



Improving accuracy, timeliness and access to flood early warning

Early warning is a key factor in building flood resilience. Systems that provide early warning messages not only allow communities to prepare and respond to flood events, they can also capture valuable information on the flooding process itself. Learning from flood events is vital to empower communities and local government to prioritise development investments in flood resilience building actions.

Key recommendations

- *Flood Early Warning Systems save lives. For poor and vulnerable people living in flood-prone communities, advance warning of floods can reduce losses, save lives and provide a secure foundation for long-term resilient development.*
- *Rollout of flood early warning must ensure access to information for people who need it the most. SMS-based mass early warning to flood-vulnerable people is low-cost, effective and must be scaled out.*
- *Utility and uptake of flood early warnings will be reinforced by their reliability, accuracy and timeliness. Systems need to provide up-to-date, accurate and understandable hazard information based on an effective combination of local (low-tech) and remote (medium/high-tech) monitoring approaches and must prioritize lead times.*

The need for early warning systems

The lesson learned from the Zurich Flood Resilience Program is that early warning systems (EWS) are vital for communities living at flood risk¹. Effective early warning systems comprise four key components, outlined here, and a deficiency in any of these components will lead to EWS failure.

Risk knowledge

A flood EWS needs to be built on accurate knowledge of local flood hazards. One way to do this is via accurate and understandable flood risk maps. These maps must be kept up to date, especially in a context of changing threat levels (acknowledging that flood profiles change due to climate change, sedimentation, land-use change and the consequence of water management schemes), past floods are not necessarily an accurate guide to future flood risk. Risk knowledge via simple flood risk maps must be accessible to communities and link technical information with traditional knowledge.

Risk monitoring

Flood early warning monitoring systems are most effective when they combine local monitoring with more sophisticated techniques to inform flood threat. A drawback of basic early warning systems (particularly in environments prone to flash floods) is the short lead time for evacuation. Lead times can be extended by incorporating river-level gauge readings with rainfall forecasts (see case study). As risk monitoring becomes more sophisticated, consideration is needed of how to communicate more complex probabilistic information to communities.

Communication and dissemination

Experience indicates that communication across the 'last mile' is critical to ensure messages reach the affected population in time, and they must be in a format they can understand and act upon. Low-tech approaches to dissemination such as the use of sirens, flags, megaphones, FM radio, or by local volunteers, are very effective. Government-supported and nationally coordinated SMS dissemination systems based on telecommunication networks can achieve simultaneous dissemination to large populations at risk (see case study).

Response capability

Response capability is dependent on at-risk communities having the necessary capacities and access to the resources they require for appropriate response. Key to this is preparedness – safe evacuation routes, shelters and regular response drills. In addition, coordination and clear lines of communication with official disaster response agencies are vital.

Cross-cutting elements for effective EWS

- Redundancy – ensure multiple channels so that failure in one does not cause the whole system to fail; for example, combining manual and automatic monitoring.
- Rapidity – ensure that communications are responsive; for example, authorize local leaders to issue warnings based on pre-agreed river levels, not waiting for higher-level authorization.
- Robustness – ensure that construction is appropriate to the hazard; for example, constructing gauges so they are not washed away in extreme flood events.
- Resourcefulness – ensure that the right resources are at the right place and at the right time; for example, using community volunteers as first responders, not waiting for the arrival of emergency services.

Evidence from the field

Practical Action has developed and piloted community-based early warning systems in five river basins in Nepal,² which have evolved from simple, low-tech river monitoring to an approach that is now integrated with the Department of Hydrology and Meteorology's (DHM) system. A post-flood study³ identified a number of challenges relating to access, timeliness and accuracy, and we are now testing two innovations to improve lead times and reach.

First, in conjunction with Lancaster University and the DHM, Practical Action is piloting a low-data probabilistic flood forecasting model that has so far extended early warning from 2 to 7 hours. This system is now being tested across all major river basins in Nepal, potentially delivering EWS to the most vulnerable and hard-to-reach communities.

Second, Practical Action has supported the DHM to pilot early warning via mass SMS in which simultaneous message alerts are sent by telecoms service providers in flood-prone locations to all mobile phones within reach of their masts. Key factors have been buy-in from the government to provide the timing and text for the mass messaging, and the mobile phone service provider agreeing to send messages free of charge.

References

¹Szönyi, M. (2015) *Resilience at the edge of the world*, Zurich Insurance Group.

²Practical Action (2012) *Early warning saves lives*, Practical Action.

³Gurung, G. (2016) *Flood early warning system in practice. Experiences of Nepal*, Practical Action.

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Photo credit: Community-monitored water level gauge at Chisapani, Karnali river, Nepal. Michael Szönyi / Zurich (December 2012).

The Zurich Flood Resilience Program

An increase in severe flooding around the world has focused greater attention on finding practical ways to address flood risk management. In response, Zurich Insurance Group launched a global flood resilience programme in 2013. The programme aims to advance knowledge and develop robust expertise and design strategies that can be implemented to help communities in developed and developing countries strengthen their resilience to flood risk.

<https://zurich.com/en/corporate-responsibility/flood-resilience>