Disaster Management Community

Solution Exchange Bhutan

Solution Exchange for the Disaster Management Community
Solution Exchange Bhutan
Consolidated Reply

Query: GLOF Risk Reduction-Role of Community and Early Warning Systems - Experiences

Compiled by G. Padmanabhan and Sonam Lhaden, Resource Persons, Nupur Arora, Research Associate and Guest Moderators G. K. Bhat, Krishna Vatsa and Rajeev Issar
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From Rajeev Issar, UNDP's Bureau for Crisis Prevention and Recovery (BCPR), New Delhi
Posted 3 December 2008

It is well known that traditional approaches towards Glacial Lake Outburst Flooding (GLOF) risk mitigation have largely been structural or engineered. These primarily involve siphoning out water from hazardous glacial lakes, using GIS or Remote Sensing tools to develop an inventory of glacial lakes and deploying satellite-based observation systems to monitor the formation, expansion and nature of glacial lakes. These approaches are by themselves beset with formidable challenges arising from the inaccessibility of glacial lakes for significant parts of the year, which renders efforts to drain the lakes arduous, labour-intensive and ultimately interim in nature.

It is recognized that comprehensive disaster risk reduction entails the adoption of a holistic approach addressing all aspects of disaster management and encompassing all stakeholders. However, with respect to GLOF risk mitigation there has been insufficient acknowledgement of the effectiveness of a community-based risk mitigation and preparedness approach. Efforts towards involving downstream communities and local administrative systems have not found much acceptance and much lesser practice.

In view of this, we request members to share:
- What experiences have you had with involving communities in GLOF preparedness and mitigation activities, and early warning systems (EWS) and awareness building on GLOF as well as with mechanisms developed to maintain EWSs?

- What training and capacity building initiatives have been undertaken so far and/or required to be adopted for preparing communities and local administrations?

Your responses will help us develop holistic approaches for addressing the risks posed by GLOF/flash flood hazards with a primary orientation of building the capacities of communities and local administrations.

We look forward to a stimulating and thought-provoking sharing of experiences on the issues outlined above.

Responses were received, with thanks, from members from CPRP-Net, E&E-Net, DRM Asia Network, Disaster Preparedness Net Nepal, Pamirtimes-Pakistan, Solution Exchange for the Disaster Management Community in India, and Solution Exchange Bhutan:

1. **Kathrine Haynes**, **RMIT University, Australia**
2. **Robyn Betts**, **Research and Strategic Projects, Office of the Emergency Services Commissioner Hume Region, Australia**
3. **Ilan Kelman, Center for International Climate and Environmental Research Oslo (CICERO), Norway (Response 1; Response 2)**
4. **Biswanath Dash**, **National Institute for Disaster Management, New Delhi, India**
5. **Ahmed Fahmi**, **United Nations Educational, Scientific and Cultural Organisation, New Delhi, India**
6. **C. John David**, **United Nations Development Programme (UNDP), Chennai, India**
7. **Usman Qazi**, **Crisis Prevention and Recovery Unit, United Nations Development Programme (UNDP), Pakistan**
8. **Arvind Kumar Sinham**, **Mountain Forum Himalayas, Himachal Pradesh, India**
9. **Eilia Jafar**, **International Federation of Red Cross and Red Crescent Societies (IFRC) - Regional Delegation of South Asia, New Delhi, India**
10. **Sushil Gupta**, **Risk Management Solutions Internationals, Noida, India**
11. **K. Arup Kumar Patro**, **FOCUS Humanitarian Assistance India, Mumbai, India**
12. **Stephen Duah-Yentumi and Thelma Amarquaye**, **Environment and Energy Unit, United Nations Development Programme (UNDP), Ghana**
13. **Himanshu**, **World Health Organization (WHO) India Office, Orissa, India**
14. **Arshad Ashraf**, **Water Resources Research Institute, National Agricultural Research Centre, Pakistan** *
15. **Barkat Ali**, **Network: Pamirtimes, Pakistan** *
16. **Ahmad Khan**, **Network: Pamirtimes, Pakistan** *
17. **Mubashir Hussain**, **Network: Pamirtimes, Pakistan** *
18. **Ghazala Naeem**, **Network: Pamirtimes, Pakistan** *

Offline Contributions

Further contributions are welcome!

Summary of Responses
Comparative Experiences
Related Resources
Responses in Full

Summary of Responses

The discussion on "Glacial Lake Outburst Flooding (GLOF) Risk Reduction - Role of Community and Early Warning Systems" recognized the significant challenges related to involving communities in GLOF preparedness and mitigation activities, the development and maintenance of early warning systems (EWS) and in creating awareness.

Members believed that **community preparedness** is essential to any risk reduction process. They pointed out that the Himalayas are very fragile, scattered, inaccessible and remote in terms of communication, transportation, establishment of support system and knowledge sharing with the community, and expressed their concerns on disaster response being not very successful. Respondents acknowledged that living in the Himalayas is itself a big challenge that put the habitants in vulnerable condition due to difficult terrains and unplanned development processes.

While discussing the importance of preparing and involving communities in GLOF preparedness and mitigation activities,, respondents highlighted the **range of challenges**, specifically:
- Not working with communities when developing coping mechanisms (often professional organizations develop plans in isolation without taking into consideration local practices)
- Communities not prioritizing preparedness activities, because they view disasters as "a vagary of nature"
- Not mapping community level resources in an inclusive manner
- Misperceptions regarding the state's role in disaster relief and response operations
- Mobilizing together community in shortest possible time to work
- No regular drills to practice community coping mechanisms to ensure skill transfer, and better performance during actual disasters
- Limited and ineffective mitigation choices.

To help address these challenges, members shared several useful references on traditional community coping mechanisms, including "Indigenous Knowledge for Disaster Risk Reduction," "Resilience of Traditional Societies in Facing Natural Hazards" and "Integrating Indigenous and Scientific Knowledge for Disaster Risk Reduction in Small Island Developing States."

Discussing **early warning systems** and **awareness building on the dangers of GLOF,** respondents argued that EWS plays a key role in reducing the impact of disasters, and cane be extremely effective in reducing the number casualties following cyclones, tsunamis and floods. If EWS are accurate, timely and supply adequate information, including unambiguous warning messages, then people staying in vulnerable areas have a chance to take suitable preventive action. They pointed out comparative examples of hurricanes Katrina (2005) and Rita (2005) in the **United States.** They also shared experience from **Tamilnadu**, **and Himachal Pradesh and Uttarkhand** India where Community and youth helped establishing an Early Warning System**s.**

Countries in the region have made significant advances in setting up **national warning system networks**, communications systems, and government operations and procedures on GLOF early warning, members noted. Some of examples include the installation of detection systems, like the seismic stations and tide gauges set up in **Indonesia**, **Thailand**, and **Sri Lanka**. **Sri Lanka** and the **Maldives** now receive data from detection systems in a timelier manner, enabling quick forecasts after their communication networks were upgraded using Global Telecommunication System (GTS) **Sri Lanka** and **Thailand** established policies and procedures to ensure the rapid and accurate dissemination of tsunami advisories. **Indonesia** and **Sri Lanka** created multiple communication channels (i.e. satellite phones) to disseminate information widely and quickly.

In addition, thousands in **Indonesia**, **Sri Lanka**, **Thailand**, **India**, and the **Maldives** were trained on community preparedness and resilience to minimize their risk in future disasters. Hundreds of technical specialists have also received training on the end-to-end components of tsunami warning systems, and **India** will become the first "Tsunami Watch Provider" for the Indian Ocean in June 2009.

