also revealed that communities did not have a clear perception of the hazards they faced.

As such while general mapping and capacity building activities were initiated, possibilities to better monitor the

risk factors were also explored. Within the communities existing risk knowledge was analysed so that past flood episodes could be recorded, their timelines and nature understood, and factors contributing to their severity identified.

At the same time it was found that the DHM (Department of Hydrology and Meteorology) had a number of well established stations, covering both river and rainfall level monitoring. While at the time these only reported information to the central authorities it meant scientifically verifiable data was available, as was the possibility of incorporating these stations into an active, monitoring network.

In collaboration with the DHM, the project identified the stations which were most useful for monitoring purposes and where others might need to be established. Historical data from these points was then compared with data gathered from the flood affected communities and 'threshold values' established for both river and rainfall levels. These are the levels at which it could be determined downstream floods would occur. To assist in this exchange visits were organized, both to familiarise upstream observers with downstream conditions and community members with the locations from where information and warning would

be communicated. These meetings gave participants the opportunity to share their respective experiences of flood and build personal relationships which have become central to the functioning of the system.

Once the feasibility of the system was established, it was taken over by a district early warning management committee which entered into an agreement to support hourly, seven day a week monitoring for the four months of the monsoon. This was partly paid for by Mercy Corps, as at this stage it was DHM practice to record only twice daily, which was insufficient for EWS purposes.

Official DHM river gauge point on the main east-west highway.





Testing sirens at the community level.

The DHM Field Office now operates as the EWS communication hub, with observers and readers reporting to it once pre-identified, critical river/rainfall levels have been exceeded. From here information is communicated directly by telephone to communities and to the other actors in the EWS network. Due to the personal relationships established community members also ring the gauge readers for regular updates during high water/rain periods. To support this detailed communication lists are

updated and circulated annually.

At the user level communities have established their own early warning systems, using megaphones and hand operated sirens provided. These communities have developed their own warning signals and levels, which largely match the 2 tier system set for river level markers, where yellow indicates that people should “prepare/get set” and red “evacuate/go”. This started with 6 communities developing response and evacuation

plans, expanded to 10, and has now been increased during 2012 to 31.

Multiple, short, complex rivers make monitoring extremely difficult, but Mercy Corps' work in Kailali has shown that even under such difficult scenarios meaningful warning can be achieved. The system continues to develop and grow.

Best Practice & Learning. The success of the systems means they are now incorporated into community and district level plans. EWS committees at community level are self-supporting and carry out pre-monsoon

simulation exercises and all maintenance of equipment. Based on the experiences of past monsoons and seeing their effectiveness, the systems are also a high priority for the District authorities who have developed District EWS guidelines and encouraged the pooling of resources by 32 flood prone communities to ensure the long term support of the system. The expansion of the systems in 2012 has taken place with little support from Mercy Corps, indicating its utility and replicability.

This process has proved that the institutionalization of systems is critical to their sustainability, but eminently achiev-

Training to community gauge readers in Kailali.



able if the costs of systems are kept low and they draw upon existing resources.

In Kailali it took time for communities and stakeholders to trust the EWS, but two consecutive floods in 2008 and 2009 ultimately demonstrated the benefit, through reduced losses in the project communities compared to other locations.

Information management at the District DHM office level remains a challenge. At peak times they can be inundated

with calls and requests and this has still to be resolved. Automated text communication may be one solution in the future.

The use of FM radio for information dissemination is also not as easy as portrayed. Because the EWS does not cover all communities in the FM catchment area the information relayed can be confusing to some. Knowledge that others are covered by a EWS is stimulating demand for its expansion however.



A community gauge reader.



**Ramlautan Chaudhary,
is a gauge reader on the Kandra River.**

“Though it was difficult to stay continuously alert during the monsoon period, I am happy that I am doing this important job. Sometimes I feel like a parent to the downstream communities, a parent who cares for their situation and this gives me new energy to do my job. The people from the downstream communities often call and ask for information and I am in regular contact with everyone in the system which is a new experience for me. The respect that the communities show for me and the importance they give to the information I provide makes me proud.

