



World Disasters Report

2009

Focus on
early warning,
early action



International Federation
of Red Cross and Red Crescent Societies

A global humanitarian organization

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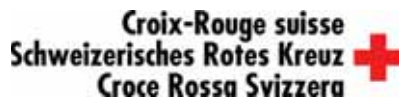
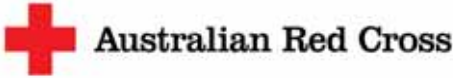
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Cover photo: Louis Jean rings the bells at a church in Cap Haitien, Haiti. Church bells can be rung as a warning that hurricanes or heavy rains are approaching. Around the world, people like Louis Jean are at the heart of people-centred early warning systems. Cutting-edge technologies for forecasting and tracking climate events will not prevent or mitigate disasters without community-based early warning and early action.

The International Federation of Red Cross and Red Crescent Societies would like to express its gratitude to the following for committing to and supporting this publication:



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Early warning and early action: an essential partnership to prevent disasters

In terms of natural hazards and their impact, 2008 was one of the most devastating years. While hazards are largely unavoidable, especially with the growing threat of climate change, they only become disasters when communities' coping mechanisms are exceeded and they are unable to manage their impacts. The world's poorest and most vulnerable people are those most at risk.

This year's *World Disasters Report* focuses on two key aspects of disaster risk reduction: early warning and early action. The decline in injuries, loss of livelihoods and deaths from disasters over the past 30 years is, in part, due to the establishment and improvement of early warning systems. Advances in science and technology, in forecasting techniques and the dissemination of information are major contributors. However, the development of a more people-centred approach is clearly essential to ensure that the warnings captured by satellites, computer modelling and other technologies reach at-risk communities and are then acted upon.

The 2004 tsunami focused the world's attention on early warning systems because no such system was in place in the Indian Ocean. Thousands of lives were lost – although tsunamis are relatively rare events. There are many outstanding examples of early warning systems for more frequent hazards. Two notable ones are those for tropical storms in Bangladesh and Cuba where community-based early warning leads to prompt evacuation and has saved hundreds of thousands of lives.

Mozambique has made great progress in early warning systems, linking them to early action. As this report describes, in 2000 the attention of much of the world's media was focused on flooding in Mozambique and on dramatic rescues there. However, in 2007 and 2008, the country again experienced severe floods but the reported death toll showed a decline, due in part to the effective early warning system that had been established and is linked to early action at community level.

Regrettably, effective early warning systems are still not an integral part of disaster management and risk reduction globally. In the developing world, there is a shortage of equipment, skills and resources and, in developed countries too, a lack of

commitment to build effective early warning systems and insufficient coordination between the many actors.

Early warning systems alone do not prevent hazards turning into disasters. Early action is essential.

Early action is more wide-ranging than emergency response, covering a range of timescales. It may be a matter of responding to the forecast of a flood in a few months' time or a cyclone a few days hence, given the increasing accuracy of seasonal forecasts.

Early action demands a longer-term perspective on addressing risk patterns, using local knowledge and working to reduce people's vulnerability to hazards. Such actions, often involving millions of Red Cross and Red Crescent volunteers, include measures to reduce poverty and the spread of infectious diseases, to legislate for stricter building codes, to strengthen community resilience and to help communities adapt to climate change risks.

However, even with timely early warnings and planned early action, people suffer the disastrous consequences of natural hazards. In Zimbabwe, for example, the government and United Nations agencies issued in March 2008 a warning of rapidly deteriorating food insecurity; a poor harvest in 2007 was one of several reasons. An urgent international appeal was made and thousands of Red Cross volunteers, in partnership with the World Food Programme, began to distribute food across the country in October. Yet again, political and other factors, plus the appalling economic situation, hindered the work of the humanitarian community. Despite early warning and attempts at early action, the majority of Zimbabweans face another year of chronic food shortage.

Early action is an investment for the future and far more effective in the long run than responding to an emergency. But this seems to be a lesson that individuals, donors, countries and some of the 'humanitarian community' have yet to learn. There is still too much resistance to change – even though increasing evidence reveals that one US dollar spent on prevention saves four dollars on emergency response. Why not set ourselves bold targets, such as allocating at least 20 per cent of emergency response resources for disaster risk reduction?

Early warning and early action together can save thousands of lives and livelihoods, reduce vulnerability and strengthen resilience. Strengthening communities' capacities to prevent and/or cope with the impact of hazards is a concrete way to prevent disasters from retarding the development of the poorest countries. Here, the Red Cross Red Crescent has been active for many years – in addition to its work in emergency response – in supporting communities to reduce vulnerability and increase resilience to hazards. In so doing, our work is aligned with, and is contributing to,

national and international strategic directions and priorities, including the Hyogo Framework for Action and the Millennium Development Goals.

At a time of financial fragility around the world, coupled with the growing challenges and 'surprises' of climate change, we must scale up our prevention activities as the most effective way to save lives and livelihoods and to safeguard development.

Early warning and early action offer concrete ways for doing so, locally and globally.

A handwritten signature in black ink, consisting of a large, stylized 'G' followed by a series of loops and a long, sweeping tail.

Bekele Geleta
Secretary general

CHAPTER 1



Early warning and early action – an introduction

At the dawn of the 21st century, the devastation and human tragedy wrought by natural hazards once again occupied global headlines. For a few days in February 2000, the international media focused its cameras on Mozambique, with heart-wrenching pictures of helicopters plucking families from rooftops and the miraculous story of baby Rosita, born in a tree. Although the death toll from the Mozambique floods was not large compared with other recent disasters, the press coverage was intense and dramatic rescue footage was captured and broadcast around the world (Christie and Hanlon, 2001).

History seemed ready to repeat itself in 2007 and in 2008, when serious floods again hit Mozambique. Yet the 2007 and 2008 floods hardly registered with the global media; there were no dramatic helicopter rescues and the final death toll was less than 30 in 2007 and six in 2008 (EM-DAT).

Did something change between 2000 and 2008 in Mozambique? The answer is clearly “yes”. Mozambique has made excellent progress in linking early warning with early action – the focus of this year’s *World Disasters Report*. Instead of waiting for the floods to trap people in trees and necessitate dramatic and expensive helicopter rescues, the authorities have put systems in place to ensure action is taken before the flood or cyclone becomes a major disaster. The improvements lie mostly with the advent of community-centred early warning systems (EWS); they have linked global and national capacity to provide timely warnings of floods and cyclones with early action taken by the at-risk communities themselves. Most importantly, many Mozambican communities now have the skills and knowledge to protect themselves when they are warned of an impending disaster (International Federation, 2007).

Is the Mozambique experience transferable to other potential hazards in other countries? The answer is a qualified “yes”. Aspects of community-centred EWS can be applied in other contexts, but it is equally clear that there is no ‘one size fits all’ early warning system for all hazards in all countries. A number of other countries have excellent flood and cyclone EWS – such as Bangladesh and Cuba – yet each system differs significantly from others. Chapter 2 of this report explores community-centred early warning in more detail, highlighting the need for locally based solutions.

Can further improvements be made to well-functioning flood and cyclone early warning systems such as Mozambique’s? While many Mozambican communities now receive warnings and have the capacity to evacuate before a major flood, or take shelter before a cyclone instead of waiting to be rescued after the event, even earlier action is

Photo opposite page:
In China, Wang Huai Min sits on a makeshift raft that he uses to visit his submerged house. He had no time to salvage any of his belongings and now lives on a dyke with his family of six.

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needed. Poorly constructed houses are still destroyed, livelihoods are set back as crops and livestock are lost, the incidence of malaria and other diseases increases after flood events. Early action means reducing vulnerability through risk reduction activities, such as improving building codes and better land-use planning, enhancing rural banking systems so savings are kept in banks rather than in the form of goods and livestock, clearing drainage canals, stockpiling medicines and mosquito nets. Chapter 3 examines ways to bridge timescales and promote early action.