Drawing **lessons from existing cyclone and early warning systems**, members highlighted lead-time, acceptance of risk reduction measures, uncertainties surrounding the occurrence of a disaster, and intensity and ownership and maintenance as some of the major challenges involved with community EWS an preparedness activities. They also raised concerns regarding the selection of technologies used for EWS communication, arguing that technology needs to be locality specific and chosen based on inputs from communities, to ensure a sense of ownership and continued maintenance.

For instance, in **Indonesia** the government made huge investments in EWS technology without consulting the end users - the people living in coastal cities and isolated rural areas. Similarly, in the U.S. state of Hawaii, despite 25 years of tsunami siren drills, the public's recognition of the tsunami siren remains low. Likewise, the 1999 Orissa Super Cyclone in **India** showed that the spatial distribution of risk followed the pattern of economic inequality. The warning systems served the haves and not the have-nots as a better off family has a better decision support system for the cyclone EWS system.

Sharing information on **training and capacity building** initiatives for preparing communities and local administrations, members mentioned several documents, including the "Early Warning Systems: Do's and Don'ts," "El Niño Early Warning for Sustainable Development in Pacific Rim Countries and Islands," and "Heads Up! Early Warning Systems for Climate, Water and Weather." They also noted the United Nation programme "Platform for the Promotion of Early Warning" contains extensive information on EWS. Lastly, the works of FOCUS, that India delivered relief to affected people in **Andhra Pradesh** after the 2004 tsunami and also empowered communities to become disaster resilient.

Respondents also listed several **steps required** when preparing communities and local administrations, such as:
- Forming and training local task forces to disseminate early warning messages and create timely evacuation plans based on existing indigenous knowledge and practices
- Increasing community level awareness on the local risks and the related preparedness and mitigation measures/plans (i.e. emergency response plans, etc.), including school awareness programmes and children led awareness campaigns
- Developing and conducting mock drills of emergency response plans for lake outbursts at the local administrative level
- Conducting exchange visits between communities where lakes have not reached danger levels and communities already affected to increase awareness on the dangers related to GLOFs

Finally, members pointed out that GLOF studies and initiatives have focused primarily on technical measures, with little emphasis placed on community participation or holistic participatory planning. Further, they pointed out that knowledge of EWS and disaster risk is not easily transmitted, unless the knowledge infrastructures supported by information and communication technology are in place.

In conclusion, discussants highlighted the dynamic nature of the risks posed by GLOFs, especially to the due the increasing rate of climate change. Members highlighted the importance of sensitized and well trained communities, the use of early warning systems up to the 'last mile' and the importance of land use planning, again with the full participation and in consultation of the communities living in those areas.

For a comprehensive summary prepared by the Guest Moderators, G. K. Bhat, Krishna Vatsa and Rajeev Issar please click: www.solutionexchange-un.net.in/drm/cr/res03120802.doc.

Comparative Experiences

India

Community Helps Establish an Early Warning System, Tamil Nadu *(from C. John, United Nations Development Programme, Chennai, India)*
In Tsunami affected areas of the state, UNDP piloted an early warning system. They identified vulnerable community members by assessing their vulnerabilities' risk. The communication technology for the system was finalized after consulting with local bodies. CSO and CBOS were identified to implement capacity building programs, and a network of local and government bodies formed to ensure proper functioning of the system. This process is now being looked at for replication. Read more

Youth Help Set up Community Early Warning System, Himachal Pradesh and Uttarkhand *(from Arvind Kumar Sinham, Mountain Forum Himalayas, Himachal Pradesh, India)*
In Himachal Pradesh 200 youths have been trained in contingency planning and research along with search and rescue, emergency health management, EWS and community education for disaster risk reduction. These youths now serve as a resource point in their communities and have developed their own network. Currently there are three centers based in Himachal Pradesh. Read more

Rehabilitation Program Works to Reduce Vulnerabilities, Krishna District, Andhra Pradesh *(from K. Arup Kumar Patro, FOCUS Humanitarian Assistance India, Mumbai)*
Focus Humanitarian Assistance India delivered relief to affected people in Machilipatnam and Nagayalanka mandals after the 2004 tsunami. They delivered food and non-food aid to 11,350 beneficiaries in 13 affected villages, located in the difficult terrain of Krishna river delta. They learnt the affected villages needed more long-term rehabilitation. The project has now expanded to support communities most vulnerable to floods, cyclones and tsunamis . Read more

Indigenous Construction Practices Reintroduced to Mitigate Impact of Earthquakes, Jammu and Kashmir *(from Ilan Kelman, Center for International Climate and Environmental Research Oslo (CICERO), Oslo, Norway)*
This region lies in a high seismic hazard zone, where destructive earthquakes take place at regular intervals. In 2005, the state experienced a 7.6 Mw earthquake, which severally impacted the state. While assessing it was found that the houses where traditional knowledge was applied sustained the shock of the earthquake. As a result, traditional techniques were reintroduced and masons are being trained on these techniques. Read more

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Related Resources

Recommended Documentation

Warning System is About People *(from Kathrine Haynes, RMIT University, Melbourne, Australia)*
Article; by Jonatan Lassa; The Jakarta Post; Indonesia; 27 November
Available at http://www.thejakartapost.com/news/2008/11/27/warning-system-about-people.html
> *Highlights that knowledge of EWS and disaster risk cannot easily be transmitted unless supported by information and communication infrastructure and technology*

The Missing Links In Community Warning Systems *(from Robyn Betts, Research and Strategic Projects, Office of the Emergency Services Commissioner Hume Region, Benalla, Australia)*
Paper; by Robyn Betts; The Office of the Emergency Services Commissioner; Victoria, Australia
Available at http://www.solutionexchange-un.net.bt/docs/res03120801.doc (Doc; Size: 66 KB)
> *Provides information that support the value of employing a bottoms-up approach to developing a community early warning system by engaging with communities*

From [Ilan Kelman](), Center for International Climate and Environmental Research Oslo (CICERO), Oslo, Norway

Early Warning Systems: Do's and Don'ts
Report; by Michael H. Glantz; National Center for Atmospheric Research; Report of Workshop, Shangai, China; October 2003
Available at http://www.riskred.org/fav/glantz2003.pdf (PDF; Size: 1.81 MB)
> *Discusses experiences with hydrological and meteorological hazards and early warning systems designed to alert at-risk people, communities and government*

El Niño Early Warning for Sustainable Development in Pacific Rim Countries and Islands
Report; by Michael H. Glantz; National Center for Atmospheric Research; Report from workshop in Galapagos Island, Ecuador; 25 February 2005
Available at http://www.riskred.org/fav/glantz2004.pdf (PDF; Size: 890.08 KB)
> *Looks at regionalizing early warning systems by geographically focusing on specific climate related phenomena -El Nino*

Heads Up! Early Warning Systems for Climate, Water and Weather
Book; Edited by Michael H. Glantz; Consortium for Capacity Building (CCB); Colorado, USA; 2007
Abstract available at http://ccb.colorado.edu/book_headsup.php
To order contact glantz@ucar.edu
> *Shares experiences and insights identified when educating the media and general public to interpret warnings from EWS and apply them to local needs*