I remember very clearly what happened on July 19, 2010, when heavy rainfall made the Kandra flood the adjoining areas. My observations helped the community in Banbarsa get prepared and evacuate in time and nothing was lost. The community thanked me a lot for informing them”.

“Previously when we started to work on the early warning system and collected information on water levels, only a few communities used to call us and only those communities close by, but this year things have changed and people from communities further away have started to call me and ask for the information. This has increased my responsibilities but I hope many more will call me in the future and benefit from the information I can provide.

Though the things I am doing are simple and easy, and almost the same as I used to do before, being part of the early warning system has given my job a totally different dimension and importance”.



Organization Name: Mercy Corps

Local Partner: NRCS Kailali

Project title: KDDRI II (Kailali Disaster Risk Reduction Initiative)

Country/Geographic area: Nepal, Kailali, Mid-west plains region

Donor: European Commission (DIPECHO)

Active project period: 2007-8

Address: P.O.Box: 24374, Sanepa Chowk, Lalitpur, Nepal

Phone: +977.1.5555.532/5012.571

Email: info@np.mercycorps.org

Weblink: www.mercycorps.org

<http://nepal.mercycorps.org>



Enhancing local knowledge: The Binahaan River Local Flood early Warning System in Leyte

Background. Along the east coast of Leyte, in the Philippines' Eastern Visayas region, flooding of the Binahaan River submerges over 6,000 hectares of precious farmland annually, affecting around 39,000 people. Previous actions taken at great expense by the national government to solve the problem, including closing several tributaries to increase peak flow, have not been successful, with floods merely spreading to other municipalities.

As a result an inclusive, local, and participatory process to look for solutions was adopted. Among the institutions, municipalities and communities (barangays) concerned, it was collectively realized there was a need to raise the level of cooperation to arrive at measures that would help the people prepare for, if not prevent, the onset of floods.

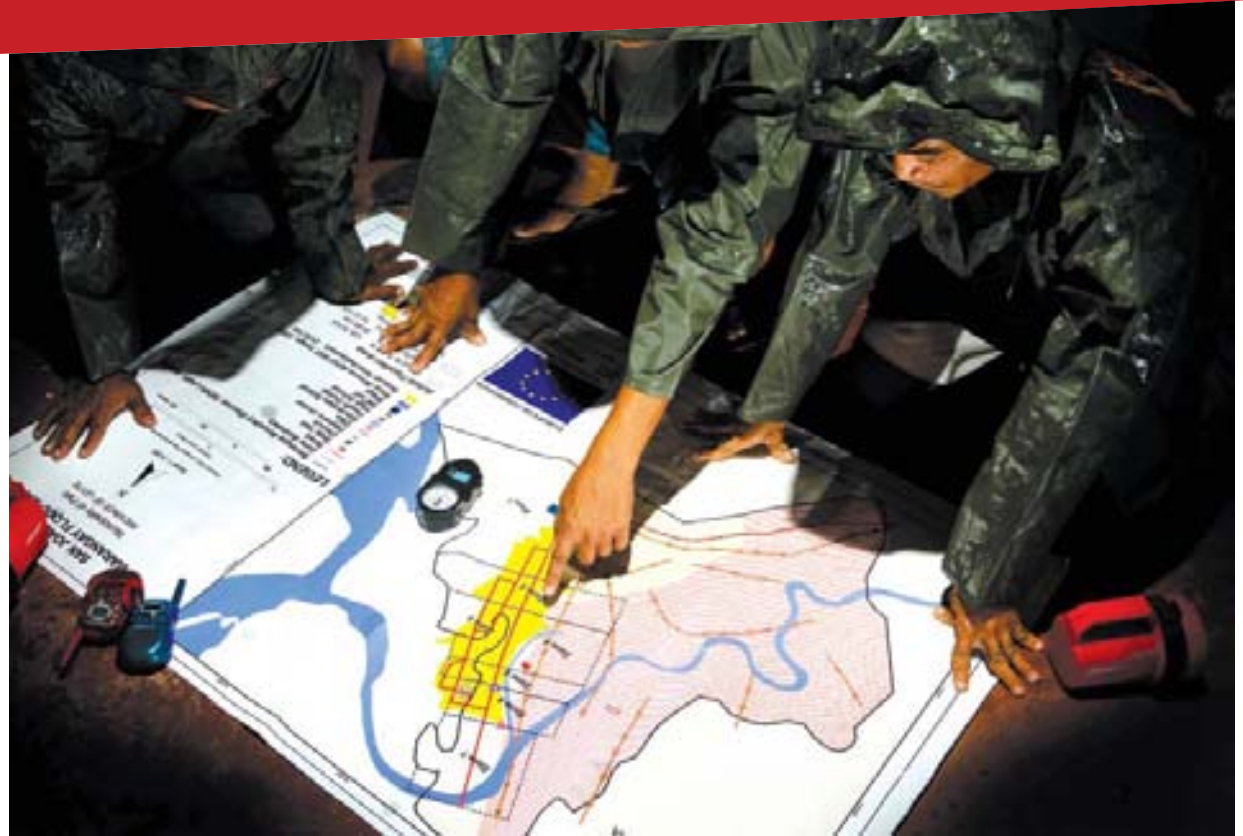
Intervention. Since 2005, the GIZ Disaster Risk Management component, through the