Finally, does the Mozambique experience mean that early warning systems have evolved sufficiently to avoid massive casualties from natural hazards? Unfortunately, the answer to this question is a categorical “no”, as demonstrated by the 138,000 deaths in 2008 from Cyclone Nargis in Myanmar. Cyclone Nargis was a highly unusual event, affecting a part of Myanmar unaccustomed to cyclones. Myanmar, like Mozambique, faces a multitude of hydro-meteorological risks and these are likely to grow more extreme given the realities of global climate change. (In addition to anomalies provoked by climate change, extreme natural events like earthquakes will continue to occur with little or no warning.) Highly unusual events will increase, cyclones and floods will suddenly affect new areas, more regions will experience extreme heat or cold. Chapter 4 examines how global climate change offers challenges and opportunities to early warning systems and for early action.

The fundamental goal of early warning is early and balanced action. Any actions taken before a disaster strikes – whether a few minutes before the event (moving to higher ground during a storm) or a few months beforehand (preparing contingency plans, building stockpiles) or years before (planting trees on hillsides, strengthening building codes) – can help prepare for, mitigate or prevent the hazard from becoming a disaster.

This chapter will examine the progress and success in efforts to develop early warning systems over recent decades, as well as highlighting some of the many remaining challenges at the global, regional and national levels. It will trace the evolution in EWS and describe current thinking about the most effective ways that early warning can lead to earlier action.

The evolution in early warning

As the death toll from Cyclone Nargis in Myanmar in 2008 rose above 130,000, people repeated the same questions that were asked after the Indian Ocean tsunami claimed 250,000 lives in 2004. Why were no systems in place to alert coastal residents of the incoming threats? Could nothing have prevented the loss of so many lives?

Global attention caused by these mega-disasters has given additional impetus to the ongoing efforts to improve early warning systems for natural hazards, which had

begun gaining momentum towards the end of the 20th century (see timeline in UNISDR, 2006a). The 1990s were declared the International Decade for Natural Disaster Reduction and the first global early warning conference was held in 1998 in Potsdam (Germany). Early warning practitioners had begun to examine systematically early warning systems to identify their strengths and weaknesses.

Not that the concept of early warning for emergencies is new. It is centuries old. The ancient Chinese used smoke signals from the top of the Great Wall to warn of impending attacks by enemy troops. For hundreds of years, the health sectors in many countries have had warning systems to provide alerts on the outbreak of contagious diseases, and they continue to do so. Modern-day food security practitioners still refer to the sophisticated price monitoring systems established in the Indian Famine Codes in the 1880s, which not only provided early warning but triggered response to potential famines.

Contemporary early warning systems emerged in the 1970s and 1980s, as a response to drought-induced famines in the Sahel. Since droughts, food insecurity and, ultimately, famine evolve very slowly, governments and donors postulated that by tracking certain indicators, such as malnutrition, market prices or rainfall levels, it would be possible to anticipate future food insecurity and intervene before people starved to death. Today, the number of deaths due to drought-induced famine has been reduced dramatically. Early warning systems for food insecurity continue to evolve and improve, although there remains a large gap between warnings and response, especially the capacity and capability to provide longer-term response to address vulnerability and the root causes of risk, as discussed in Chapter 5.

Other hazard-specific early warning systems have emerged, especially in developed countries and especially for frequent hazards. Tornado warning systems are well developed in the United States, for example; many countries have established flood early warning systems for major river basins; cyclone warning systems exist and represent excellent examples of international cooperation. Early warning systems for volcanoes exist in most regions or countries where there are active volcanoes (see Box 1.1). Interestingly, the tsunami early warning system for the Pacific Ocean has been operational for more than 40 years yet such a system was absent in the Indian Ocean in 2004 due to the infrequency of tsunamis in this region.

Early warning is a system, not a technology

The three global early warning conferences (1998, 2003 and 2006) catalysed efforts to examine what was working and what was not working in early warning. The 2005 World Conference on Disaster Reduction in Kobe, Japan followed by the third early warning conference in Bonn, Germany in 2006, led to notable progress in linking early warning to early action and risk reduction. From these processes emerged a

Box 1.1 Early warning systems for volcanoes

Early warning systems for volcanoes have been adopted in many regions where volcanoes are active. They work as a coordination and communication tool between scientists and other stakeholders to help minimize the economic and social impact of volcanic activity. Individual volcano early warning systems (VEWS) vary considerably due to a number of factors including the ability to monitor and forecast volcano hazards, management of volcano observatories and broader social, political and economic issues. The organizations that coordinate VEWS are predominantly the volcano observatory if there is one (it may be part of a local university), emergency managers/civil defence or, in some cases, the local government, but the coordination varies depending upon the country and its disaster management policy. VEWS can operate from the local level of an individual volcano, through to regional, national and international levels (particularly for the aviation sector). The United Nations has provided a number of generic EWS guidelines that some governments may or may not adhere to.

Volcanic activity presents a complex problem for volcanologists and emergency managers; they have to forecast and manage a diverse range of hazards that may occur, sometimes without warning, when volcanoes are active or dormant. Volcanoes can produce a wide range of hazards: from fall processes (ash and ballistics), to flowage processes (pyroclastic flows, surges, lateral blasts, debris flows/lahars, floods and lava flows) and volcanic gases, earthquakes and tsunamis. Approximately 10 per cent of the world's population live in close proximity to one of the 1,511 known active volcanoes, and yet populations living some 100 kilometres away from volcanoes and unaware of volcanic activity can be devastated

by lahars (type of mudflow or landslide composed of pyroclastic material flowing down from a volcano) or ash. Therefore the vulnerability of a population living near a volcano depends heavily on its geographical location, infrastructure, the hazards' characteristics and also weather conditions at the time of activity.

Unlike other hazard types, some volcanic hazard processes can occur very rapidly; for example, pyroclastic flows travel at more than 80 kilometres/hour, rendering the ability to provide a warning futile. Forecasting, therefore, plays an important role in volcano hazard management. Scientists work to identify, map, date and develop a volcano's history and monitor its activity to establish a baseline that can be used to detect abnormal behaviour. VEWS have been developed to provide warnings to populations at risk from volcanic hazards to allow them to seek safety, both locally and regionally. At the very core of VEWS is decision-making, but equally important is the communication, dissemination and understanding of a decision and what it means. This makes VEWS a key interface between scientists, civil authorities, the public and other stakeholders.

Ideally, emergency managers require information relating to: when and where the volcano will erupt; the magnitude, style and duration of the eruption; likely hazards and expected location; and the effect of volcano hazards at the local, regional and global levels. In contrast to other hazard types such as hurricanes or landslides, these questions are difficult to answer due to a number of key aspects (see Table 1).

Therefore managing volcanic crises requires careful consideration and understanding of how to take action in the context of extreme uncertainty, from both scientific and social standpoints. To do this successfully a VEWS should

Table 1 The complexities of volcanic hazard information

- Scientifically**
 - Volcanologists and related scientists are still developing theories to understand the origin, processes and eruptive behaviour of volcanoes and the numerous associated hazards.
 - This makes predicting and forecasting volcanic activity and hazards extremely complicated.
- Socially**
 - Volcano hazards generally occur on a larger time frame than political terms or human generations and therefore are not normally a priority.
 - This generally results in limited funding and resources for monitoring volcanoes and conducting research on their past activity, and limited volcano hazard awareness.
- Institutionally**
 - Increasing levels of bureaucracy and contending stakeholders mean that decisions can be complex and protracted.
 - The wide-ranging impact of volcano hazards tends to involve many institutions and it is difficult to maintain communication both within each institution involved and externally.

