MercyCorps

# Early Warning in Nepal

## The Mercy Corps experience 2008-2013.

# The role of Early Warning.

The role Early Warning Systems (EWS) can play in disaster risk reduction is now universally acknowledged. As an example the wide variations in the level of loss experienced during Hurricane Nargis, in May 2008, are widely credited to the role early warning played. In Bangladesh where effective EWS was in operation the death toll was 3,400. In Myanmar where it was not, the death toll was 84,537, with a further 53,836 missing.[1]

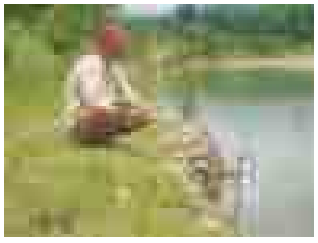
More recently the greatly reduced loss of life caused by Typhoon Bopha, in the Philippines during December 2012 (418 deaths[2]), was also attributed to early warning: "This time last year over 1,400 people died on Mindanao in a similar event, but this time big improvements in the early warning systems have saved many lives. More than 167,000 people have been evacuated to shelters."[3]

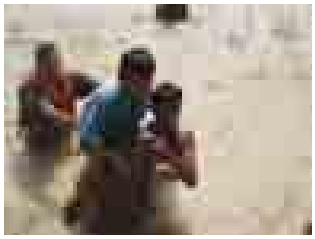
Such events and the early warning systems established to protect against them have been largely at the macro level and have concentrated on high tech/high cost approaches to mitigate against them. These are justified given the huge scale of the threats, the number of potential beneficiaries and the predictability and regularity of the climatic events they address.

For many however the risks faced are small scale and localized in comparison. Globally, localised flood or landslide, no matter how catastrophic for the communities concerned, can be statistically insignificant, particularly as aggregated data on such events is often never gathered. This can make the setting up of early warning systems seem unrealistic, particularly where the risk scenarios faced are complex and localized, and issues of system viability and sustainability seem daunting.

These are typical of the challenges faced in establishing EWS in Nepal.

*1 SCF 2008. http://www.savethechildren.org/site/c.8rKLIXMGIpI4E/b.7492227/*
*2 BBC on-line news. 7/12/2012. http://www.telegraph.co.uk/news/worldnews/asia/philippines/9726094/Typhoon-Bopha-death-toll-passes-400.html*
*3 UNISDR Head of Regional Office for Asia, Jerry Velasquez. 5th December 2012.*





# CONTENTS


1 NEPAL
2 THE PRINCIPLES OF EARLY WARNING
3 EARLY WARNING IN KAILALI
Set-up
Communications Needs Assessment
Communication Channel Development

10 EARLY WARNING IN KANCHANPUR
The Improvement or Installation of Rain and River Gauges
Training, Equipping and Support of Gauge Readers
Preparing Communities for Response
Development of Communication Channels
Observations
Foot Notes

21 LEARNING AND IMPACT
22 THE FUTURE


Mercy Corps has been working in Nepal since 2005. One of its primary focuses has been on Disaster Risk Reduction (DRR), within which the development and support of Community Based Early Warning Systems (CBEWS) has been a major thrust. This is based on the belief that CBEWS if one of the most cost-effective forms of DRR and of building resilience. It is also one of the most necessary interventions in areas where communities are routinely threatened by the unpredictability of their environments.

Through the support of the various DIPECHO Action Plans for South Asia, Mercy Corps has been working in Disaster Risk Reduction (DRR) in Nepal since 2007, concentrating specifically on the Far Western Region districts of Kailali and Kanchanpur. The current programme “Strengthening the Capacity of Communities for Disaster Risk Reduction through Early Warning in Nepal (SCORE)” is being carried out in conjunction with Mercy Corps’ local partner, Nepal Red Cross Society and has continued ground breaking work in Community Based Flood Early Warning System (CBEWS) development and the use of low cost bio-engineering approaches for flood protection. The project has also piloted measures both to mitigate damage from landslide in hilly areas and to establish EWS for landslide.

# Nepal

Nepal is both blessed and burdened with outstanding natural beauty. The landscape and topography which is so admired by tourists and locals alike marks the northerly limit of the annual monsoon and spawns rivers which carry its floods to India and on into Bangladesh every year. Being on the 'new' Himalayan mountain range, and sitting on tectonic faults, Nepal is also prone to earthquake which increases the already considerable risk of landslide in many areas. Globally Nepal is ranked 30th in terms of vulnerability to flood and 11th in terms of vulnerability to earthquake[4] .

On 18th August 2008 the Koshi river, the largest river basin in Nepal, breached its eastern embankment at Kusaha, in Sunsari district. Flood waters entered settlements, damaging national highways, power transmission lines, communication cables, schools, health posts, village roads and private and public buildings. 42,800 people were displaced in four major Village Development Committees (VDCs) in Nepal-Shreepur, Haripur, Paschim Kusaha, and Laukahi[5]. Downstream 2.5 million people were marooned in eight districts in Bihar. 650 km² of land was inundated and dozens, perhaps hundreds were killed. This was an extreme event and brought the issue of flood risk in Nepal into international focus. But smaller floods occur every year in Nepal, killing scores, displacing hundreds and thousands, and devastating productive assets and livestock. Flood in Nepal is not a one off catastrophic episode, but a routine, regular and predictable event.