Setting up a river level gauge

support of DIPECHO and the German Federal Ministry for Co-operation and Development (BMZ), has been supporting local government units in Eastern Visayas to increase capacities to manage the negative impacts of disaster. In 2007, GIZ facilitated the signing of a memorandum of agreement between four municipalities comprising the Binahaan watershed, to establish the Binahaan River Local Flood Early Warning System (BRLFWS). Three other institutions also signed, as either operating useful existing infrastructure, or having specialized knowledge on river behaviors or in community mobilization. The Leyte Metropolitan Water District (LMWD) was involved as operating a dam

on the upstream portion of the Binahaan River, at which point water level gauges were set up. The PAGASA (national weather bureau) conducted hydrographic surveys of the watershed, provided technical assistance in the installation of remote sensors and rain gauges and helped in the formulation of flood alert levels for downstream communities. While, as the government face of contingency planning, the OCD (Office of Civil Defense) contributed to raising local awareness of hazards and later assisted in conducting community drills.

The primary objective of the BRLFWS was to reduce the vulnerability of populations,



Setting the hazard map for Palo, Leyte

Starting a evacuation drill



during floods in particular, through the “timely exchange of information to concerned stakeholders or barangays.” To do this, the EWS was setup in such a way as to harnesses both indigenous knowledge and cutting edge technology.

In the system at present solar panels and batteries power a self-contained rainfall (RF) gauge and water level (WL) sensor upstream of the Binahaan River. These transmit data via radio to an Operations Center run by the province. This Center is linked, again via radio, to the municipal operation centers, which in turn warn the barangays. Within the barangays, simpler, more locally appropriate methods are used to disseminate the warning further, such as bells and empty

Liquid Propane Gas tanks used as gongs. These are used to send pre-arranged signal patterns, set according to a three-step warning protocol - stand by, prepare and evacuate ! Residents also rely heavily on indigenous knowledge and collective experience to anticipate the likelihood of flood.

Best Practice & Learning. Flood safety has acquired a new dimension because of the BRLFWS. Aside from round-the-clock readiness provided by the central Operations Center, the protocol developed now gives communities a “last mile” window of at least 7 hours warning, before actual flood waters hit. The BRLFWS has predicted subsequent flood incidents experienced since 2007. The

earliest being Typhoon Mina in November 2007 and the most recent flash flooding on March 17th 2011.

Heightened cooperation between the stakeholders has also assisted the creation of municipal DRM teams that have participated in risk assessments, mapping exercises, contingency planning and flood simulation drills. "Zero casualty" rates experienced in the municipality of Palo, during heavy flooding on December 26th 2011 where 600 families were evacuated, was as a direct result of these drills. Municipal disaster risk reduction and management council (MDRRMCs) reports for the four municipalities, indicate no losses have been sustained

in terms of lives, livestock or property due to the timely warnings received since the inception of the BRLFWS.