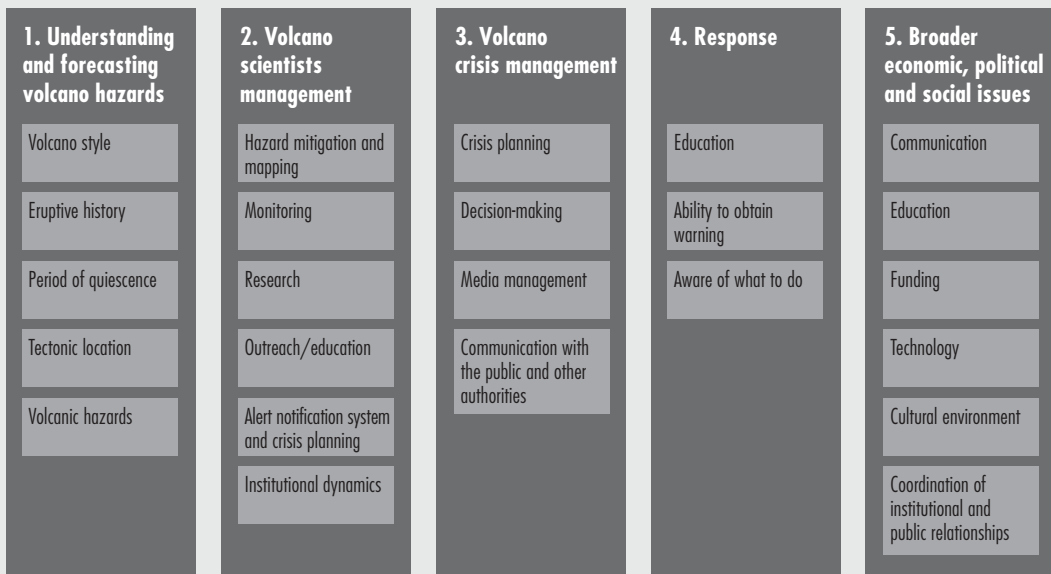
be fully integrated so that it covers everything from monitoring and detection, to analysis and interpretation of the data, to communication and generating an effective response. This requires planning, cooperation, the running of drills, education, and discussion and communication between all stakeholders so that during a crisis effective decisions can be made quickly. The

ability to develop, provide and maintain a successful VEWS is built around five key components listed in Figure 1 (see below).

While the VEWS model may appear to be linear, there is ongoing interaction between the five components and the different knowledge groups within the system. The five components have functions before, during and after a crisis;

Figure 1

A model for a successful volcano early warning system



neglect of any one of these through the cycle may cause a VEWS to fail. What is most unusual about a VEWS is that in any one crisis the dynamics are likely to be unique, and therefore it seems no real 'rule of thumb' can be applied to managing a crisis, only guidelines of best practice.

History has shown that if the management of a volcano crisis is not successful, volcano disasters can cause significant loss of life, socio-economic impact and damage to the environment, thus there is a demand and benefit to mitigating against volcano hazards. Conversely, given the existing advantages of living within a volcanic area (fertile and mineral-rich volcanic soils, geothermal heat, hot springs, tourism and unique scenery), there can be a perception or reality that too much money is being spent on a precautionary approach for a hazard that is unlikely to occur within the population's lifetime. The result is divergent attitudes to risk in different environments. A balance needs to be established, although often there are not enough resources to provide basic monitoring and understanding of many volcanoes to develop a mutual understanding of acceptable risk by the scientists and public.

The lack of such understanding, the failure to comprehend the risks involved and the procedures that manage volcano crises has led to a number of unnecessary disasters. In 1985, the Nevado del Ruiz volcano in Colombia generated a lahar that killed more than 23,000 people (Voight, 1990). Despite the scientists' and authorities' awareness of the hazard, it was human misjudgement, indecision and bureaucratic short-sightedness that led to this disaster. Other examples of historical disasters have been caused by political interference (the 1902 eruption of Mont Pelée that destroyed Saint-Pierre, Martinique killing 30,000 people), miscommunications between scientists and the media (a

conflict in the interpretation of volcanic activity at Guadeloupe during 1976 led to the important lesson of providing one clear and consistent message from scientists to users) (Fiske, 1984) and interactions and relations between scientists and authorities (this generated problems in communicating the risk level of the local population with the government and public at Montserrat in 1995 that are still ongoing) (Aspinall et al., 2002). In Goma (in the eastern part of the Democratic Republic of the Congo), the local Red Cross is actively working with local authorities and the Goma volcano laboratory to disseminate early warning information to local populations. This collaboration started shortly after the eruption of the Nyiragongo volcano in 2002 in which many lives were lost and properties destroyed. A database for volunteers has been set up, and training sessions for volunteers on the prevention of volcano risks organized.

The recognition that volcanologists have a moral obligation to communicate their knowledge effectively for the benefit of society has led to some successful VEWS. In Japan, during Mount Unzen's violent eruptive activity from 1990 to 1995, officials developed a VEWS which resulted in the effective evacuation of 12,000 residents in 1991. Consequently a number of large structures to minimize destruction from lahars by trapping sediment and channelling the flows were developed, which was extremely costly but enabled rehabilitation.

Also in 1991, the eruption of Mount Pinatubo in the Philippines demonstrated the importance of education (Newhall and Punongbayan, 1997). Using a video on *Reducing Volcanic Risk* filmed by the late Maurice and Katia Kraft, the scientists helped the government understand the extent of devastation that Mount Pinatubo could cause, and generated the political will for the safe evacuation of more than 60,000 vulnerable people.

Volcano-related disasters to date imply that the effectiveness of VEWS has been, and continues to be, hindered by institutional weaknesses in procedures and infrastructures, poor

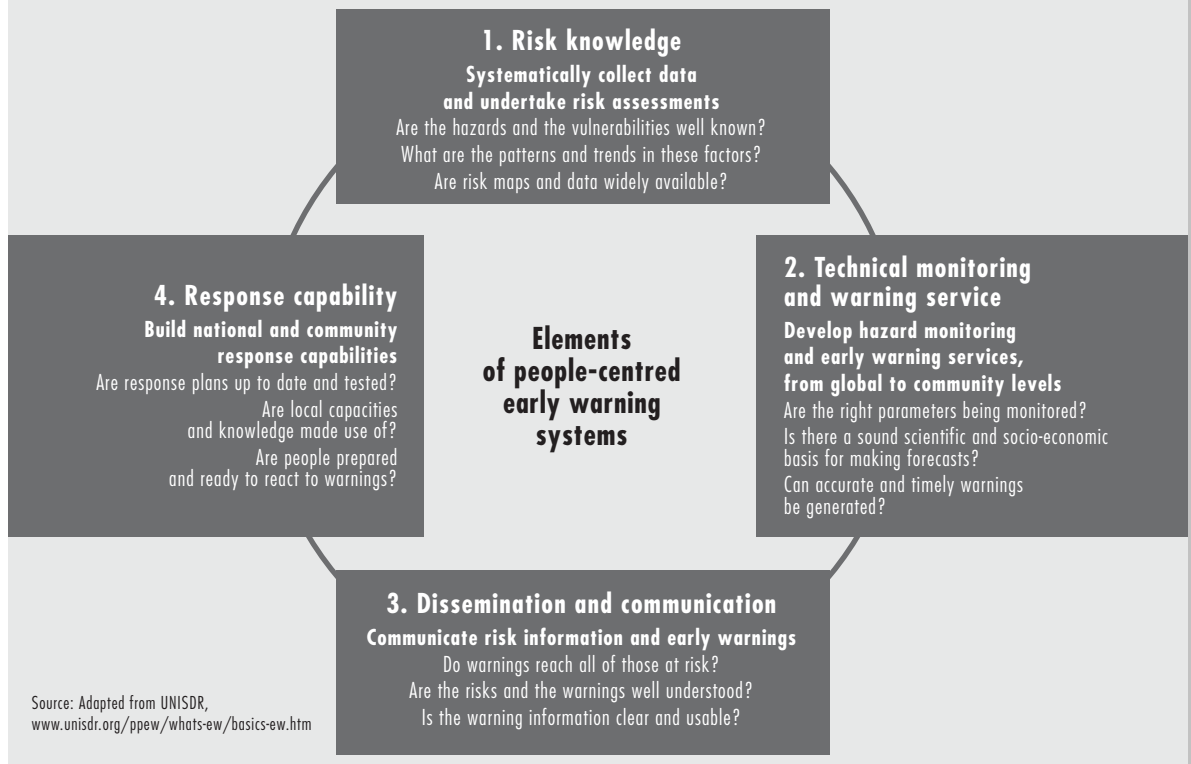
integration and sharing of knowledge between scientists and stakeholders, and effective communication without the scientific understanding or level of warning technology available. ■