While threats of flood in big river catchments are now being taken seriously throughout the country, the impacts of flash floods in small catchment river basins are given far less importance and have been largely overlooked. For this reason, since 2007, Mercy Corps-Nepal has taken the strategic decision to concentrate specifically on this problem and the communities it effects.

*4 UNDP/BCPR, 2004*
*5 UN OCHA Koshi Flood Response Update, 20 May 2009*

# The Principles of Early Warning

According to UN-ISDR terminology[6] "*an early warning system is made up of the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by hazards to take necessary preparedness measures and act appropriately in sufficient time to reduce the possibility of harms or losses.*"

Though a range of definitions exist, broadly speaking these capacities, or elements, of an early warning system can be summarized as:

- Knowledge of the risks
- Monitoring, analysis and forecasting of the hazards
- Communication or dissemination of alerts and warnings
- Local capacities to respond to the warnings received

The critical issue with these capacities, and normally what decides the success or failure of an early warning system built around them, is where and with whom these capacities lie. In Mercy Corps' work the focus has been centred on ensuring all these capacities lie with communities, not outside actors. Through this approach communities are able to gain greater control over their environments, contribute more meaningfully to wider risk reduction initiatives, and become important actors in risk reduction rather than beneficiaries of it.


***Mangal Prasad Chaudhary, Tilki;***

*The messages were being chanted round the village as the rain fell in Tilki, "All wake up, a big flood is coming and it's increasing.....put your lalpurjas (property ownership documents), citizenship cards and other important documents in a bag and get ready. Put your rice, flour, wheat in the upper part of house....Put children in the upper part of house...The first siren has been blown....All of you get to safe place..."*

6. 2009 ISDR Terminology on Disaster Risk Reduction

# Early Warning in Kailali

Kailali District covers 3,235 Km² of which 59.7% lie in the plains (known as the Terai). It contains three major rivers. The Karnali, marking its eastern border, the Mohana running along its western and then southern border with India, and the Kandra, running north-south, through its centre. The Karnali, being snow fed, carries a significant flow throughout the year, while the two others, originating in the adjacent Churia range, carry significant flows only between June and September. During this period the annual monsoon swells their banks and brings regular floods to the district.

The Karnali, rises hundreds of kilometers upstream in the Himalayas, passes through a number of gauging/recording points and also through a number of populated areas. As such it is both more predictable and more easily covered by warning. For this reason Mercy Corps chose to work on the Mohana river initially and then moved on to the Kandra, representing as they do both the greatest threat to the poorest and most vulnerable communities in Kailali and also the most difficult rivers, technically, in terms of establishing early warning.

The Mohana river starts in the Churia hills with its seven main tributaries gaining most of their dry season flow from springs. This flow is greatly increased during the monsoon however when surface runoff from the district catchment flows into the tributaries and routinely overwhelms their carrying capacity. Floods develop quickly, with little warning, resulting in disastrous consequences particularly for communities lying along the Indian border.

Prior to Mercy Corps' involvement no warning system had been attempted. Though communities had traditional means of predicting floods - they took readings from the clouds, noted differences in the smell and colour of the water, watched animal behavior closely – they acknowledged these indicators did not provide reliable or timely information, especially at night when flood most regularly occurred. They were therefore often left to evacuate when it was far too late and consequently lost lives, belongings and livestock.

It also became clear through Mercy Corps' initial work that communities did not have a clear perception of the pattern or basis of the hazards they faced, nor that more thorough and systematic preparation and access to timely warning information could greatly reduce their losses.

## Set-up

Mercy Corps' work started with a detailed assessment both of the community situation and possible institutional arrangements which could assist in broadening the information available to them. This assessment concentrated on the four stages of EWS - Knowledge of the risks; Monitoring, analysis and forecasting of the hazards; Communication or dissemination of alerts and Warnings; Local capacities to respond to the warnings received.

As a full Community Based Disaster Risk Reduction (CBDRR) programme was envisaged it was anticipated the first and fourth elements would be addressed through this (i.e. raising awareness and building capacities to respond). What were less clear were how warnings might be communicated and, critically, how monitoring, analysis and forecasting could be achieved at the community level. As such initial work concentrated on these two key elements.


Consultative meetings were held with the Department of Hydrology & Meteorology (DHM) at national, regional and district level. This was to establish what institutional capacity existed in terms of river and rainfall monitoring, whether this could be incorporated into an EWS and whether formal collaboration with DHM could be possible. At the same time, at District level, talks were held with the District Administration Office and District Development Committee to gauge their interst in and support for an EWS. Discussions at both levels were positive and as such a distirct assessment was carried out. This resulted in the following technical findings.

- For the Mohana watershed existing DHM rainfall monitoring stations existed at Godavari, Garva Darbar, Chaumala, Attaria and Sitapur. These could be utilised in any future EWS without the need for any additional support.
- Stream (river level, or 'staff') gauge stations on the Mohana river (at Malakheti), Khutiya river (at Mudi Bhavar), Guraha river (at Khereti) and the Kataini river (at Manikapur) could also all be incorporated into an EWS.
- It was noted that monitoring in other locations would also be required however, to give full coverage in locations upstream of the communties covered. Following study of

topographic maps, satellite imagery and the walking of many river courses, new locations were identified which were verified during site visits by the staff of DHM.