Indigenous Knowledge for Disaster Risk Reduction: Good Practices and Lessons Learned from Experiences in the Asia-Pacific Region
Document; UNISDR, Kyoto Univwersity and Eupropean Union; Bangkok; 2008
Available at http://www.unisdr.org/eng/about_isdr/isdr-publications/19-Indigenous_Knowledge-DRR/Indigenous_Knowledge-DRR.pdf   (PDF; Size: 3 MB)
> *Contains knowledge on 18 indigenous techniques for reducing risks from different types of hazards in various environmental and cultural settings throughout Asia and Pacific*

Resilience of Traditional Societies in Facing Natural Hazards
Article; by Jean-Christophe Gaillard; Laboratoire Territoires, Institute de Geographie Alpine, Grenoble, France; Disaster Prevention and Management, Vol. 16, No. 4; 2007
Available at http://www.riskred.org/fav/gaillard2007.pdf (PDF; Size: 280 KB)
> *Looks at the responses of traditional societies in overcoming the damage caused by the occurrence of natural hazard*

Integrating Indigenous and Scientific Knowledge for Disaster Risk Reduction in Small Island Developing States
Project Document; by Jessica Mercer; Department of Human Geography, Division of Environmental and Life Sciences, Macquarie University, Sydney, Australia
 Available at http://www.islandvulnerability.org/png.html#mercerphd
> *Evaluates disaster risk reduction strategies to identify intrinsic, and extrinsic factors contributing to community vulnerability*

Placing Climate Change within Disaster Risk Reduction
Article; by Kelman Ilan and J. C. Gaillard; CICER, Norway; Disaster Advances, Vol. 1, No. 3; July 2008
Available at http://www.managein.org/disas/Back_Issue/editorial/edit_03_08.html
> *Proposes the framing of climate change research to connect policy more smoothly by placing climate change work within disaster work*

National Calamities (Prevention and Relief) Act, 1958 *(from Arshad Ashraf, Water Resources Research Institute, National Agricultural Research Centre, Islamabad, Pakistan)*
Act; Government of Pakistan; 1958
Available at http://punjablaws.gov.pk/laws/88.html
> *Act for the maintenance and restoration of order in areas affected by natural calamities and for the prevention and control of and relief against natural calamities*

Recommended Organizations and Programmes

United Nations Development Programme (UNDP), India *(from C. John)*
Post Box No. 3059, 55 Lodi Estate, New Delhi, India; Tel: 91-11-46532333; Fax: 91-11-24622712; http://www.undp.org.in/index.php?option=com_content&view=article&id=21&Itemid=257
> *Provides training, expertise and knowledge to help communities prepare for disasters and increase their resilience, including helping to set up EWS*

Mountain Forum Himalayas (MFH), Himachal Pradesh, India *(from Arvind Kumar Sinham)*
Shubham Cottage, 1st Floor, Near Block No.20, BCS Phase-III, New Shimla, Himachal Pradesh 170009; Tel : 91-177-2673439; Fax : 91-177-2673439; http://www.mfhimalayas.org/dm_strategy_papers.aspx
> *Addresses issues of disasters and Vulnerability in the Himalayas through the people's preparedness and advocates for appropriate models of risk reduction measures*

UN International Strategy for Disaster Reduction, Switzerland *(from Kathrine Haynes, RMIT University, Melbourne, Australia)*
International Environment House II, 7-9 Chemin de Balexert, CH 1219 Chatelaine, Geneva 10, Switzerland; Tel: 41-22-917-8908/7; Fax: 41-22-917-8964; http://www.unisdr.org/eng/about_isdr/isdr-mission-objectives-eng.htm
> *Provides information on disaster reduction, developing awareness campaigns and producing articles, journals, and other publications and promotional materials related to disaster reduction*

From Ilan Kelman, Center for International Climate and Environmental Research Oslo (CICERO), Oslo, Norway

Consortium for Capacity Building, University of Colorado, United States
National Center for Atmospheric Research, PO Box 3000 Boulder, CO USA 80307; Tel: 001-303-497-8119; Fax: 001-303-497-8125; http://ccb.colorado.edu/index.php
> *Focuses on enhancing the use and value of climate and climate related disaster information for the betterment of societies and well being individuals*

Platform for the Promotion of Early Warning, Germany
Hermann-Ehlers-Strasse 10 D-53113 Bonn, Germany; Tel: 0049-228-815-0300; Fax: 0049-228-815-0399; http://www.unisdr.org/ppew/ppew-index.htm
> *Helps develop early warning and preparedness systems and advocates for better early warning systems, especially in development assistance policy and programs*

From K. Arup Kumar Patro, FOCUS Humanitarian Assistance India, Mumbai, India

FOCUS International Coordinating Committee (FICC) Secretariat, Canada
Suite 201, 789 Don Mills Road, Don Mills, Ontario, M3C 1T5 Canada; Tel: 1-416-422-0177; Fax: 1-416-422-5032; http://www.akdn.org/focus_disaster.asp
> *Works to decrease a community's vulnerability to natural disasters and prepares them to respond rapidly and effectively to natural disaster, including developing ESWs*

India Meteorological Department, New Delhi, India

Mausam Bhawan, Lodhi Road, New Delhi 110003; http://www.imd.gov.in/
Responsible for issuing predictions, information and warnings regarding Cyclones as well as Tsunamis

Related Consolidated Replies

Mitigating Risk of Glacial Lake Outburst Flooding, from Rajeev Issar and Rahul Pandit, Regional GLOF Risk Reduction Initiative, UNDP's Bureau for Crisis Prevention and Recovery (BCPR), New Delhi (Experiences; Examples). Disaster Management Community, Solution Exchange India and Solution Exchange Bhutan, Issued 31 May 2008
Available at http://www.solutionexchange-un.net.in/drm/cr-public/cr-se-drm-08050801-public.pdf (PDF, Size: 114 KB)
Shares a wide range of research studies on GLOF and information the affects of outburst flooding on communities and listed mitigation measures to reduce impact

GLOF Risk Mitigation - Key Issues, Challenges and Approaches, from G. K. Bhat, TARU, and Krishna Vatsa and Rajeev Issar, UNDP's Bureau for Crisis Prevention and Recovery (BCPR), New Delhi (Discussion). Disaster Management Community, Solution Exchange India and Solution Exchange Bhutan, Issued 27 November 2008
Available at http://www.solutionexchange-un.net.in/drm/cr/cr-se-drm-05110801.pdf (PDF, Size: 114 KB)
Discussed the probability of occurrence of GLOF events in the region and Risk Mitigation measures adapted by various countries for GLOF and the common challenges faced.

Responses in Full

Kathrine Haynes, RMIT University, Melbourne, Australia
Very recent article on the topic in the Jakarta post. Written by Jonatan Lassa http://www.thejakartapost.com/news/2008/11/27/warning-system-about-people.html Warning system is about people Jonatan Lassa, Bonn Opinion.

Can scientists create an Early Warning System (EWS) for the Tsunami Early Warning System (TEWS)? Can an early warning system have an early warning system of its own, alerting the beneficiaries of such things as its failures, effectiveness, efficiency and if there is an absence of system sustainability?
Can scientists and policymakers create a self-reflective and robust EWS which guarantees accuracy, credibility, reliability, timeliness and transformability of information, resulting in a better response?

These are important questions for everyone who has an interest in a disaster risk-reduction policy - but especially in Indonesia.