new consensus: early warning is not only the production of technically accurate warnings but also a system that requires an understanding of risk and a link between producers and consumers of warning information, with the ultimate goal of triggering action to prevent or mitigate a disaster.

This analysis has broken early warning systems into four separate but interlinked elements as shown in Figure 1.1 below:

- risk knowledge
- technical monitoring and warning service
- dissemination and communication of warnings
- response capability and preparedness to act (by authorities and by those at risk)

Figure 1.1
Elements of early warning



In recent decades, much effort has gone into the second component of early warning systems – developing the technical capacity to detect and produce good warnings. While this component has seen the most obvious improvements, recent disasters clearly show that the production of technically sound warnings can be nearly meaningless if not preceded by an assessment of risk or followed by clear dissemination and appropriate response capacity. As succinctly stated in a report on the Sri Lanka early warning system, “Public warning is a system, not a technology” (LIRNEasia, 2005). Excessive focus on technological solutions without balancing the other components is not only expensive but it can create a false sense of security.

Some effort has gone into building risk knowledge, in terms of both scientific assessment of return periods and frequencies of various disasters, and socio-economic assessment of human vulnerability to various risks. However, much of the effort to build risk knowledge has been based on analysis of historical patterns such as past tracks of cyclones or river levels. Climate change means historical analysis of risk may be a less reliable guide to future risks so renewed efforts must be made to understand ever-changing and less predictable risks (see Chapter 4).

The *Global Survey of Early Warning Systems* (United Nations, 2006) clearly stated the fundamental problem with the current status of early warning: “Failure in any one of these elements can mean failure of the whole early warning system.”

The elements of early warning systems most likely to fail are the last two – dissemination and communications of warning, and response capability and preparedness to act. A people-centred approach is especially essential for these two elements, one that focuses not only on the science and technology behind the warnings, but also on the social and psychological aspects of early warning and early action and on activities to build a culture of prevention, rather than a culture of short-term response (see Chapter 2 for more on the community-based approach).

The devastation caused by Cyclone Nargis in Myanmar in 2008 was not due to a technical failure in the early warning service – warnings were provided by the Myanmar Meteorological Service – but to a failure in the other elements of effective early warning, especially communications and preparedness to act.

However, the Cyclone Nargis case should not be oversimplified but used to illustrate the enormous challenges faced by efforts to create early warning systems. Whether due to climate change or not, Cyclone Nargis was highly unusual. It did not follow ‘normal’ cyclone tracks, but hit from the west and forced water up the Irrawaddy Delta, flooding the vast low-lying delta very quickly. And even if the warnings had reached the delta’s residents, it was such an unusual event that many people would not have believed or been prepared to act on the warnings. Their capacity to evacuate the area would have been severely limited by poor roads and infrastructure. How

Photo opposite page:
A group of Masai women in Kenya listen to radio broadcasts on a Freeplay Lifeline radio. Wind-up and solar-powered radios can ensure disaster warnings reach the last mile – the poorest, most vulnerable and most remote communities.

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can a poor country like Myanmar fully prepare for anomalous events that may not recur for decades or even centuries?

Working towards a multi-hazard approach

One solution to the dilemma highlighted by the Myanmar disaster may be in the adoption of a multi-hazard approach to early warning, especially for relatively infrequent events or for regions vulnerable to many different types of hazards. This approach does not advocate the creation of one ‘mega’ early warning system for all hazards, but it focuses on the logical linkages such as shared observation systems for certain hazards and multi-hazard public education campaigns.

The multi-hazard approach can be adopted at global, regional, national and local levels. The city of Shanghai, for example, has pioneered efforts to establish a multi-hazard approach. One of the most densely populated cities in the world, Shanghai faces unique challenges in providing early warning of hazards to its 17 million residents. The city experiences many natural hazards including typhoons, tornados, strong winds and floods and also faces risks of chemical spills, nuclear accidents and public health emergencies. Building on priorities articulated in the Hyogo Framework for Action, Shanghai has created an integrated multi-hazard early warning system.



This system has integrated a ‘top-down’ approach with unified policies, data collection systems and multi-agency command structures with a ‘bottom-up’ approach that ensures the community is aware of the risks, understands appropriate responses and can channel information upward to emergency response authorities as well as receive information transmitted from authorities (Xu, 2006).

While the Shanghai system relies heavily on GIS (geographic information systems) and other state-of-the-art technologies, less developed mega-cities can learn from its approach. Its grid-based system divides the city into manageable units for preparedness and response.

Another advantage of the multi-hazard approach is that by pooling resources and hazards, the system will be triggered more often. Early warning systems improve only through use and practice. It has been demonstrated repeatedly that the components of preparedness systems erode over time, so it is extremely difficult to maintain EWS for disasters that may occur very infrequently (Burton, Kates and White, 1993; UNISDR and German Committee for Disaster Reduction, 2006).

It is important to emphasize that multi-hazard systems do not replace single hazard systems, especially for frequently occurring hazards. Different technical agencies will be involved (for example, hydrological departments for floods, geological departments for earthquakes, health departments for epidemics), lead times will be very different (hours for floods, weeks for epidemics) and the appropriate response will be unique (evacuate for floods, improve sanitation for epidemics). A multi-hazard approach would not force these processes into one mega-system but would identify logical linkages and data-sharing possibilities, to remove any duplication and ensure synergies.

As the number and magnitude of natural hazards are projected to continue to rise, and the number of people living in areas vulnerable to these hazards increases, it will be impossible to invest in separate early warning systems for each potential hazard, for every area at risk. The cost–benefit of EWS has not been studied comprehensively, especially in developing countries, but it is clear that certain hazards occur very infrequently – including tsunamis in the Indian Ocean. Creating separate early warning systems for each potential hazard would be prohibitively expensive.

Early warning as a global priority

Because hazards do not recognize national boundaries, a global network of organizations supports national and local efforts to provide effective early warning. While many United Nations (UN) agencies, regional bodies and non-governmental organizations contribute to this global network, major roles are played by the World Meteorological Organization (WMO) with its data collection and sharing networks including the Global Observing System, Global Telecommunications System and

global data processing and forecasting system, and the UN International Strategy for Disaster Reduction (UNISDR) which promotes policy, strategic and programmatic work on disaster risk reduction.

Notable single hazard systems include the Japanese government and WMO's efforts to monitor floods globally, with the Global Flood Alert System, under the International Flood Network. The UN's Food and Agriculture Organization leads efforts to track food insecurity through the Global Information and Early Warning System, the World Health Organization (WHO) leads global mechanisms to issue health-sector early warnings and major coordination efforts are under way to improve tsunami warnings for various oceans, under the Intergovernmental Coordination Group operating through the UN's Educational, Scientific and Cultural Organization (UNESCO).