The assessment of resources also included discussion with existing DHM guage readers responsible for carrying our rainfall and river flow readings. Discussion covered the present functioning of the exisiting recording and reporting system, challenges faced by the readers, and their opinions on how and where improvements could be made. The opportunity was also taken to confirm all locations by GPS reading. As a result of these discussions various recommendations were made to the local authorities and DHM. These included;

- The need for the provision of CDMA phones to recording stations with communications difficulties.
- The need to offer additional payments, for additional work during peak rainfall periods, to DHM employees.
- The need to offer a package of additional awareness activities, training and incentives to DHM staff.
- The need to recruit volunteer readers within the communities themselves, who would go through the same capacity building programme as the DHM staff.

***Dil Bahadur Chaudhary, a gauge reader on the Banhara River at Banhara;***

*"At 2 pm, the river level had increased to 2.8 m. I came back and blew the first siren. As I am also a member of the search and rescue task force, I put on my life jacket and got ready for action along with other search and rescue task force members.*

*We blew the second siren about 15 minutes later as the water started breaking through the embankment near the high tension tower. Sahadev Rana told those with elderly and children to go to the Janauthhan Primary School, which is higher up, as soon as possible.*

*All the time we were continuously informing downstream communities about the river level. Meanwhile, Mangal Prasad Chaudhary, of Tilki, told us over the phone that if the river level would increase by 1 hand (30cm), it would enter their community. We were worried for them"*


# Communication Needs Assessment

Once it became apparent that potentially useful warning information could be gathered, possible communication methods and channels were explored. This was discussed within an EWS steering committee, set up at district level to oversee the development of the system. The committee agreed and highlighted that other stakeholders also needed to be incorporated into the system, including district security forces, local FM radio stations and senior district authority staff with DRR and disaster response responsibilities.

For communication between recording stations and the community, and between communities themselves, CDMA telephone was found to be the best solution. Although connectivity could still be an issue with this system (which relies on low orbitting satellite) it was still regarded as more reliable than landline communication which was not available to all communties anyway. It was also far cheaper than HF radio (more recently standard mobile services have largely replaced the CDMA system, as mobile use and coverage have become both more universal and its cost greatly reduced). As the recording stations and all targeted communities lacked electrical power backup this issue remained a problem, though since resolved by providing solar chargers .

Although monitoring stations were now confirmed and means of communication established the major problem was to identify warning levels. As no EWS had been attempted before little information existed on the downstream consequences of high water levels upstream for example, nor the impact of different levels and intensities of rainfall on river flow.

As such a participatory modeling exercise took place where by DHM gauge station information was compared with community knowledge and experience of previous flood episodes. Through this a picture could be created of past floods. Community members recounted their experiences of what had happened during real floods and by comparing these with the official records it could be seen what the consequences of a particular

river level upstream was for the communities downstream. In this way various upstream levels could be identified at which warnings needed to be relayed. These levels varied for each community, as some were lower lying than others.

By recording the high water levels from previous floods the 'lead time' could also be calculated for each community. The lead time being the difference between the time of the high water experienced at the upstream DHM station and the time the high water was recorded in the community. This established how long exactly a community had between receiving a warning and flood reaching their village. Again these varied widely, from 2½ to 8 hours, depending on how close to the gauge station the community lay.

It was also decided to establish a number of warning levels for the initial year of operation. In the first year it was assumed that three levels would be set; Ready; Get Set and; Go. To match these levels poles were erected in each community displaying green, orange and red colours, indicating the same warning levels.

In addition rainfall levels were also recorded. None of the rivers being monitored were long and as such lead times gained from measuring river flow were accordingly very short. By measuring the intensity, duration and total amount of rain during severe rain periods it was hoped a correlation could be made between these indicators and subsequent river flow. If such indicators could be used it was hoped warning could be issued even before water had reached the river courses.

***Bal Sugrib Rana, Chairperson & Member, EWS Task force of Itaha CDMC Dekhatbhuli-6, Tilkipatti;***

*"It was midnight and we were sleeping. Mangal Prasad Chaudhary was calling us outside our home with Raj Kumar Chaudhary, CM for our community. He told us that he had received a call about the increasing flood on the Machheli River in upstream areas.*

*We went to observe the river and although it was very quiet, water had covered the land reclaimed by the bio-engineering works and was up to 2.90 m.*

*We decided to blow the siren to warn the other villagers at 12:15. Ramashree Rana, an EWS task force member sounded the siren and we told people to wake up and put their important documents and materials in a safe place.*

*Mangal Prasad Chaudhary had a CDMA mobile phone and he was continuously getting information from upstream. He was also informing the downstream communities about the flood. At around 2:25 am, we saw a star in the sky and we shouted in joy. The rainfall stopped at 2:30 am."*


## Communication Channel Development

The final stage in communication system development was to formalize communication protocols, clarify communication routes and make public the communication network. To facilitate this a number of workshops took place during which community members, gauge readers, DHM staff and district stakeholders collectively produced a communication tree. This clearly identified those responsible in each location and at every stage, by name and telephone number. Copies of this were subsequently produced in banner form for hanging in police posts, government offices, and community centres. It was also printed as part of a diary, for community members, so all critical numbers could be carried at all times.