There have been huge investments during the past three years from both donor countries and the Indonesian national budget in TEWS technology- soon to be officially operating. This paper serves as a constructive criticism regarding the lack of investment in the end users of TEWS - the ordinary people in coastal cities and isolated rural areas.

It is important to note that the people at risk are the raison d'etre of TEWS, i.e., the technology exists for the people. Therefore, a TEWS's emphasis should be on the people and not the technology, despite the importance of technology as a means for achieving human security.

Unfortunately, in many TEWS project settings, technical instruments receive much attention, while efforts to increase a community's disaster risk education and awareness receive less attention - holding only sporadic events such as tsunami drills and these mostly in urban areas.

In Hawaii, tsunami siren drills have been conducted for more than 25 years and a siren description has been available in the phone book for 45 years. Unfortunately, the public's recognition of the tsunami siren still remains low.

In Hilo, Chris Gregg and colleagues showed that of the 462 adult respondents who were aware of the drill, only 14 percent understood its meaning. Of 432 student respondents, only 3 percent understood the meaning.

The adult rate had increased marginally from the 5 percent recorded in the same area 47 years ago. Ten years ago, other research found that when the warning was given, many people went to the beach to watch the wave arrive and simply did not evacuate.

It is important to note that importing instruments from the United States and Japan, for instance, is much easier than importing the enabling conditions and incentive structures that have sustained EWSs in these countries for more than 40 years.

In addition, in selected indicators such as political stability, press freedom, voice and accountability, government effectiveness, and rule of law and regulatory quality, Indonesia's experience is far too low compared with the United States and Japan.

These are the governance and institutional settings that play a central role in a TEWS's sustainability. Even though further scrutiny is needed, sociologically speaking, the establishment of a TEWS should be seen as an exercise of power by the government for the protection of the people.

Government effectiveness determines sustainability of a TEWS. It also reflects the quality of services delivered by Indonesia's state bureaucrats working along the TEWS chains. This power exercise often neglects grassroots concerns and risk priorities.

Furthermore, there are questions about how TEWS officers and scientists sitting in front of high-tech computers with 24/7 connections with satellites can be receptive to grassroots feedback. In their recent paper, Havid*n Rodrmguez and colleagues emphasized the necessity of feedback and accountability in the early warning systems.

They conclude that "the payoffs of increasing technological sophistication and improving lead time may reach a point of diminishing returns in which morbidity will not come down and in fact may increase in the absence of socially based programs to educate the public and facilitate their understanding of tsunami related information."

A case study of the 1999 Orissa Super Cyclone in India showed that the spatial distribution of risk followed the pattern of economic inequality. The warning systems better serve the haves and not the have-nots. This is easy to explain because a better off family has a better decision support system for the cyclone EWS system.

The case of Orissa, India, is a good case study. The cyclone EWS had a longer lead time to save lives but failed. How can Indonesia then guarantee safety with a TEWS, when tsunamis have shorter lead times, to the poorest of the poor in isolated regions, so that they may have access to warning services as well?

The other challenge is the grassroots response to disaster risk knowledge. The UN International Strategy for Disaster Reduction (UNISDR) describes risk knowledge as the first step to a people-centered EWS. However, in a country like Indonesia (an archipelago with 17,000 islands) knowledge of TEWS and disaster risk cannot easily be transmitted unless the knowledge infrastructures supported by information and communication technology are in place.

The writer is PhD Candidate, Research on Disaster Risk Governance, BIGS-DR-ZEF, University of Bonn, Germany.

[Robyn Betts](#), Research and Strategic Projects, Office of the Emergency Services Commissioner Hume Region, Australia

I am attaching an article http://www.solutionexchange-un.net.bt/docs/res03120801.doc (66 KB) which I wrote on early warning systems - This came at a time when I was evaluating the effectiveness of two different types of public warning systems.

Warning systems are one piece of the puzzle of community preparedness and response - People utilize warning messages when they also have a context of knowing, risk perception and planning I enjoy being part of this network - keeps my eyes open

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[Ilan Kelman](#), Center for International Climate and Environmental Research Oslo (CICERO), Norway

Thank you for these useful remarks on warning systems. To add to the information, and to possibly assist in answering some of the questions, Dr. Michael Glantz now at the University of Colorado, USA http://ccb.colorado.edu has provided three warning systems documents that might be of interest:

1. Early Warning Systems: Do's and Don'ts http://www.riskred.org/fav/glantz2003.pdf

2. El Niño Early Warning for Sustainable Development in Pacific Rim Countries and Islands http://www.riskred.org/fav/glantz2004.pdf

3. Heads Up! Early Warning Systems for Climate, Water and Weather http://ccb.colorado.edu/book_headsup.php

The United Nations also has early warning systems information from their Platform for the Promotion of Early Warning http://www.unisdr.org/ppew/ppew-index.htm

I hope that this material might be of use.

[Biswanath Dash](#), National Institute for Disaster Management, India

I have these comments for part 2 of the GLOF e-discussion. Some of the challenges in operating an early warning system for GLOF/Flash Flood are: a) lead time; b) acceptance of risk reduction measures; c) uncertainty surrounding occurrence and intensity; and d) ownership and maintenance. While the first and last (lead time and ownership/maintenance) are typical of other early warning systems, the other two assume special significance in GLOF/Falsh Flood cases.

Firstly, available mitigation choices are often limited and ineffective. Secondly, repeated poor response many times is a consequence of the uncertainty factor. The landslide warning system, particularly those operated at community level, can provide a good example for GLOF and Flash Floods.

I strongly feel that the selection of technology needs to be locality specific. Often one good model looks worthy of replication across regions. There is obviously a risk in such an approach and most importantly, if the community is not sincerely involved in the selection and evaluation of new technology, we can not expect ownership and maintenance over long periods of time.

The lessons drawn from operating cyclone and tsunami warning systems can be included in these respects, notably community participation, evacuation behavior, recognition of local mitigation practices, training strategies etc. However, GLOF/Flash Floods also bring some unique problems e.g. should the selected system be only used for warning communication?

If so, how do we ensure its reliability?

[Ahmed Fahmi](#), United Nations Educational, Scientific and Cultural Organization (UNESCO), New Delhi, India

Thank you for this article which makes a good case for the need to better communicate early warnings to the end users of TEWS, particularly the people of coastal cities and isolated rural areas. I completely agree with these submissions and findings and the need to improve these systems through policies and on ground. After all, DRM is in constant state of development and improvement, countries like USA and Japan where recent disasters have proved the ineffectiveness of certain systems and policies, will de facto reassess their DRM programmes.

However, I feel that the Asian region (particularly south and south-east Asia) have come a long way since the Tsunami of 2004 and other recent disasters in setting up EWS. Taken in context, in the case of Tsunami, one ought to mention that countries across the region have made significant advances to national warning system networks, communications, and government operations and procedures and are now able to disseminate appropriate warnings rapidly to local populations.

Some of the examples include, the installation of detection systems including seismic stations and tide gauges in Indonesia, Thailand, and Sri Lanka. As a result of upgraded communication networks using GTS, Sri Lanka and the Maldives can now receive data from detection systems in a timelier manner so that forecasts can be generated more quickly. Sri Lanka and Thailand have adopted policies and procedures to ensure that tsunami advisories are disseminated rapidly and accurately. Indonesia and Sri Lanka have created multiple communication channels through the use of satellite phones to disseminate information widely and quickly.