The global tropical cyclone warning system is one of the best examples of international, regional and national collaboration in technical monitoring and warning. The WMO's global operational network enables continuous observation, data exchange and regional forecasting.

Six regional specialized meteorological centres provide forecasts, alerts and bulletins to national meteorological services in all countries at risk with lead times of 24–72 hours. The national services then issue warnings to governments, the media and the general public according to national protocols. Historical risk areas are well established (although historical patterns are becoming a less reliable predictor, as demonstrated in the case of Myanmar) and five regional tropical cyclone committees work continuously to enhance forecasting skills.

Enhancing early warning systems was a key priority of the Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities (HFA), which was the major outcome of the World Conference on Disaster Reduction in Kobe, Japan, in January 2005. The HFA emphasized the importance of preventing loss of lives and livelihoods and reducing potential economic impacts rather than merely reacting to disaster occurrences. It also advocated a multi-hazard approach to improve the effectiveness of risk reduction activities.

The framework marked the beginning of a new era for disaster risk management. Among its five priorities, it called for disaster risk reduction to be made a national and local priority with a strong institutional basis for implementation, and stressed the importance of identifying, assessing and monitoring risks and enhancing early warning.

The HFA articulated the need for governments, regional and international organizations and the development sector to integrate disaster risk reduction into their sustainable policy, planning and programming at all levels. It stressed that early warning systems contribute to the sustainability of development.

Early warning as a national priority

The Hyogo Framework for Action placed the primary responsibility for implementation and follow-up on national governments. Ensuring its citizens' safety is a primary responsibility of government, and national leadership and ownership are keys to effective early warning and early action. Of course, the state must forge partnerships with local leaders, civil society, the private sector, the scientific and academic communities and the media to implement effective early warning systems (see Box 1.2). The state also must ensure regional organizations complement their national efforts to build effective EWS and disaster reduction strategies.

Box 1.2 Technology and volunteers support an early warning system in Jamaica

The Rio Cobre Gorge forms part of the major transportation link between Kingston, the capital of Jamaica, and the north coast of the island, which is the major tourist centre. This is a critical route because tourism is the primary foreign exchange earner for the country. However, the main road through the gorge runs parallel to the Rio Cobre River for several kilometres and is eight metres above the river bed. The river, therefore, floods the road quite frequently. Reports from 1886 indicated that during the passage of a hurricane, the river rose 7.62 metres above the river bed.

Prompted by the frequent flooding of the gorge and the risk posed to commuters and tourists, in the early 1980s the government installed an automatic early warning system. The system is operated jointly by the fire service, the Office of Disaster Preparedness and Emergency Management, the police and the Underground Water Authority (UWA).

It is designed to operate on a real-time basis, i.e., to transmit information on the river's current water levels on a continuous basis to the UWA. Any increase in the flow of the river would be monitored and a warning issued if the water attained a critical level. This transmission of real-time data would enable the relevant authorities to close the gorge and divert

traffic to alternate routes before the area was flooded.

However the problem of commuters being trapped in the gorge by rising waters continued to be a periodic problem, despite the installation and operation of the early warning system. In early November 2008, 150 people had to be rescued by the fire service. This flood highlighted the need for public education with regard to the gorge and intensified efforts to upgrade the warning system.

Although designed to operate automatically using a wide array of rain gauges located within the surrounding watershed, the EWS had experienced operational difficulties in the transmission of data from remote sites. In order to circumvent this problem, a combined manual and automatic system was devised. Under this new system, volunteers in the neighbouring communities were recruited by the UWA and trained to read the river gauges. These volunteers are always ready to move to their assigned location when notified to do so by the authority. Manual readings are carried out and the UWA is contacted once the river has attained a height of six metres. This provides a window of opportunity for the necessary protective measures to be implemented before the road becomes impassable when the river reaches a height of eight metres.

Efforts are also under way to improve the system by incorporating active and passive technological measures. These include the installation of electronic signs and sirens to alert motorists of the road closure, gates to deny access through the gorge once a critical water level has been reached and cameras to monitor the movement of traffic.

At the same time as the upgrading of the system, a public education exercise will explain how the system operates and what actions should be taken once a warning has been issued. Warnings will be issued via radio and TV. The use of text messages via cell phones and the internet is being investigated. ■

The HFA follow-up documents, *Words into Action: A Guide for Implementing the Hyogo Framework* and *Developing Early Warning Systems: A Checklist* (UNISDR, 2007 and 2006b), fully articulate the steps national governments must complete to reduce risk and build resilience. If governments make a fundamental commitment to supporting all elements of early warning systems, they will build appropriate policies, linkages and programmes to reduce risk and enhance sustainable development through building safety and resilience.

Early warning as a local priority

Local-level involvement must start with the first element – building risk knowledge. Hazard assessment and risk mapping can help bridge the gap between scientific and local knowledge. In many societies, people overestimate the risk from low-frequency events and underestimate the risk from smaller yet more common events. While general preparedness for catastrophic low-frequency events should be included in a multi-hazard approach, it is important for people to be able to compare risks from different threats and to build up local databases/baselines to better monitor and measure trends, impacts and cost-effectiveness.

Local knowledge can more effectively be built into the second phase – the technical warning service. In the past, local knowledge about early warning signs has been largely dismissed as unscientific, but it is increasingly clear that such knowledge can complement technical warnings. For example, in Mozambique, downstream communities watch the colour of the river water and the size and type of debris floating down to judge the magnitude of a potential flood. Communities monitor many other warning signs, especially animal behaviour (Howell, 2003). Instead of dismissing this local knowledge, it should be studied and integrated into warning systems as appropriate.

In slow-onset disasters such as drought leading to food insecurity and famine, local knowledge is essential. In hydro-meteorological terms, a serious drought may exist but its potential to result in food insecurity or famine is highly dependent on dynamic local cultural and socio-economic trends. For example, the availability of

wage labour and the functioning of local food markets can allow households to shift resources into the labour market and withstand a severe drought. If cultural mores require wealthier families to employ poorer households in times of drought, the food security effects of a major drought may be minimal. Conversely, the collapse of labour or food markets, or changes in cultural traditions, can result in drought-induced food insecurity.

Local authorities and communities clearly have a major role to play in the communication and dissemination of warnings. Not only can they assist in the actual transmission of the messages, such as volunteers going from house to house or spreading warnings via local radio broadcasts, but they can also feed information back to the warning providers about how they understand the warnings and how they might be made more actionable or comprehensible.

Finally, local actors must be prepared to respond to the warnings. They must feel knowledgeable about the appropriate actions to take for different sorts of warnings. They must believe that by taking the prescribed actions, they will protect their lives or livelihoods. In some situations, authorities may have to force communities to respond, for example mandatory evacuations, but these can breed resentment if not based on prior understanding. Community-based early warning systems are explored further in Chapter 2.

Linking early warning with early action: the challenges remaining

The fundamental goal of early warning is to prevent human, social and economic losses through action taken before, during and after a disaster strikes. Collaboration from the international to the local level, and building on synergies through a multi-hazard approach, can contribute to early action. This section highlights the major challenges remaining in each of the four elements of early warning systems: risk knowledge, technical warning, communication and dissemination, and response capability.