In parallel with these planning activities a broad awareness, capacity building and skills training programme was carried out at community level, as part of a community based DRR (CBDRR) programme. As part of this task forces for search and rescue, first aid and early warning were established, with appropriate equipment distributed to match. In terms of EWS hand sirens were distributed as past experience indicated these were far more reliable and equally affective as powered ones. These would sound general warnings over a wide area. Additionally battery powered hand microphones were given, as ideal for relaying specific spoken messages.

As a concluding test of the system mock drills took place in all communities. These not only

tested the communications systems and channels, but also the community and district level response plans. Since 2008 the system has operated in Kailali, being called upon during several flood incidents. It operates with diminishing levels of direct support from Mercy Corps and since 2009 district authorities and other stakeholders have funded the additional cost of its running. It is now self sustaining.

***Mr. Ramlautan Chaudhary, gauge reader at the monitoring point on the Kandra River explains his role in the early warning system on the Kandra River;***

*"Though it is difficult to stay continuously alert during the monsoon period, I am happy to be 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. People from the downstream communities often call and ask for information and I am in regular contact with everyone 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 make me proud.*

*I remember very clearly what happened on July 19 2010, when heavy rainfall made the Kandra flood the adjoining areas, and my observations helped those in Banbarsa get prepared and evacuate on time without losing anything. The community thanked me a lot".*

*"Previously, when we started to work with the early warning system and collect information on the 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 responsibility and I hope many more will call me in future and benefit from the information I can provide. Though the things I am doing are simple and easy, and almost exactly the same as I did previously before the early warning system was established the EWS has give my job a totally different dimension and importance.*

# Early Warning in Kanchanpur

In 2011 Mercy Corps expanded its EWS work into neighboring Kanchanpur District.

Topographically Kanchanpur district is similar to Kailali, but it suffers the added disadvantage of having even shorter rivers. Floods come faster than in Kailali and the coverage of DHM monitoring stations is much sparser too. With the district having two main watersheds Mercy Corps decided to concentrate on the eastern one, where three main tributaries, the Siyali, Sombhara and Machheli/Doda drain into the larger Bhanhara river.

Mercy Corps carried out a similar risk and communication mapping exercise as previously carried out in Kailali, but this was done with the knowledge that very few existing DHM stations could be utilised. This had the advantage however that communities would not just be involved in downstream monitoring and warning activities, but also in the active upstream monitoring of river flow and rainfall as well. The establishment of the EWS was divided into four stages.

# The Improvement or Installation of Rain and River Gauges

Although there were some meteorological and hydrological stations in Kanchanpur two fundamental problems existed. Firstly, insufficient readings were taking place on which to base analysis and so warning. The DHM based meteorological (rainfall) stations were currently taking readings only once a day, at 8:45 am, while the hydrological (river) stations were taking readings only three times a day (at 8:00 am, 12:00 pm and 16:00 pm). In neither case was there systematic or regular analysis of the information being gathered. Secondly, as anticipated, the vast majority of stations were not in locations which could be useful for forecasting flood in the communities targeted.

As such Mercy Corps, NRCS and the staff of the District DHM office, in conjunction with community representatives set about identifying and mapping the most appropriate locations for monitoring. It was also decided what form that monitoring needed to take. It was decided that both rain and river (staff) gauges would be established in the communities of Banhara, Dayaamarpur, Bayelkundi, Kataan, Tilki and Simari. This dual monitoring approach was taken as while the river gauges would show the most obvious indicator of imminent flood, the short rivers in the area meant such indicators were likely to give too brief a warning before floods actually struck. By monitoring rainfall however, and its correlation to flood, it was hoped this method might offer a better approach long term.

Through study of maps and community discussion it was realised monitoring of rivers would also need to take place elsewhere in the Banhara catchment area. Community level monitoring would provide insufficient upstream monitoring on some tributaries and as such locations were identified where the main east-west highway

crossed them, as settlements could usually be found in these locations. This resulted in additional monitoring points being established on the Machheli (Doda) River, Banhara River and Sonbhara River. On the Siyali River a monitoring point already existed, though presently unstaffed. In all locations river and rain gauges were installed through the support of DHM staff, with community members providing the labor and advising on the best locations, with non-hydrological considerations in mind (i.e. proximity to the potential gauge readers house)

***Mr Challu Ram Chaudhari, Teacher, Hasulia, Kailali;***
*"We are proud that no one died in our communities. With the careful use of EWS and application of the skills and knowledge we gained through training, we made sure that no human casualties were reported in our communities. 24 people died in adjoining communities, where EWS was not in place. These figures show that if local communities are prepared sufficiently in advance, the impact of flood can be reduced dramatically"*

# Training, Equipping and Support of Gauge Readers

Volunteer gauge readers were identified in the target communities while other readers were identified for the monitoring points outside the immediate project area. Various trainings were organized to mobilize and build the capacity of the gauge readers, in which existing gauge readers from other locations and the staff of DHM were heavily involved.