Thousands of people in Indonesia, Sri Lanka, Thailand, India, and the Maldives have been trained in community preparedness and resilience to minimize the risk to communities in future disasters and hundreds of technical specialists have received training on the end-to-end component of tsunami warning systems. Moreover, India is to become the first Tsunami Watch Provider for the Indian Ocean as of June this year.

Up until now, the PTWC in Hawaii and the Japanese Meteorological Agency (JMA) in Tokyo have been offering an interim service. They will nevertheless continue to act in an advisory capacity until 2011. In effect, these measures needed to be established first and government policies have reflected that. The priorities now will need to shift towards building a culture of Disaster preparedness and mitigation, a community based one, like that found in Japan, for example, which have traditionally benefited from a culture of disaster mitigation, the EWS build thereafter complemented that culture!

[C. John David](#), United Nations Development Programme, Chennai, India

UNDP, UN Team from Tsunami Recovery and Support Very sincere appreciation to the team for exploring the most crucial aspects of early warning systems and to address one of the significant issues in the area of disaster preparedness.

Very recently we have piloted an early warning system in Tamil Nadu, one of the Tsunami affected states in India. The system, which was developed through a process is considered to be one of the most viable

systems for establishing last mile connectivity and is being seriously pursued for replication. I am sure the sharing of our experiences will contribute to the development of a system for a similar purpose in GLOF-affected locations.

The basic objective of the exercise was last mile connectivity, meaning communicating an imminent hazard to the vulnerable community in Tamil Nadu. There were 4 phases during the execution of the project:

Phase 1 (Identification of the vulnerable villages by assessing the vulnerabilities/risks)
One of the vital information requirements for the establishment of a Last mile connectivity system is the identification of the most vulnerable locations. The locations were identified based on physical/social vulnerabilities. The locations were identified based on either the past disaster-damage data base, experiences of the district authorities or through organizing community based vulnerability mapping (GIS based). A workshop was organized for the NGOs/CBOs on participatory GIS methods to facilitate community based vulnerability mapping.

Phase 2 (Finalization of communication technology by studying various technical options)
In consultation with the State/District administration, UNDP identified communication technology that is viable for EWS. This was done through consultation meetings with Government/Community/Technical stakeholders. A range of technologies suitable for Early Warning Systems was studied and demonstrated (see attached). Wireless radio based communication technology was found to be the most suitable technology and hence the same was field tested in 5 villages in one of the most vulnerable villages of a district. On proof of the technology functionality, the necessary equipment was procured and installed in the vulnerable villages of the State.

Phase 3 (Building of capacities of the stakeholders to receive and respond to alerts/ warnings/ disaster related communication)
UNDP identified one or more civil society organizations/ community based organizations to implement capacity building programmes in vulnerable villages, where the EWS is set-up. The programmes enable community members to get acquainted to the Early Warning Systems, set up in their village and also get trained on the response (to early warnings) strategies. Capacity building programmes included awareness generation on risks and vulnerabilities, significance and application of early warning systems, response (to early warnings) strategies, monitoring and maintenance of the EWS equipment and the essentials of the EWS network and its functions.

Phase 4 (Promoting a structure to sustain the programme)
A network of Non-government organizations, community based organizations, panchayat raj institutions and government departments is being formed to ensure the proper functioning of the system. The network will organize periodical mock drills to ensure functioning of the system and facilitate practice of response strategies by the stakeholders.

For more information click http://www.solutionexchange-un.net.in/drm/cr/res03120801.pdf (Size: 754 KB).

Ilan Kelman, Center for International Climate and Environmental Research Oslo (CICERO), Oslo Norway *(response 2)*

For "Communities' Traditional Coping Mechanisms", some documentation has been started internationally. Three excellent examples are:

1. "Indigenous Knowledge for Disaster Risk Reduction: Good Practices and Lessons Learned from Experiences in the Asia-Pacific Region". A United Nations book, with the full text freely available at

http://www.unisdr.org/eng/about_isdr/isdr-publications/19-Indigenous_Knowledge-DRR/Indigenous_Knowledge-DRR.pdf (3 MB in PDF).

2. Gaillard, J.-C. 2007. "Resilience of Traditional Societies in Facing Natural Hazards". Disaster Prevention and Management, vol. 16, no. 4, pp. 522-544. Full text freely available at http://www.riskred.org/fav/gaillard2007.pdf (280 KB in PDF)

3. Jessica Mercer's work in Papua New Guinea http://www.islandvulnerability.org/png.html#mercerphd

But there is so much more that could be learned from communities, let's continue to document, share, and implement what the people know already.

I would also like to take this opportunity to fully support Jack D. Ives words. One way to avoid the pitfalls that the identifies is proposed at "Placing Climate Change within Disaster Risk Reduction" http://www.managein.org/disas/Back_Issue/editorial/edit_03_08.html

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Usman Qazi, Crisis Prevention and Recovery Unit, United Nations Development Programme (UNDP), Pakistan

I would like to share an observation regarding this year's flash flood in Peshawer valley, North Western Pakistan. The monsoon rains were at their five years' surge level and the torrent had accommodated similar flows in the past. This year however, the river burst its banks and inundated large populated and agricultural area. One of the reasons is the improper land use systems in the basin area. Recently, the Peshawer Development Authority "developed" the land in the basin area for a housing colony. In the process, the riverbed was encroached upon by the developers and on one place, the bridge laid upon the torrent had narrow holes as water chutes.

When the flood came, the chutes were immediately clogged because of the debris and silt flowing with floodwater and soon the river broke its banks, causing wide devastation. I guess that all the "development" and land use planning in area likely to receive flash floods or GLOF should keep in mind the nature and quantity of floodwater.

Arvind Kumar Sinham, Mountain Forum Himalayas, Himachal Pradesh, India

Community preparedness is the key to any risk reduction process. Himalayas are very fragile, scattered, inaccessible and remote in terms of communication, transportation, establishment of support system and knowledge sharing with the community. Any disaster response during, pre and post is not very successful, unless it is supported and organized by the first responders.

First responders or communities have the huge capacity to cope with the situation, which is very part and parcel of their life. Challenges lies in organizing, policing and adding the innovation in these capacity from the professional institutions. Living in the higher Himalayas is itself a big challenge, it put the population in vulnerable condition due to difficult terrains, and unplanned development processes in the Himalayan state for harnessing the potential resources in the name of development.

There are few challenges in the preparing the community for the process of risk reduction at local level and apex level.
1. Preparedness is very much in built in their day to day work, it lack the professional approach during the time of response, because community is not able to put the priority and integration in the approach.

2. Community coping mechanism is always lack the value addition from the professional organizations, because it is developed in the laboratory and most of the time does not relate to the local practices.
3. Priority in preparedness does not exist at community level, as disaster is understood as the vagary of nature and it has to happen.
4. Community has never mapped their resources to function in inclusive manner.
5. It is understood as a state role to save us from any kind of calamity.
6. Early warning system is much localized and it does not cater to larger community to come together in shortest possible time to work.
7. Regular practices does not take place for the any community coping mechanism at community level for the skill transfer and better performance at the time of actual need.

Approaches in community preparedness for the natural calamity in the Himalayan state
Community preparedness is very scientific and professional approach for reduction of long term vulnerability, which includes the knowledge base from the community itself and adds the value from the professional knowledge and understanding from the any professional institution to make it very inclusive and people friendly.

Document the learning from the local practices and use this learning in the organized set-up to make the community realized about the importance of this knowledge with the suitable examples from their own field.