Major challenges in risk knowledge

There has been an increasing focus on risk perception, i.e., understanding disaster risk through risk assessments, risk analysis and risk mapping, but much of this has been traditionally based on a scientific analysis of the historical frequency, return periods and magnitude of hazards, modelling potential impact on critical infrastructure and calculating the number of people potentially affected based on population densities and demographic characteristics. While this scientific analysis is necessary, a thorough understanding of risk requires an additional, people-centred perspective. Although some efforts have been made to assess vulnerability, which is defined by UNISDR as “the conditions determined by physical, social, economic and environ-

mental factors or processes, which increase the susceptibility of a community to the impact of hazards” (UNISDR, 2004), these factors are much more dynamic and difficult to measure than the hazards themselves (see Chapter 2).

Another challenge in acquiring risk knowledge is the very nature of risk. Risk is the interaction between hazard conditions and vulnerability conditions, which means it is an ever-changing process. Climate change and environmental degradation may cause the frequency, intensity and location of hazards to change, while urbanization, poverty, population growth, and disease continuously alter the nature of vulnerability. Risk knowledge should not be seen as a one-time effort to produce expensive and detailed risk maps, but a continual process to understand the evolving nature of both hazards and vulnerabilities.

Lessons can be learned from the health sector, which has grown increasingly sophisticated in understanding risk – not only from a scientific perspective but also from a sociological perspective. The 2002 *World Health Report*, dedicated to the question of risk, stated: “It has been argued that concepts of risk are actually embedded within societies and their cultures, which largely determines how individuals perceive risk and the autonomy they may have to correct them” (WHO, 2002).

People accept a degree of risk, depending on their perspectives. Many people choose to live in flood plains or along riverbanks where the soil is fertile. People choose to build houses along the coast, even when the risk of cyclones is clear. While they face a high risk of floods or cyclones, the fertility of the soil and the convenient or attractive location offers the potential for high returns. Community involvement in risk mapping and risk analysis adds a necessary perspective to scientific understanding. Enhancing vulnerability assessments with understanding of risk perception as well as capacity/coping ability will enhance early warning efforts.

Ultimately, the number of potential risks in the world is limitless. While dramatic mega-events like the Indian Ocean tsunami garner intense international attention, it is necessary to prioritize those risks with the greatest potential negative impact rather than focus on highly dramatic, but very rare, events. The multi-hazard approach can help build systems for less frequent events.

Major challenges in technical warning services

Although technical warning and monitoring have been the main focus of the development of early warning systems, major gaps remain – especially in the poorest countries. While early warning is a national responsibility, many countries still lack the capacity (financial and human resources, organizational, policy) to implement effective multi-hazard EWS. Further gaps exist in drawing in community-level knowledge and data into systems. Community involvement can include collection of ‘hard’ data

such as river levels and rainfall quantities as well as participation in scientific inquiry into the veracity of traditional early warning signals. Some efforts to study indigenous warning signs have been carried out (Howell 2003; RAIPON and UNEP 2006), but much more rigorous scientific analysis is required.

Global efforts spearheaded by the UNISDR system aim to ensure better use of existing monitoring technologies, promote a more multi-hazard approach and enhance inter-agency, regional and international collaboration and sharing. One notable effort is the Global Earth Observation System of Systems initiated by the Group on Earth Observation, which intends to build on existing systems and new initiatives to create timely, accurate and inter-operable data on all aspects of the earth, for use in early warning, risk reduction and other endeavours.

The accuracy of warnings must be improved to avoid false alarms. As new warning systems become operational, there is a risk that false alarms will breed complacency. The 'cry wolf' phenomenon has been demonstrated to be accurate – nearly 50 per cent of respondents said they would be less attentive to future warnings after a predicted earthquake failed to materialize (Atwood and Major, 1998). Some 75 per cent of all tsunami warnings in the Pacific Ocean are false alarms, which makes it very difficult to maintain the credibility of the warning systems (Samarajiva and Waidyanatha, 2007). Given the rise in information and communication technologies (ICT) and the difficulty in ensuring that only one, authoritative voice issues warnings, the risk of false alarms is increasing.

Many technical monitoring systems, whether global or national, continue to have a top-down, scientific bias. Warnings based on remotely sensed data or national modelling can miss important dynamics existing at the local level. A major challenge for all technical warning systems is how to build community-level early warning indicators and indigenous knowledge into the system. Early warning systems for slow-onset disasters such as droughts will not be accurate if they ignore community-level indicators. Even for rapid-onset disasters, local indicators can be important elements of the system if properly understood and integrated (see Chapter 2).

Finally, despite all of the progress made in creating fully operational warning services, gaps still remain. After the 2004 Indian Ocean tsunami, observers pointed out that the Mediterranean region is actually more vulnerable to tsunamis than the Indian Ocean, with 10 per cent of all tsunamis occurring there – yet there is no operational early warning system. With 140 million people living in coastal areas, large numbers of tourists and high population density in parts of the Mediterranean, a major tsunami could have devastating consequences. Efforts are under way to quickly establish the technical portions of a tsunami warning systems, but overall progress has been slow and public outreach has been limited (UNESCO, 2008; Greek Ministry of Foreign Affairs, 2008).

Major challenges in dissemination and communication of warnings

Why do messages fail to reach their intended recipient? In most cases, warnings need to be transmitted from a national (or sometimes international) technical agency through multiple receivers before they reach the vulnerable population. Any message that passes through many hands before reaching the ultimate target runs risks of delay or distortion. In the case of a hydro-meteorological threat, the initial warning may be produced by the meteorological department and passed to the disaster management office. It may then be transmitted to other political structures, or to local disaster management offices or local government structures. In many cases, it may be disseminated via the national broadcast media (radio, TV, newspapers) or local broadcasters. It may be channelled through social structures or community-based networks. While many different combinations of channels can work depending on local conditions, each requires close coordination between all agencies involved and a clear understanding of roles and responsibilities.

Even with well-coordinated structures, dissemination to remote areas is still difficult in many places and requires a combination of technological and non-technological solutions. There is no 'one size fits all' solution. For example, the Bangladesh Red Crescent Society's volunteer networks are equipped with megaphones that are vital to the dissemination of warnings in Bangladesh, but such a system does not work in other communities with smaller populations, lower population density and other cultural barriers. There is a need to focus more on 'last mile communication' to ensure warnings reach the final target – the community or individual threatened by a hazard.

Studies have been carried out in Sri Lanka to evaluate the effectiveness of various ICT approaches, including satellite radio and SMS (short message service) sent via cell phones (LIRNEasia, 2008). Even proponents of SMS-based dissemination view it as complementary to other warning channels due to limited cell phone penetration among the most vulnerable, language limitations with SMS, potential damage to cell phone networks during disasters, network congestion and suchlike. The traditional broadcast media remains the most widely used channel globally to disseminate warnings, but the effectiveness of this channel can be compromised if the most vulnerable populations lack access to TVs or radios (see Box 1.3).

It should be noted that early warning communication flows for certain slow-onset disasters, especially food insecurity or famine as well as some diseases, is reversed. Communities suffering from food insecurity or disease outbreaks normally know about the impending disaster before the authorities. Early warning systems for slow-onset disasters must be locally based and controlled, or at least there must be close coordination between national and local systems, to ensure early detection and early response. While populations may have no idea a cyclone or tsunami is coming their

Box 1.3 Radio reaches the most vulnerable people

In many developing countries, traditional broadcast radio remains the most widely used channel for disseminating disaster warnings. Warning messages that are broadcast on radio can quickly reach isolated rural communities where no other form of communication is available.

However, in the poorest communities, even radio ownership is rare. A radio may often be the first 'luxury' good procured by a household, yet the need to purchase disposable batteries means that regular radio use is expensive.

Wind-up and solar-powered radios eliminate the need for batteries or electricity and can provide the poorest households with reliable access to disaster warnings and other lifesaving information. The Freeplay Lifeline radio is both wind-up and solar-powered, and was specifically engineered for conditions in the developing world; it can withstand dust, water and harsh temperatures. These radios can ensure dependable and free access to information broadcast over AM, FM or shortwave frequencies.