It was expected that readers within the project communities would carry out their role voluntarily, as it was to their own and their community's benefit. From June to September the rainfall recorders were instructed to take readings at 8:45 am during normal conditions, but to switch to hourly recording during periods of rain. As there were no existing thresholds established for rainfall (i.e. the level which is known to bring about flood), the recorders were told to telephone DHM, NRCS, Mercy Corps and downstream communities directly, if it rained at a level of more than 40 mm or more in any given hour. Similarly river level recorders were instructed to take readings at 8:00 am, 12:00 pm and 4:00 pm during

normal conditions, which is the DHM norm, but to switch to hourly recording during rainfall/ flood.

Since the setup of the Kailali system the spread of mobile coverage has been rapid in rural Nepal. As such the choice of communication system was easier in Kanchanpur, though mapping took place to check signal strength and the best network in any given location. It was also checked that gauge readers had fully functional phone sets.

As an incentive the community gauge readers were given telephone recharge cards worth NRs. 200 (€2) per month, from June 15 to October 15. They were also provided with support materials such as raincoats, torches, boots and umbrellas. The gauge reader from Parasan was also provided with a CDMA mobile set, as there was still no reliable mobile service in this area.

Subsequently it was found connectivity was also an issue in other locations, particularly during extreme weather conditions.

Gauge readers from outside of the project area were also paid NRs. 120 (€1.2) per day, for the four months of the monsoon period (including the DHM employed gauge reader on the Siyali River). The DHM normal rates of pay for rainfall and river level recorders are NRs. 45 per day and NRs. 65 per day respectively. The higher rate was paid in this circumstance due to the requirement for readers to carryout hourly and 24hr recording in this EWS role.

***Sitaram Chaudhary, Gauge reader on the Machheli river at Bayelkundi and CDMC Secretary, Krishnapur-4, Bayelkundi;***

*'It was so dark and the trees and land mass in front of my house were falling. At around 10:00 pm I heard the flood approaching on the Machheli. The noise of flood was so loud and scary.*

*At 11:10 pm, we blew the siren. The search and rescue task force members came to us after hearing the siren. They were ready for action, with ropes and life jacket, and it increased our courage and confidence to cope with the situation.*

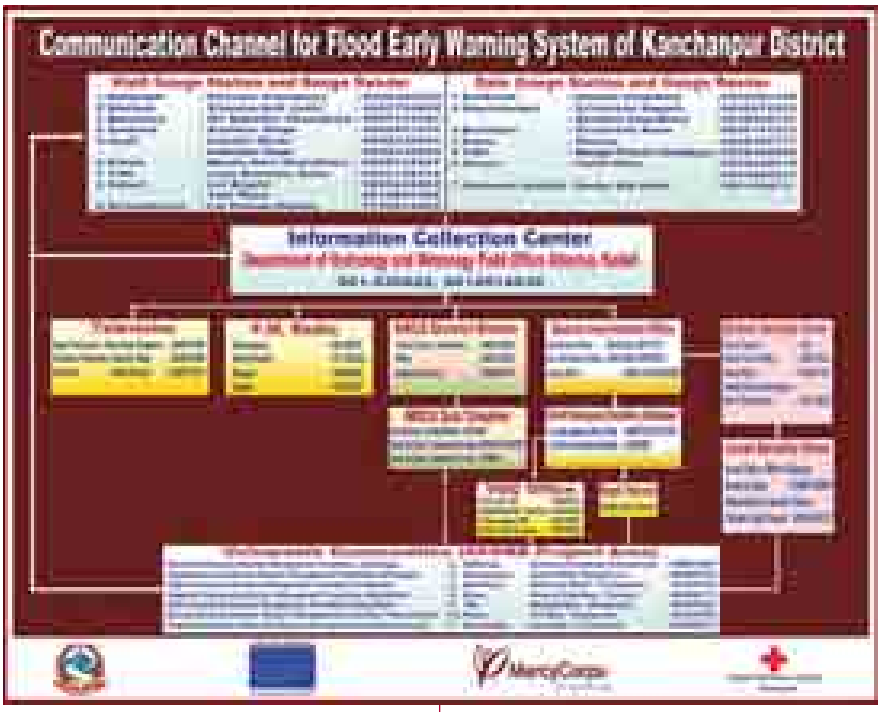
*Without any delay, we alerted the community, using hand mikes and the siren, to come out and untie their cattle… all of us stayed together in school, waiting for the rain to stop"*

# Preparing Communities for Response

As had occurred in Mercy Corps' previous actions each community was supported for appropriate response. As part of community based disaster planning safe evacuation routes were identified for times of flood and improvements made where necessary. PwD, the elderly and others requiring assistance in movement were identified and teams trained and equipped for search and rescue and first aid activities. Additionally EWS task forces were formed with clearly defined roles in terms of receiving warning, dissemination of warning, contacting other communities and emergency services, and managing orderly evacuation. All these selection processes, planning exercises and identification activities were done openly in common community forums, so all community members were fully aware and consulted. Learning from past experience only equipment which could be relied upon to work in the most difficult of circumstances was provided. Hand sirens and megaphones which could run on readily available batteries were supplied.