Prepare the youth from the community itself through the specialized trainings in search & rescue, shelter management, early warning systems, skill for the development of their own village contingency plan, Emergency health management and damage assessment. These specialized trainings help the community to relate it with their own day-to-day practices for the normal life.

Youth are the potential carrier of the new learning and approaches for the community and themselves, use of this potential could help in the development of new resource base for the transfer of learning in the action during the calamity as well development of large number of youth as brigade of disaster youth volunteers at community level.

Provide the space for recognition of their good work through putting their details on the website, different state government department offices and liaison them with the state task force of disaster risk reduction.

Institutionalized the learning through the establishment of the disaster management resource center at community level, it is a good learning institution owned, managed and developed by community. It also provides the space and structure to build the capacity of community. It is a very informal structure and less resource intensive.

It also help in the development of village contingency plan with the participation of different stakeholders at community level, it also provide the space for the regular practice of the plan to be functional during any emergency situation, regular practice of the plan also gives the opportunity for the update the plan with new innovation.

Our own experiences:
Mountain Forum Himalayas (MFH) is a multi stakeholder's platform of different civil society groups in Northern part of Indian Himalayas. It is mandated to address the issues of disasters and Vulnerability in the Himalayas state through the people's preparedness and advocate for the appropriate models of risk reduction measures in terms of earthquakes, landslides, Cloudburst and flash flood. On part of advocating with the government for the appropriate models of risk reduction, we organize workshops, seminars,

debates, conduct researches for the logical debate and appropriate state policy and governance structures in terms of risk reduction.

Community preparedness is a very integral part of our strategy for the risk reduction. We have selected around 200 youths from different walk of life; these youth have been provided the training in contingency planning, search & rescue, Emergency health management, Early warning systems and community education for disaster risk reduction. They have been given the intensive training and these youths are the resource point at the community level to run the disaster resource centers and further skill building to the youth, it is a process of creating a large resource pool from the community to act as a skilled volunteers during any calamity and preparedness work through local dialogues, role play, songs and contingency planning.

These community resource persons are skilled and have developed their own networks for cross sharing of learning and working together. We have established the three disaster management resource center at the community level for organized learning of the community. These centers are fully equipped with the learning and teaching aid. It provides the organized learning and this space is also used for development of learning aids of the basis of available knowledge and value addition from any resource agency.

Our three centers are based in Himachal Pradesh and one in Uttarakhand. We have a Trans Himalayan Disaster resource centers at cold desert area of Himachal Pradesh owned and managed by the community members from the same locality. This is a unique experience for the development of the informal learning institutions and network. These trained youth have several experiences in saving the community in any small and big disasters. They are also helpful in giving the fair opinion about the government programmes, which can help in reduction of vulnerability through structural mitigation processes.

[Eilia Jafar](), International Federation of Red Cross and Red Crescent Societies (IFRC) - Regional Delegation of South Asia, New Delhi, India

The potential extent of glacier disasters makes it necessary to apply modern GIS and remote sensing techniques for the assessment of glacier hazards in high mountains. However there is a bigger reality that such related hazard source areas are mostly situated in remote regions, often difficult to access for physical and/or political reasons. This calls for efforts to increase capacities of the local communities.

The following efforts should be taken up in order to reduce the disaster risks:
- Formation and training of local task forces on dissemination of early warning, and timely evacuation. This could be built on the foundation of existing indigenous knowledge on local EWS in many rural areas.
- Increased community awareness on the risk and related preparedness and mitigation measures. School awareness programmes and children led awareness campaigns.
- Development and practice/ mock drills of emergency response plans for lake outbursts at local administration level and awareness about these plans to the community.
- Exchange visits between community where lakes have not yet reached danger levels and communities already affected could also prove very effective towards realisation of the gravity of the situation.

While the GLOF studies and initiatives so far are more focused on technical measures, I strongly believe that community participation and a holistic participatory planning is critical for successful risk reduction.

[Sushil Gupta](), Risk Management Solutions Internationals, Noida, India

Its an excellent effort to have such a discussion group. Here, I would like to re-emphasize that it is well known that Earthquake triggered GLOFs are difficult to Predict.

However, probabilistic GLOF hazard maps can be developed and using the modern modeling techniques and it is possible to demarcate potentially (high Probability) high hazard GLOF zones and subsequently structural/ non-structural measures can be build - upon on a case by case basis to mitigation the GLOF hazard.

K. Arup Kumar Patro, **FOCUS Humanitarian Assistance India, Mumbai, India**

Greeting from FOCUS Humanitarian Assistance!!!

The EWS is extremely effective in reducing casualties in cases of Cyclones, Tsunami and Floods when accurate, timely and adequate information including unambiguous warning messages are issued to people staying in vulnerable areas to take suitable preventive action so as to save themselves from the effect of natural disasters.

FOCUS is an international group of humanitarian agencies established in Europe, North America and South Asia to complement the provision of emergency relief, principally in the developing world. FOCUS Humanitarian Assistance (FOCUS) in India is part of global disaster management initiatives along with other initiatives in Europe, North America, South and Central Asia. Focus empowers communities to become disaster resilient and better prepared for effective response and recovery in the aftermath of natural or manmade disasters. It aims to reduce loss of life & property and protects community from natural & manmade hazard by building organizational & local capacities through comprehensive risk management strategy of mitigation, preparedness, relief and recovery.

After the 2005 tsunami, Focus Humanitarian Assistance India delivered immediate relief to affected people in Machilipatnam and Nagayalanka mandals of Krishna district, Andhra Pradesh. Food and non-food aid was distributed to 11,350 beneficiaries in 13 affected villages, located in the difficult terrain of Krishna river delta. After relief provision it was felt that the affected villages needed more long-term rehabilitation; thus, the APR2D project was initiated. This project supports the communities most vulnerable to floods, cyclones and tsunamis in Andhra Pradesh to build disaster resilience through CBDRM process, capacity building and infrastructural measures. As part of this multi-input programme, selected community members in each village were formed into Community Emergency Response Teams (CERTs) and trained in early warning, evacuation, first aid, fire fighting, search and rescue and psychosocial care.

15 habitations comprise the program area. These have 4,091 households and a combined population of 14,784 persons. Eight of these habitations are located on an island called Nachugunta (revenue village Edurumandi) surrounded by the River Krishna and the Bay of Bengal. The only mode of reaching these villages is by ferry.

The program was designed to meet four primary objectives,
- Strengthen capacities of communities, local self governments and districts to prepare, mitigate, prevent and respond to hazards (natural and man-made)
- Reduce vulnerability and diminish the threat posed by health and hygiene risks;
- Establish linkages with key stakeholders and the dissemination of knowledge, learning and best practices; and
- Enhance gender equality in the program area.

Key strategies employed to achieve program objectives:
- Enhancing capacities of community and community based institutions for Disaster Management.
- Constructing critical infrastructure to ensure shelter, safety and access to basic amenities at times of disasters.

- Establishing institutional linkages with key stakeholders.
- Improving environmental sanitation through provision of infrastructure and creation of awareness.
- Setting up Early Warning System (EWS) at individual village level and strengthening the EWS of the district emergency unit.
- Providing Emergency Water Purification Systems in each operational beneficiary village;
- Setting up a comprehensive village emergency stockpile (non food item) at every operational village as well as regional stock piles at the Mandal level;

As mentioned above setting up village level early warning systems and link it with mandal and district level government authorities is an important strategy adapted for programme implementation.