The Mozambique Red Cross Society has integrated Freeplay Lifeline radios into its cyclone and flood early warning activities (International Federation, 2007), and the radios have been credited with dramatically improving the country's ability to prevent a repeat of the devastation caused by the 2000 flood and cyclone disaster. A disaster preparedness volunteer is charged with guarding the radio on behalf of the community and listening to broadcasts. When a warning is sounded, the activist alerts village leaders and a pre-planned response is launched. Freeplay Lifeline radios have also been used in Red Cross hurricane preparedness activities in Haiti, as well as in efforts to bring weather information to communities via radio and internet technology through RANET projects in Niger, Kenya, Uganda and other countries.

For 'last mile' warnings to truly reach the poorest and most vulnerable parts of the world, maximizing the use of readily available, low-cost, low-tech solutions such as broadcast radio is essential. ■

way, they know when crops have failed and children show signs of malnutrition or disease, so they must have a significant voice in the early warning systems.

Other reasons for the failure of dissemination and communication of warnings include:

- *Tourism.* While permanent residents can be educated about risks and know where to listen for warnings, visitors are highly vulnerable. Many places with a high number of seasonal visitors, such as in the hurricane-prone Caribbean, tsunami-threatened Mediterranean or many earthquake zones, pose special problems for the dissemination and communication of warnings (see Box 1.4).
- *Trust.* If there has been a breakdown in trust of the messengers, communication can fail. In areas of civil strife, residents may lack trust in authorities or the media. Civil and religious organizations can be vital actors in these cases.
- *Multiple voices.* Ideally, warnings would be transmitted by a single authoritative voice, but realistically, this does not always happen and cannot be controlled. Advances in ICT and the widespread access to the global media means a break-

Box 1.4 Peace of mind for a tourist paradise

In the Maldives, located in the Indian Ocean south of India, some 300,000 people live on 200 of the 1,200 small islands which make up the country. The densely populated capital Malé is home to one-third of the population. This atoll nation is the wealthiest in the region with a gross domestic product (GDP) per capita of US\$ 2,992 and more mobile phone connections than people (Maldives Government, 2008).

Tourism is the single most important industry, contributing around 27 per cent of GDP. Some 92 of the uninhabited islands have been converted to resorts that attract upmarket tourists, whose numbers amount to more than one-fifth of the country's population during the peak winter season. According to the Asian Development Bank, the Maldives was among the countries worst affected by the 2004 Indian Ocean tsunami. Loss of life was small, but about one-third of the population was affected and property damage was estimated at around 60 per cent of GDP (Asian Development Bank, 2006). Ensuring public safety and giving visitors a sense of security are thus high priorities for the government.

The highly dispersed population (it takes 48 hours to go from one end of the Maldives to the other by boat) is one reason why radio and television are less than ideal for public warning. Tourists are unlikely to listen to national channels, and radio and TV sets have to be switched on for warnings to be communicated. Complete mobile coverage of inhabited and resort islands, the near ubiquity of handsets among both citizens and guests, and their ability to sound alerts point to mobiles as an attractive option for early warning.

SMS and cell broadcasts (CB) are two options for public warning via mobiles. The former is better known but is unsuited for public warning (see Table 1).

A recent United States Federal Communications Commission Order on public warning via mobiles found SMS to be unsuitable and indicated that operators should instead use the point-to-multipoint capabilities of networks. CB is the only viable method at the present time. Since handsets incapable of delivering public warnings will have to carry notifications, this has turned the tide among manufacturers and operators in favour of CB.

In consequence, the Telecommunications Authority of the Maldives (TAM) requested LIRNEasia, a regional telecom policy and regulation think tank with expertise in disaster early warning, to identify the preconditions necessary for the use of CB for early warning and to evaluate its potential for commercial applications. The biggest barrier was found to be lack of knowledge. In the tiny but intensely competitive Maldives telecom industry, the operators, each with a customer base less than that of a small city elsewhere, focus almost exclusively on marketing. However, upon learning of the existence of over 66,000 logical CB channels, they quickly realized CB's potential – not only for public warning but for numerous commercial and other applications.

Obviously, the efficacy of a public warning technology rests on the speed and accuracy of warnings and orders issued by government on one side and the readiness to take appropriate action by the populace on the other. Tourist resorts are organized communities with structures for decision-making and taking action. With periodic training and refresher courses, they can be prepared to respond appropriately. Ensuring general community preparedness poses a more difficult challenge.

CB is an intrinsic feature of several networks that are available in the two Maldivian net-

works. But it must be activated. Most handsets are capable of receiving CB messages as long as the feature is turned on. However, in the early stages, getting customers to turn this function on could be an effective way of educating them about mobile-based public warning.

Following stakeholder meetings that included the sharing of information on the ongoing CB channel-standardization work of the International Telecommunication Union (ITU) and of experience in attempting to use CB for public warning in Sri Lanka, the recommendations to TAM are being finalized. They include the constitution of a 'trust protocol board' to develop the terms of access to the CB broker server. This will ensure security and the conduct of live demonstrations on a test channel, which the public will not see, that are likely to bring up

technical issues that require resolution before full-scale implementation is possible.

Once technical implementation is complete, a public awareness campaign will be required to persuade citizens to switch on the CB function in their handsets. It will take time, and the success of ITU's standardization efforts, for all tourists to automatically receive warning messages on their roaming mobiles. A campaign telling tourists how to turn on the Maldivian warning channel will not only enhance their security but also communicate the image of a more caring Maldives. For sustained adoption, it will be necessary for the regulator to continue discussions with the operators to develop a framework for commercial CB applications and to encourage such uses. ■

Table 1

Short message service	Cell broadcast (CB)
Messages sent point-to-point (messages directed to handsets)	Messages sent point-to-area (messages directed to radio cells)
Requires input of recipient phone numbers	Does not require input or knowledge of numbers
Only pre-registered numbers notified	All numbers within a cell notified
Messages cannot be differentiated by location of recipients	Messages can be differentiated by cells or sets of cells
Subject to congestion and thereby delay	Being broadcasts, not subject to congestion
140–160 characters in length. Can concatenate up to five messages	93 characters. Can concatenate up to 15 'pages' to produce a single message of up to 1200 bytes of data
No indication that message is generated by a legitimate authority	Not possible for outsider to generate a cell broadcast so greater authenticity

down in control and potential confusion among target groups. While a single voice may be desirable and may still be possible in some countries with limited access to ICT, it is likely to be increasingly difficult to control.

Major challenges in response capability and preparedness to act

People's willingness or ability to take appropriate actions when warnings are received can be affected by various factors, many of which can be overcome through prepared-

ness. People are more likely to pay attention to warnings if they have been educated about the risks in advance and know what actions to take. Public education campaigns, including inserting disaster risk awareness into school curricula, can build capabilities.

Contingency plans can map out roles and responsibilities in advance and speed the response time, although in many cases, they become routine annual documents rather than living, operational processes. Simulation exercises can be very effective in building response capabilities and bringing preparedness planning to life. They can test the response systems, coordination structures and the knowledge of at-risk populations. While it is not possible to carry out full simulation exercises for every potential risk, a multi-hazard approach can test systems for a variety of threats, including those with relatively low probability.

A lack of options is another challenge to the ability of communities to respond to warnings. While the multiple systems failed during Hurricane Katrina in New Orleans, one of the main reasons the hurricane caused such a major disaster is that poor, disenfranchised populations were without the resources needed to escape. They lacked personal transportation or sufficient money to leave their homes. In many cyclone-prone regions, populations may not heed warnings because there are no viable escape routes or shelters. There is a need to build 'front-line capacity' to ensure people have options to respond when confronted with a warning.