# Development of Communication Channels

Communication maps prepared for Kailali in previous years were used as models on which to base a communication tree for Kanchanpur. However as this was the first year of operation in Kanchanpur and no bench mark flood data existed, the DHM office in Attariya and Mercy Corps's own staff were placed more centrally in the system. It was realised a high degree or real time monitoring would have to occur during the 2012 monsoon and as such coordinators with direct experience of all communities and a high degree of personal contact would be required. Gauge readers, community leaders and district level stakeholders participated in the preparation of the 'map'. Discussions around how communication should take place during this first year also took place, as did the importance of recording, since the 2012 monsoon would provide benchmark data for subsequent years.




In all these activities the knowledge and understanding of all actors was enhanced through exposure visits to existing DHM sites and exposure to communities already operating EWS elsewhere in Nepal. This strengthened everyone's belief in the possibility and potential of what they were attempting.

## *Kanchanpur – 18/19th September 2012*
## *The story of a developing flood*

During 18th September 2012 heavy rainfall was recorded over much of Far Western and Western Nepal. Record levels were recorded in a number of locations and active monitoring was started throughout the station network being supported by Mercy Corps in Kanchanpur. River levels rose steadilly during the afternoon of the 18th in most locations. This is a snap-shot of what occurred on that day…….

At 23.51 Sitaram Chaudhary, a gauge reader on the Machheli River, at Bayelkundi, called the Mercy Corps staff member responsible for EWS support. He was highly concerned and reported that ***'The waters of the Surja River are entering our community. They've started entering as they're being blocked from joining the main Machheli River, due to flood on that river too. It's raining heavily and trees and slopes are falling'.*** He also communicated that he had tried contacting various other downstream readers, but found no network in operation (later, on 21st September, a field visit by Mercy Corps staff, discovered that the mobile tower covering Tilki was inoperative on that day, as the generator was partially submerged by water). As such at 23.55 Mercy Corps called Mangal Chaudhary, from Tilki, on an alternative CDMA (a satellite system) number. He was asleep, but was woken and informed of the situation. Tilki was informed first because this is the lowest lying community, and at shortest distance from Bayelkundi.

At 00:00 (midnight) the Bayelkundi DMC (Disaster Management Committee) decided to sound the first siren alarm and informed every household of the probable risk. The community started arranging their most important materials, as preparation to leave.

By 00:06 the district branch of the Nepal Red Cross Society (NRCS) were made aware of the developing situation, as was the Chief District Officer (CDO) of Kanchanpur.

At 00:35 the first siren was sounded in Tilki to alert the community to the fact that the level of the Machheli river had increased by ***"one hand"*** (about 30 cm). By 00:52 Lal Prasad Sharma, the gauge reader in Parasan had also been contacted to ensure he was observing the flood level there (Parasan is the lowest lying community, but also that lying furthest from the head waters of the various rivers).

At 01:16 Sitaram Chaudhary reported ***"I am at the river gauge. The river level is now 1.90 metres".*** He also communicated that 5 households in Tufaan danda, 25 houses in Surja and 96 houses in Mukta Kamaiya basti

were heavily water logged, that the river was still rising and that observation in Bayelkundi might have to cease for safety reasons.

At 01:35, Sunita Rana, the gauge reader from Simari, called to report that some parts of Simari were now water logged, due to flooding of the local Simari river (rather than the main Machheli river). Simari is actually some way from the Machheli and it seems the floods were being caused by the accumulation of water from the paddy fields and very heavy local rainfall, rather than river flow itself.

At 01:51 Mangal Chaudhary from Tilki reported that they had started to make warnings by electric hand microphones at about 24:30 and that the river, reported as 2.90 m at 00:00, had now risen to over 3m by 01:00.

At 01:55 Sunita Rana from Simari called to say that the flood waters had entered the settlement. She is a rainfall gauge reader so was not able to give information on the river level, Simari being some distance from the river bank.
At 02:11 it was attempted to reach Lal Bogati, from Parasan. Network problems were experienced but at

02:12 he was finally able to communicate that they had used electronic loud speakers to keep people informed and had sounded the first siren about half an hour ago. The villagers had started going to the pre-identified safe place (i.e. a nearby school) to take shelter. Flood was reported to have entered 4 houses and they requested that someone make contact with Raato Taal, which is close by, to ensure they were staying alert and ready to handle the situation if floods reached there too.

At 02:16 Shankar Datta Joshi from Bani, on the Machheli river, informed that the river level had been 1.75 m at 2:00 and was still rising.

At 02:23 Ramesh Deuwa, from Rato Taal, near Simari, gave his first update saying ***"there is water everywhere. We blew the siren at 2:16 and are going to a safer place now, with our cattle."***

At 02:30 Mangal Chaudhary reported that a portion of the flood waters had broken through from the northern part of Tilki, and were converging directly with the Machheli river. Normally the Banhara River converges with the Machheli further downstream. As such the community was now cut off.

At 02:37, Shankar Datta Joshi from Bani called to report that the river level of Machheli at 02:35 am was 2.3 m. The river level was still rising.