The significant lesson to be learned from the BRLFWS is that successful community managed EWS is possible if a convergence between the social preparation aspects of a system and the technical ones can be achieved. Experience over the last few years shows clearly that a low-tech, affordable EWS (establishment costs are estimated at around \$40,000) based on mass community participation can result in an extremely reliable and community trusted system – there have been no missed floods and only one false alarm to date.

Shelter also form part of preparedness



A cost benefit analysis undertaken by GIZ has revealed that savings from avoided damages outweigh the costs of system setup very quickly, usually

within the first year of operation. As a result the Philippine national disaster risk management agency, the OCD, now actively promotes the LFEWS piloted by GIZ.

“In the past,” recalls Paul Mooney, who heads the BRLFWS Operations Center and whose family has lived in the downstream municipality of Palo for several generations,



Another form of community map

“the floods could come without warning, like the Biblical thief in the night. Now we are more prepared, even in the early morning hours.” In October 2009, Paul partici-

pated in a DRM training course conducted by the Asian Disaster Preparedness Center in Bangkok. “I was surprised to learn that, as far as the social preparation



aspect of the early warning system, like participatory risk assessments was concerned, the Binahaan model was more advanced compared to others.”

With Paul’s help, this social aspect of the BRLFWS has been enhanced, and the BRLFWS model has already been replicated in 3 other watershed areas in Leyte province.



Organization: GIZ (Deutsche Gesellschaft fuer Internationale Zusammenarbeit)

Project title: Urban Disaster Risk Management/Disaster Preparedness in the Eastern Visayas

Country/Geographic area: Philippines, Region 8

Donor: European Commission (DIPECHO), Federal Ministry for Cooperation and Development (BMZ)

Active project period: 2009-12

Address: GIZ. DILG Compound, Kanhuraw Hill, Tacloban City, Leyte, Philippines

Phone: +63 (053) 321 4995

Email: olaf.neussner@giz.de

Weblink: www.giz.de

Mobile Flood Warnings in Uttar Pradesh, India

Background. Uttar Pradesh (U.P.) tops the list of flood prone states of India, with Bahraich (north east of Lucknow) the most flood affected district in U.P. Flooding has always affected the state but the building of the upstream Girijapuri barrage in 1973 has resulted in a major increase in their effects. In addition, the construction of 110km of embankments, while protecting communities beyond, has worsened conditions of dwellers closer to the river, where the poorest communities live.

Notionally a government early warning system exists, but

this rarely reached the most vulnerable, nor in a language which they could understand. As such villages still rely on their own early warning, based on the following indicators;

- Rising water levels in the Bha-kosa Nala – a water channel which is connected directly to the Ghagara – monitored using marked Bamboo sticks to measure, level, volume and speed of flow.
- Updates on the level of the Ghagara received from people, often friends and relatives, living upstream.
- Information requested from the Block (local administration) office and daily newspapers which are disseminated through temple and mosque loud speakers.



- Radio, which plays an important role, though forecast messages are often too general to be useful.
- Monitoring of rainfall, since people know that continuous rain for three to four days, in adjacent areas and Nepal (on which they get information through the radio) results in flood within 12 to 24 hours.

In spite of these, however, villagers could not truly predict the timing and scale of flooding, only its likelihood.

Intervention. To address this problem, a study explored various options and recommended improving the existing EWS components, but

linking them to the District Administration level. The intervention specifically aimed to improve the dissemination system and the comprehension and receptiveness of communities.

At present 50 hamlets are covered. These form the 'last mile' of a system whose technical component is based on a software system similar to that used for tsunami warnings. It is based on auto-dialing software available from many software companies, which Sahbhagi Shikshan Kendra (SSK), the local partner of Malteser International, worked on modifying. While working to make it more user-friendly,

they simultaneously discussed the approach with the DM (District Magistrate - the head of the District administration and thus the person finally

responsible for District level early warning), who was highly receptive and supportive. The system has now been in operation for a period covering two

monsoon seasons, and was made operational through the following steps.

- Space in the District Disaster Management Cell (DDMC)/



New alternative message are used to spread the warning.



Early Warning Cell was offered, where the software was installed, and 24hr staffing ensured from July to October, through a dedicated Information Technology (IT) person.