Problem Statement –
The Indian Meteorological Department (IMD) of Government of India under Ministry of Science and Technology is responsible for issuing predictions, information and warnings regarding Cyclones as well as Tsunami. IMD has few early warning stations located along the coast which operate on INSAT satellite. However these don't cover all vulnerable population of the state and there is an urgent need to establish an effective EWS which will be useful in either Cyclone or Tsunami disasters.

The EWS is extremely effective in reducing casualties in cases of Cyclones, Tsunami and Floods when accurate, timely and adequate information including unambiguous warning messages are issued to people staying in vulnerable areas to take suitable preventive action so as to save themselves from the effect of natural disasters.

There are few limitations of this early warning situations.
- No direct access to village level from the District level
- Dissemination of message from MRO to village is done by a human messenger, almost without any technology. This is usually a time consuming process and has possibility of human errors.
- There is no scope for communication from village to MRO.
- Less time to prepare at the MRO level as most time is taken in disseminating the information.

Focus initiative in establishing early warning system: Use of technology to link people with government early warning system.

To set-up Early Warning System (EWS) with redundant resources. The system will be based on use of:
- INSTAXX based SMS and Voice Mail delivery system installed at District Emergency Unit and
- VHF network with broadcasting and emergency messages system with its base station at Mandal office

The communication between government authorities and general public staying within vulnerable region will be via:

- SMS and Voice mail messages forwarded from INSTAXX system located at District Emergency Operations Centre (DEOC) and
- VHF linkage from Mandal office

The warning message will be delivered to the village via Public Address (PA) system so that it can be heard by a large population simultaneously. The PA system will be always on but will operate only through a relay to ensure that messages not meant for public consumption are not broadcast by mistake.

The VHF network set-up between Mandal office, village Panchayats and fisherman boats will be useful for EW messages as well as an emergency communication links for fishermen who are in distress on the sea.

In recent cyclone storm developed over west central Bay of Bengal (Khai Muk Cyclone) on 14th Nov 2008 our community received warning from MRO (Revenue Department) before hand. They managed very well all components of disaster preparedness. But this Khai Muk Cyclone shifted direction and weakened at it approached the coast, and crossed over the Nellore district of AP. Here I am attached here our lessons learnt in the EWS.

Stephen Duah-Yentumi and Thelma Amarquaye, **Environment and Energy Unit, United Nations Development Programme (UNDP), Ghana**

Farming in the northern parts of Ghana which is prone to the effects of seasonal floods shows considerable adaptation to the spatially and temporary variable agro-ecological conditions. Results from UNDP supported sustainable land management project have revealed that serious challenges remain on how to promote appropriate affordable technologies to sustain production, and therefore effective support to land use planning should consider the following interventions:

- Review the structure and functions of existing land management Agencies
- Inventory characterisation, reclamation and monitoring of degraded lands
- Assisting communities to produce resource management plans
- Sustained promotion of the use of simple agronomic soil and water conservation measures (eg, agro-forestry, crop rotation, mulching, improved fallow etc)
- Promote the central role of traditional rulers, landlords in mobilising communities for integrated land and water management activities

The Ghana experience also shows that improving women's access to land is vital in any sustained land management policies. This is because women supply 80% of the labour in harvesting, storing, processing and marketing of agricultural produce.   It is critical to note that women's insecure land
- Limits the types of crops they can grow
- Restricts their access to credit from formal source
- Discourages their interest in land conservation
- Encourages low productivity and aggravation of food insecurity.

Himanshu, **World Health Organization (WHO) India Office, Orissa, India**

Glaciers and glacial lakes are the sources of headwaters of many large rivers in areas such as Hinu Kush Himalayan regions of Nepal, India, Pakistan, Bhutan and China (Tibet). A unique risk in mountainous areas is Glacial Lake Outburst Floods (GLOFs). GLOFs have caused catastrophic downstream flooding and serious damage to life, property, forests, farms and infrastructure.

The vulnerability of human health to climate change is a function of sensitivity, which includes the extent to which health or the natural or social systems are sensitive to changes in weather and climate and the characteristics of the population (such as the level of development and its demographic structure).

Many different factors work together to produce an impact on human health. Such an impact will be greater in mountain areas, where people are more vulnerable, isolated and lack of access to many public services that people in lowlands often take for granted.

During and after a flash flood or GLOF strikes there are a number of factors that affect human health. The hazards themselves may cause several physical injuries and mortalities to people. Vulnerable groups such as the economically and socially weaker section of community, namely women, children, the elderly and disabled are often hit the hardest. Moreover in the Himalayas the majority of the population still lives in rural areas where distances to hospitals may be considerable, thereby aggravating the results of the physical damage to humans during floods.

GLOFs / flash floods impact on mountain population's health by creating favorable conditions for disease vectors. Expansion of insect and rodent borne diseases like malaria, dengue, kala-azar, increased incidence of water borne diseases like diarrhoea, and malnutrition are major public health threats to communities in mountain areas during and after flash floods and GLOFs.

Expansion of insect and rodent diseases: Many vector-borne diseases are sensitive to ambient temperature and precipitation. Studies estimate that the majority of malaria spread in the future is projected to occur at the edge of the current geographical distribution where climate affects transmission occurance. Other vector borne diseases in mountain regions include bartonellosis and tick born encephalitis.

Increased water related diseases: Diarrheal diseases are one of the major causes of morbidity and mortality. In mountain regions, the quantity, variability, and timing of runoff from snowmelt and glaciers can directly or indirectly affect the incidence and prevalence of water related diseases. In mountain regions water related infectious diseases can be transmitted through water supplies (water borne), lack of water (whether clean or contaminated) for personal hygiene (water washed), and through aquatic inveribrate host and insects that depend on water.

Malnutrition results from a disturbance in food production or distribution but also from loss of agricultural land due to flash floods.

Apart from government intervention, community based approaches in preparedness and mitigation are vital to address public health issues caused by GLOFs. When village health plans are prepared by the community, the vulnerability of the village to disasters, health needs of people and community level preparedness measures to reduce the impact on health should be included in the plan. In places where disaster management plans exist, they should be updated or used as a base for developing Village Health Plans.

Effectively targeting prevention or adaptation strategies requires understanding which demographic or geographical sub populations may be most at risk and when that risk is likely to increase. Thus individual community, regional, and geographical factors determine vulnerability. At the community level the following adaptive activities can be initiated in response to health preparedness and mitigation against GLOFs.
1. Hazard mapping of the areas
2. List the vulnerable populations like children, pregnant women, elderly people, disabled etc
3. Resource mapping in the locality
4. Mapping the safe Infrastructure for shelter/ drug storage and distribution centres / NGO/ CBO health facilities/ Anganwadi centres which could be used during disaster situations
5. Impart continuous health education programmes to the community
6. Regular campaign to clear mosquito breeding sites and the control of vector borne diseases in new regions
7. Monitor air and drinking water quality locally
8. Protection of water treatment plants to ensure current and increase future safe drinking water supplies
9. Develop proper waste disposal methods and solid waste management practices
10. Strengthening disease surveillance at community level
11. Establish early warning systems at community level
12. Impart information on treatment of diarrhoea, minor ailments, sanitation and hygiene
13. Strengthen health infrastructure and plan for alternatives
14. Prepare a roster of trained health personnel in the areas
15. Identify, sensitize and train volunteers who could assist in disasters
16. Raise community awareness on preventive measures and health impacts of disaster

Develop learning resource materials for local communities (particularly for women and children) on the potential impact of climate variability on human health.