At 02:38 Sitaram Chaudhary from Bayelkundi also reported that the level of the Machheli was still rising. He said the second siren was blown there at around 01:00 am, but he had found it difficult to inform others downstream due to mobile phones being so busy ! At 02:43 Mangal Chaudhary, in Tilki, was informed of the updates from Bani and Bayelkundi. He relayed that nearly all the villagers were gathered together, as there was no safe place locally to go to, and they could not leave the village. By this time Tilki had become an island between two rivers (this regularly occurs during major floods).

At 04:54 Sitaram Chaudhary, from Bayelkundi reported that rainfall, which had been continuous for nearly a day, had stopped at 04:00 am and that people had started to return to their homes. He could not reach the river gauge to give an accurate reading at this time however as it was too slippery, dangerous and water logged to approach at this hour (it was pitch black).

At 04:56 Gayetri Mishra called to report that the river level at Siyali was 2.50m at 04.00 and was holding constant at the time of the call. She had informed Tilki and Parasan at 04:30 am of the flood level. She'd been very active previously in reporting information, the day before, when there had also been a risk of flood. This river had not been a priority for reporting earlier, as only a threat to Simari and Parasan (which are the furthest downstream).

At 05:01 Shankar Datta Joshi from Bani called to inform that the level of Machheli had now gone past its maximum (2.40 m) which had been reached at 03:45 and had since then gradually declined to 2 m at 04:00 and 1.7 m at 05:00.

At 5:08 am Mangal Chaudhary from Tilki reported that the level of the Machheli at 03:45 was 4 m and was now decreasing. It had fallen to 3.5 m at 05:00 am. He said that the villagers had started to return to their homes to assess the damage.

At 05:22, Aashika Singh, gauge reader on the Sonbhara River called to relay that the river level at 23:00 was 3m, but by 05:00 it had dropped to 2m.

At 06:57, Lal Prasad Sharma communicated that the water level there (Parasan) was 1.20 m and the two families living in Saal Ghari had left their houses the night previously (these were the most vulnerable to flood, as near a major drainage channel).

At 11:05 Sunita Rana from Simari called to report that the water level was decreasing. She had not left her house all night, to get to a safer place, because the water level and current was still too high and strong and the rescue team were giving priority to children and the old. 26 affected households from Raato Taal had shifted to IBRD (school) however, and 95 households from Simari went to TCN (school) in Kalika VDC, ward number 1.

At 13:45 Lal Prasad Sharma from Parasan informed that the flood level was 2.70 m and was entering the community at a rapid pace. The CDO of Kanchanpur was informed of this situation, through NRCS.

At 14:15 Lal Prasad Sharma called again to report that the flood level was now 1ft above the recently constructed raised road/evacuation route and that the community was heading towards Janajagaran Community forest, in the north of the VDC, which is elevated and safe from flood.

At 16:20 Lal Prasad Sharma reported that 388 houses in ward no. 8 were inundated and that the residents and their cattle were now staying at Janajagaran Community forest. About 150 people without animals were staying at the Rastriya Ma Vi (School) Plot. He reported that though the houses were less affected, they were concerned about their inundated agricultural land. By this point the Nepal Police were also mobilized in Parasan.

From this point onwards water levels dropped rapidly in all locations, having started dropping a long time earlier elsewhere.

## Observations

1. There were no casualties reported in Kanchanpur following the floods of 19th September, and very, very few animal losses. Families were able to rescue many household resources in the areas affected and it was clear the warnings provided greatly assisted in this (in Tilki community members immediately reported that the warning gave them enough time to store grain supplies on upper floors for example).
2. No historical data existed on these rivers, so the warning process was more interactive and participatory than it would be in future years, when 'official' verified warning levels will have been established. However the flow of communication and information highlighted in this report shows the potential of such systems, not just for warning, but for the exchange of vital information of value to organisations and authorities involved in relief and response activities among others.
3. The role played by the gauge readers, both community based and from DHM (Department of Hydrology & Meteorology), cannot be overstated. The performance of the system over 18th–19th however demonstrates some real life practicalities. Some important stakeholders were not where they were planned to be, while others did/could not respond when information was critical. Other key stakeholders could have played a more active role.
4. Within the system as it stands there is clear need for gauge readers and community members alike to have more and alternative contact telephone numbers and systems.
5. Simple, easily addressed problems existed within the communication system. In some cases Mercy Corps and NRCS staff were required to make and relay

calls as gauge readers were low on telephone credit for example.

6. The operation highlighted a fundamental problem with phone/mobile/data transmission based systems. While communication channels had worked well in testing, in actual poor/extreme weather conditions communication quality and reliability reduced drastically. This was partly anticipated in advance and was why Mercy Corps and NRCS staff played such an active role in relaying messages on the night.
7. This is a "Flash flood" area. However this flood episode clearly indicated that floods only hit downstream communities (Parasan for example) upwards of 12 hours after they had affected those most upstream. This shows the system offers huge potential for genuine and meaningful EWS.
8. In general the communication generated through the system was hugely successful and gave all involved a great deal of comfort and support, as well as warning.