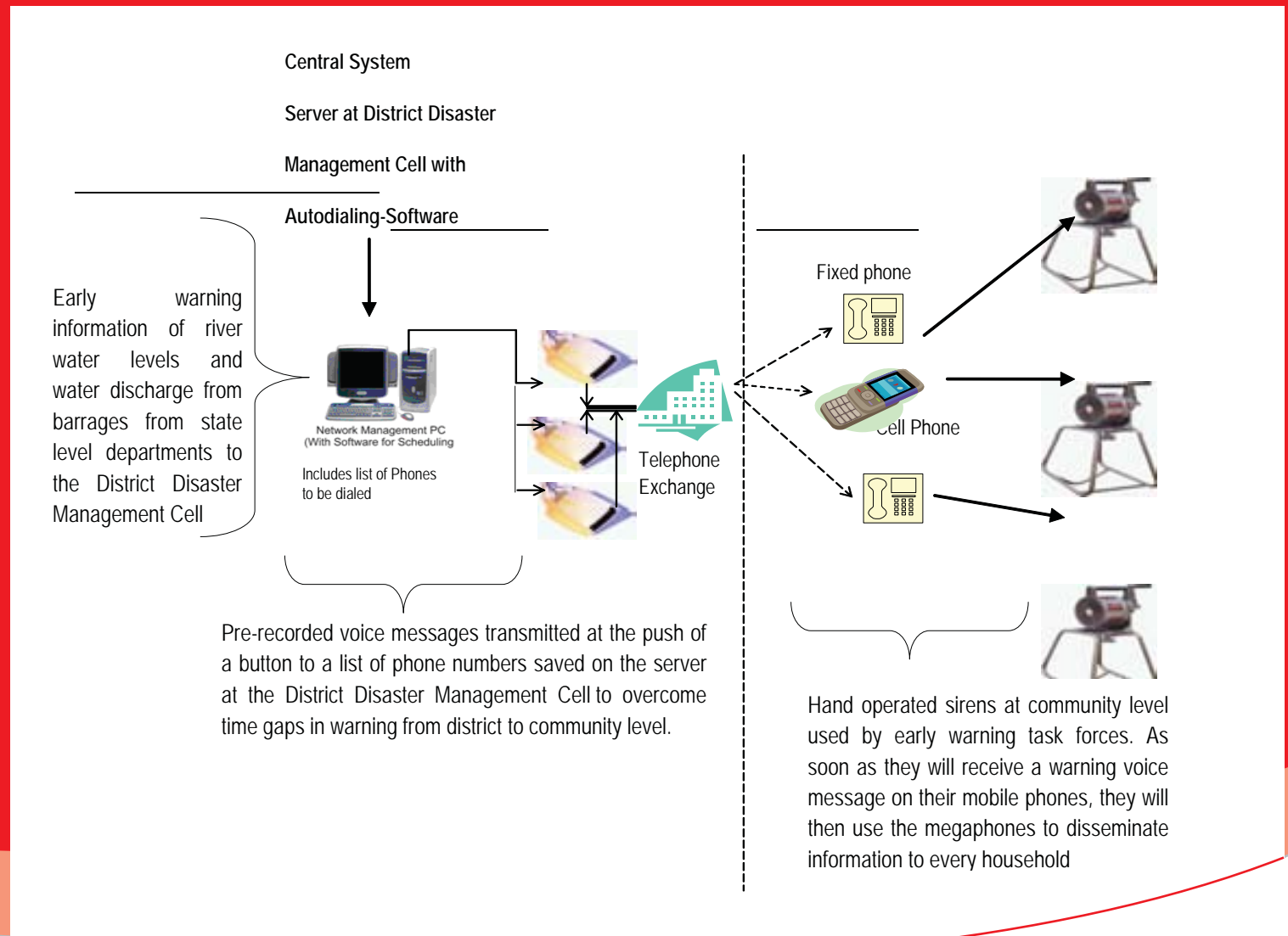
- Mobile and landline numbers for all officials at Tehsil, Block and District level were fed into the system, as well as the contact details of village representatives (Pradhans) and four trained volunteers from each flood-prone village. The DM ensures a 24 hours power supply back-up to the system.
- It was agreed that updating the system would be a shared responsibility with communities informing the administration when phone numbers change.
- The DDMC was set-up to receive official information regarding water levels and releases via the India Meteorological Department based in Lucknow, as well as the control room at the Girijapuri Barrage, which notifies it as soon as the barrage releases water in a volume of more than 100,000 cusecs over a two days' period.
- When readings indicate the likelihood of a flood the DDMC immediately creates a voice mail message, based on the information available and releases it to all mobile and landline numbers.
- This information goes directly to the current project villages, where people are also monitoring levels, using local, traditional, methods.
- The Hamlet Disaster Manage-