Arshad Ashraf, Water Resources Research Institute, National Agricultural Research Centre, Pakistan*

Keeping in view the useful discussion going-on over early warning and land-use planning for GLOF risk mitigation, I want to discuss this important area in the context of the Northern Areas of Pakistan. The impact of GLOFs makes us realize the need and importance of awareness and mitigation strategies. The communities living within the high mountains of the Northern Areas conceive well the changing behaviour of the climate/surrounding environment and their consequences, as they are in direct contact with nature. In these areas, rainfall and snow fall are the common phenomena that trigger hazards like landslides, rockfall, mud and debris flows, GLOFs and flash floods.

In the Northern Areas, early warning of GLOF hazards can be made effective through better identification of potential GLOF sites, proper monitoring and effective communication to warn target communities. Locally, the people are used to certain signs and techniques for disseminating hazard warnings like creating loud sounds, firing, smoke and lighting etc.

Most of the early warnings from the main meteorology department are related to heavy precipitation in different parts of the northern mountain region, which is usually interpreted as a warning of flash floods and often ignored in areas lacking communication facilities. Hence,
- Detail hazard assessment is required especially in mountain areas containing valley glaciers influenced by changing climatic conditions
- Flood routing should be identified and hazard prone communities should be informed/warned about the potential GLOF hazard
- Proper communication facilities should be provided to the target communities
- EWS should be established with the involvement of local people, especially the notables and religious people who have influence in the communities. Indigenous techniques should also be adopted or improved based on induction of new knowledge and techniques
- Flood warnings should be made in the local language well in time by the local government, also mentioning the safer places to evacuate to and coping mechanisms to adopt

The livelihoods of most of the communities in the Northern Areas is agriculture-based. The agriculture land use is developed according to the availability of glacial melt water. The GLOF situation mostly affects the water supply channels locally called 'cools' that are the main source of irrigation and domestic supplies for the local communities. Within a minimum land resource, the maximum area is utilized for agriculture land use. In such circumstances and with climate change induced glacial hazards, there is a need to develop safe areas with optimum resource-use planning and management. After carrying out detailed hazard zonation of target regions, the identification of such areas should be undertaken with the help of remote sensing and Geographic Information System (GIS) techniques coupled with ground information.

Barkat Ali, **Network: Pamirtimes, Pakistan***

I feel unfortunate that I missed the earlier phases of the e-discussion. Once again this is a great initiative from your side, which will really bring field experience and need-based suggestions for further planning and policymaking.

Early warning systems play a key role in reducing the impacts of any disaster. They help communities to protect their lives and move possessions to a safe place. We have very practical examples about the role of EWS locally and internationally. The comparative impacts of hurricane Katrina and Rita exemplify how

effectively this EWS works. Likewise, we have a couple of examples of early warning here like in Damas District Ghizer, where people who were living in upper areas timely informed the people who were settled in lower catchments. As this flood took a couple of hours to reach downstream, the resulting losses were significantly reduced.

Similarly, few of the community members of Passu and Gulkin had witnessed GLOFs at their starting points with different warning signs, but again it depends upon the seriousness of those individuals who observe these things in informing the concerned community. In this regard, sensitization and awareness programs are essential. Some of the major challenges regarding the EWS are the passages of these GLOFs and the time it takes while reaching the settled area. In this regard, village level disaster risk management planning is indispensable. On the basis of this exercise a management plan for each village should be available which will provide guidelines and strategies for pre and post disaster activities.

As far as local administration is concerned, there is a need to have representatives on board this process because we haven't seen any active involvement of local administration in any incidents that happened in the past. There is a need to make the community disaster resilient while building their capacities, raising their awareness and providing necessary equipment so that they can use the available resources in pre- and post disaster scenarios.

Land use planning would ultimately be an integral part of any village level DRM Plan, but to make it most effective it would require technical expertise from professionals. No land use planning practices are performed or followed by the local communities. We usually construct our houses, hotels etc at the snouts of glaciers calling them breeze points, which are actually life threatening points which we rarely notice due to a lack of awareness and ignorance. This is not only the case within the risk prone areas, it also happens everywhere in the NAs where people construct there houses in the middle of their agricultural fields. So there is need of proper guidance through seminars, workshops and campaigns to make communities aware by telling them how there lives are important and how their land should be used. There should be proper surveys and studies on existing threats and the potential impact of any natural disaster, particularly GLOFs, so that based on facts and findings, resettlement or land use planning decisions will be made.

In summary, I would say that there must be EWSs, which are community based and apply both traditional methods with sophisticated technological systems, along with the necessary capacity building in each village.

Ahmad Khan, Network: Pamirtimes, Pakistan*

Community approaches is an important part of the GLOF risk reduction processes. There are however questions that can be raised and satisfied on land-use and mitigation measures. To enable communities to response and act better, there should be an understanding of the indigenous practices of land-use.

The mountain communities, living in areas prone to disasters, usually know the nature of their land very well and have adapted accordingly. Their settlements would usually be usually located on raised ground, well out of the reach of any glacial effects. They take into account slope, aspect, terrain, and architectural modalities of their buildings. In any interventions, this should be considered and accounted for.

Land use planning, as defined in technical terms, is certainly not a practice in high altitude communities and they rely on external assistance. To provide communities with skills and techniques, assisted action may be required, where a facilitator agency is involved. This assistance should understand indigenous practices of land use and risk mitigation, and provide knowledge, skill and capacity to incorporate exotic techniques that would result in enhanced security of the local communities from GLOF risks. It should,

however ensure that whatever suggestions made to communities are based on reliable experimental and adaptive management best practices.

Mubashir Hussain, Network: Pamirtimes, Pakistan*

Land-use planning aims to make the best use of limited resources. The communities who are at risk should be involved in such a simple way that they should understand which land is available and suitable for which activity. Where are the high risk areas? What activity needs to be stopped or relocated to reduce the risks? A simple community mapping exercise should be conducted using their knowledge and understanding of their own surroundings. They must identify and own the final plan. This is not something highly formal and on-scale accurate planning, but a very simple guideline and sketch map prepared by the community and whatever local institution is available there. Only little and necessary external support should be provided. Afterwards, some community awareness activities should be conducted.

Indigenous mitigation and preparedness measures should be part of the plan. Local institutions (if any), community elders and young volunteer groups should own this planning and should develop very close and strong relationships. External intervention can help to strengthen these relationships. In this way, a sustainable, indigenous solution to reducing risk in GLOF affected communities may be provided.

Ghazala Naeem, Network: Pamirtimes, Pakistan*

First of all it is important to evaluate the target communities' level of GLOF risk perception. This has to do a lot with the understanding and interpretation of the natural phenomenon by all stakeholders i.e. the techno-legal regime and community.

Further, mountain communities have their particular characteristics, capacities and indigenous ways of mitigation. However, there might be a need to develop and modify these indigenous techniques considering communities' adaptability and affordability. It is also important to improve communities' access to information about possible threats and feasible remedial measures.

*Offline Contributions

Many thanks to all who contributed to this query!

If you have further information to share on this topic, please send it to Solution Exchange for the Disaster Management Community in India at se-drm@solutionexchange-un.net.in with the subject heading "Re: [se-drm] Query: GLOF Risk Reduction-Role of Community and Early Warning Systems - Experiences. Additional Reply."

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