***Gayetri Mishra***

***Gauge reader at Siyali River;***

*"It was Teej that day and everybody was busy going to temples and dancing. It had been raining since the night before and when I took the reading at 6:00 am, the level of the river had increased slightly to 1.70m. I informed the downstream communities of Tilki, Simari and Parasan, as well as the DHM office at Attariya. As it was raining continuously I monitored the river level every two hours, but at 12:00 noon the river level had risen to 2.5 m and I switched to hourly readings. It rained the whole day and although at 7:00 pm it stopped, it again started heavily soon after. I measured the flood level and informed the downstream gauge readers continuously. Sometimes there was a network problem in the downstream communities but I kept calling.*

*I have been recording the river level for 13 years and previously it was simply a part of my job. I did not know the possible use of the river level data, but Mercy Corps and NRCS Kanchanpur helped me understand the importance of the information and the need to communicate it to downstream communities during flood. I used to take readings three times a day for DHM, but now I take readings every hour during the flood. I know if I inform the downstream communities they will have time to prepare, get their documents, grain, their children and family to a safe place. This Teej I could not celebrate it as I used to in previous years, but I am so happy that I did something noble. I am so happy to be a part of Kanchanpur EWS."*

## Foot Notes

1. This report represents only a very brief edit of a full report circulated through ECHO, the UN system and the Nepal Risk Reduction Consortium (NRRC) on 22nd September. A great many more individual communications were made within the EWS than recorded here and the above is given as an indicative record only, demonstrating the type and content of communications made.
2. This report covers only the activities which took place in regards to warning. Mercy Corps, its partners, NRCS and community DMCs were also actively involved in immediate response and relief activities. These are not covered in this report.

# Learning and Impact

» Floods in Kanchanpur in October 2008 affected 5,961 households and claimed the lives of 14 people .[7]

» Between 9th and 12th October 2009, 2,250 families were affected by flood in Kanchanpur. 3 people were killed and another never found. 76 families were displaced, 150 houses were completely destroyed and 850 partially destroyed .[8]

» On September 18th–19th 2012 while 2,075 families were affected by flood, 96 families displaced, 96 houses completely destroyed and 1,229 partially damaged, there was no loss of human life (and very few animals lost either) .[9]

While these statistics cannot prove the impact of EWS, floods in Kanchanpur in 2009 and 2012 in particular were reported as being similar in terms of magnitude and scale from a hydro-meteorological point of view. Community and district authority opinion supports this, as does the view, from both community and official level alike, that EWS was a major contributory factor in reducing losses during 2012. Opinion in Kailali on EWS performance over the last four years reinforces these opinions. Early warnings save lives.

These systems have shown that local level monitoring and warning are entirely feasible, even on rivers affected by 'flash flood'. Remote, technology driven approaches to EWS are unlikely to provide benefits under such scenarios however. Where the flood experience of communities only a few kilometers from each other are entirely different warnings need to be site specific, generated by the system users themselves. This is learning Mercy Corps is building upon in its present work.

7 *UN OCHA Situation Report No. 5. 22nd October 2008*

8 *UN OCHA report. 12th October 2009, covering a period of 9-12th October, 2009. Also http://training.fema.gov/EMIWeb/edu/compEmMgmt/Comparative%20EM%20-%20Session%2020%20-%20Handout%2020-5.doc.pdf*

9 *Flood situation and response update prepared and presented by NRCS Kanchanpur on 27th September 2012, covering the impacts of flood in Kanchanpur during-September 18th-19th*

# The Future

The spread of mobile coverage in Nepal makes instant and direct contact a real possibility. Three or four years previously this was almost unthinkable. Robustness and reliability of systems remains a consideration but Mercy Corps is exploring various options in semi-automated warning messaging, so real-time data can be relayed to a greater number of communities in the future. These trials continue to place communities at the heart of all systems however, so that the sustainability and utility of systems is ensured and local level accountability is maintained.

Mercy Corps also continues to advocate for incorporation of EWS in all DRR planning, and the formal recognition of the importance of EWS, through the adoption of the national EWS strategy developed by the Department of Hydrology & Meteorology in Nepal.

EWS has proven its value in Nepal not just through the lives saved but through the pioneering work it has piloted in utilizing affordable, locally available resources. Mercy Corps will be continuing to advocate for expansion of EWS through its DRR work into the current decade and pushing for community approaches.

**Content and Materials Developed by:**

Peter Crawford
Keshab Pokhrel
Anil Nepal
Ramesh Shrestha

**Photo Contribution:**

Mercy Corps Nepal / Peter Crawford

**Design and Printing:**

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The European Commission's Humanitarian Aid and Civil Protection department (ECHO) was created in 1992. In its 20 year existence it has provided €14 billion of humanitarian assistance to victims of conflict and disasters in 140 countries around the globe. In 1996 ECHO launched a specific programme, DIPECHO (Disaster Preparedness ECHO) dedicated to disaster preparedness. This programme has been operating in South Asia since 2001

MercyCorps

**Mercy Corps Nepal**
Sanepa Chowk
P.O. Box: 24374
Lalitpur, Nepal
Tel: +977.1.555.5532
Fax: +977.1.555.4370
Websites: www.mercycorps.org
http://nepal.mercycorps.org