Receiving a voice message from the District Disaster Management Cell.



ment Committee (HDMC) then makes a decision, with volunteers of the EW-task force using hand operated sirens to generally alert people, and mega phones to give specific information on the possible timing and severity of the flood.

Best Practice & Learning. It has been essential, for long term sustainability, that this EWS incorporates existing, traditional,



Components of the system.



indigenous practices at community level, into a government managed system.

The project has attempted to make the government system more efficient and accountable and is based on the assumption that the administration will exercise its duty as envisaged in the DM policy, and will continue managing the EWS. There remains an element of risk also however, as high staff turnover can affect effectiveness, but having a DM policy in place helps. Village groups are prepared to hold the administration accountable and thereby keep the system efficient, and Malteser International and SSK have prepared the ground to ensure that communities act in this watchdog role. They are

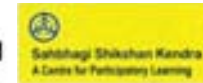
Recording of Early Warning messages at the District Disaster Management Cell, Bahraich.

ensuring this through regular dialogue and engagement. The intervention also included specific training modules, for all stakeholders, on “Social inclusion in DRR” as developing an understanding of vulnerabilities – especially of people with disabilities – is regarded as critical.

The fact that another NGO is piloting a different EWS in adjacent States is also seen as highly beneficial as this give an opportunity to analyze the two side by side and see if one offers a better base for replication than the other. Since both organizations have decided to coordinate with each other, there is also the opportunity to carry out joint analysis for shared recommendations.



Receiving a voice message at community level.



Organization Name: Malteser International, Headquarters; Cologne, Germany; roland.hansen@malteser-international.org, www.malteser-international.org

Local Partner: Sahbhagi Shikshan Kendra/SSK with support by UNNATI (www.unnati.org/)

Project Title: Mainstreaming Disaster Risk Management into the Local Development Processes of Uttar Pradesh

Country/Geographic area: India/Uttar Pradesh – Bahraich District

Donor: European Commission (DIPECHO)

Active Project Period: June 2009 – October 2010

Local Street Address : Chhata Meel, Behind Police Fire Station, Sitapur Road, Lucknow – 227 208 UP (India)

Phone- +91-522-6980124

Email: info@sahbhagi.org

Website: www.dmrk.sahbhagi.org



Practical Action and Mercy Corps have been jointly working on the development of community based early warning systems in Nepal since 2007 and as formal consortium partners since 2011. Prior to this independent pilot work on EWS in Nepal goes back to 2002.

Mercy Corps exists to alleviate suffering, poverty and oppression by helping people build secure, productive and just communities. It works in 40 countries and has been present in Nepal since 2005. Mercy Corps' current work in Nepal focuses on agriculture and food security, access to finance, DRR and climate change, and youth engagement. Women's

issues and work with disadvantaged groups are cross cutting themes. www.nepal.mercycorps.org

Practical Action is a UK based organization established in 1966 with the objective of reducing poverty through wider use of appropriate technologies. It has worked in Nepal since 1979 and its current work focuses on securing food for the poor; reducing risks from disaster and the adverse impacts of climate change; maximizing access to markets for small holder farmers; improving the access of the rural poor to basic services; improving the urban environment and; supporting healthy homes www.practicalaction.org





This publication, as well as many of the initiatives highlighted within it, has been developed through the support of ECHO's DIPECHO Action Plan for South Asia (and South East Asia in the case of projects). Currently in its VI cycle in South Asia DIPECHO projects fund innovative pilot work which targets the poor and demonstrate the potential for replication.

For more information on ECHO and its global disaster risk reduction program visit http://ec.europa.eu/echo/about/index_en.htm