Risk perceptions play a large role in attitudes about heeding warnings, as described above. People may ignore warnings because they have inherently accepted the risk posed by the hazard.

Building response and preparedness capacity before an event requires resources. Very often, massive resources are poured into short-term, post-disaster response while funding for public education on disaster preparedness, contingency planning and simulation exercises is relatively scarce. A separation between the producers or operators of the early warning system and those making funding decisions for preparedness and response activities is common. When funding decisions fall in a different ministry or organization, those controlling the resources may require additional verification or analysis before taking action.

Some of the most effective early response systems occur when information and analysis units are directly tied into funding units. As the 'culture of preparedness' advocated by the Hyogo Framework takes hold, more agencies are linking information to action and pre-positioning response funds ideally to be used even before the disaster strikes. Some pre-positioned funds have been created on a national basis and are being used for *pre-disaster* interventions as well as quick post-disaster response, such as the Humanitarian Response Fund (HRF) in Ethiopia. The International Federa-

tion's Disaster Response Emergency Fund (DREF) allows it to call in emergency assets immediately after a disaster – and before, when a warning is received. The DREF can be mobilized by early warnings before disaster strikes, such as the recent allocation of 500,000 Swiss francs for potential flooding in West Africa, based on warnings in the seasonal forecast (see Chapter 3, Box 3.4). While both HRF and DREF are mainly targeted at short-term relief interventions to save lives after a disaster, their ability to release funds pre-disaster is an important step forward.

Efforts to establish epidemic early warning systems for malaria (see Box 1.5), meningitis and diarrhoeal diseases can greatly benefit pre-disaster funding. If warning systems can establish when environmental conditions favour an outbreak of an epidemic, pre-disaster funding can lead to a pre-positioning of vaccines, public education campaigns and advocacy efforts.

Box 1.5 Malaria: early warning and early action in Africa

Malaria is one of the world's biggest killers; about 1 million people die from it every year. It is endemic to several regions of the world, but Africa accounts for an estimated 90 per cent of cases. A malaria early warning system is being tested in several African countries, allowing early action in the right place at the right time.

Malaria is endemic to regions where conditions allow the malaria mosquito to breed and the malaria parasite to be transmitted year-round, so malaria control needs to be routine and ongoing. At the fringes of these regions are areas that are normally free from malaria, but are at risk from malaria epidemics when, from time to time, conditions become favourable (for example, changes in rainfall and temperature).

Where malaria is endemic, people usually have some resistance to the disease, and medical services are used to dealing with malaria. In contrast, when epidemics occur, they affect people with little or no immunity. Medical services, without early warning ahead of an epidemic, can be overwhelmed; thus early warning and early action have a critical role.

Roll Back Malaria, an initiative of WHO, the UN Development Programme, the UN Children's Fund and the World Bank, with more than 90 partners including national ministries of health, has developed the malaria early warning and response system. The system has five components:

- Vulnerability assessment and monitoring help keep track of vulnerable populations ahead of an epidemic.
- Seasonal climate forecasting: since the conditions that lead to epidemics are largely to do with the climate – high rainfall and humidity and warm temperatures favour the malaria mosquito and transmission of the parasite – forecasting can help predict where and when epidemics may occur. Seasonal forecasts predict conditions several months ahead, allowing plenty of time for appropriate early action. But there is a trade-off: the further ahead a forecast predicts, the more uncertainty it contains and the higher the chance that efforts will go to waste.
- Environmental monitoring: like seasonal forecasting, this gives advance warning of favourable conditions and the likelihood of

an epidemic. It has shorter lead times so contains less uncertainty, but also gives less time for preparation to deal with an epidemic.

- Sentinel case surveillance: a rise in malaria cases indicates the start of an epidemic.
- Planning, preparedness and response: this is the early action component, made possible by the early warning system of the first four components.

The system has been introduced in several epidemic-prone African countries, including Botswana, Ethiopia, Madagascar, Mozambique, Namibia, South Africa, Swaziland and Zimbabwe. According to Joachim Da Silva, epidemics and emergency officer of the WHO Southern Africa Inter-Country Malaria Control Programme (IRI, 2007), it is proving successful: "The quality of epidemic response in countries implementing the malaria early warning and response system has improved significantly. National malaria control programmes are able to forecast for the transmission season, detect early epidemics, and mount very effective responses to control them before they get out of hand, and therefore minimize suffering and deaths."

Ethiopia has recently begun to use the malaria early warning system. An estimated two-thirds of its 77 million population are at risk from epidemic malaria. One of the first challenges was that climate service providers and health workers rarely cross paths and would need to collaborate better for the system to be effective. Fundamentally, climate service providers need to provide information that health workers understand and can use. This is being addressed by a new climate and health working group, which brings these communities together.

Early action to combat malaria

National programmes are responsible for monitoring malaria progression throughout a season,

with the help of the early warning system tools. When there is the likelihood of an epidemic, staff can begin control activities such as spraying with insecticide and supplying mosquito nets. Emergency mobile treatment centres can be prepared, ready to be moved to where they are needed as soon as an epidemic breaks out.

Early action is also critical at the community level, and this provides an additional challenge in epidemic, as opposed to endemic, areas. Awareness of malaria in epidemic areas – both its symptoms and also effective control measures – is usually low, even among health-care workers, since the disease is relatively uncommon. As some of the most effective control measures can be implemented at the household level (such as sleeping under mosquito nets or taking anti-malarial drugs promptly when symptoms appear), education and awareness-raising at this level are critical early actions that can make a huge difference to the outcome of an epidemic.

The role of the media is, therefore, important. In South Africa, TV and radio are used to warn communities they might be at risk and regular updates on outbreaks are given. In Ethiopia, monthly bulletins on climate conditions and malaria risk are distributed via the RANET web site (<http://meteo-ethiopia.net>).

Climate change adds a new dimension to early warning and early action for malaria and other climate-sensitive diseases. It remains to be seen how the climate will change in the long term, but it is widely agreed that global warming will continue over the coming decades (see Chapter 4). This has implications for both endemic and epidemic malaria regions, and adds urgency to the need for early action. Whatever the climate brings, reducing vulnerability at the individual, community and national levels is the early action needed. ■

In slow-onset disasters such as drought, it is difficult to define when an ‘emergency’ begins. Early warning systems monitor a variety of indicators, but without clear indicators to trigger response, it is often delayed until the effects are visible and populations have suffered economic or physical losses. Multiple assessments are carried out, data are collected and analysed to formulate response options while affected populations liquidate assets, pull children from school or migrate to find opportunities. Chapter 5 explores these issues in more detail. Climate change is even slower onset, making it even more difficult to trigger action. Warnings clearly have been sounded at the global level. In some regions, action to support adaptation to climate change is under way but as highlighted in Chapter 4, much more is needed.

Conclusion

Early warning systems continue to evolve. Understanding early warning as a system rather than a technology highlights the need to address risk assessment, communication and dissemination, and preparedness to act with the same level of commitment provided to the technological aspects of early warning. A breakdown in any one of the pillars of early warning can cause warning messages to fail to reach and motivate their intended recipients.

Significant challenges remain, especially as the nature of vulnerability continuously evolves and historical trends no longer provide reliable signals for future disaster occurrences due to climate change. There is no single solution, given the diversity of risks facing virtually every corner of the globe, but global cooperation has helped create systems to better prepare for and mitigate natural disasters. Lessons about multi-hazard approaches and ways to create community-centred early warning structures are being passed from country to country and adapted for local conditions.

Communities and governments, as well as international agencies, play a central role in early warning. At every level, the people involved must work together in a coordinated system to achieve the goal of preventing loss of life and livelihoods from both mega-disasters and the smaller disasters happening every day well away from the media spotlight. Early warning must lead to early action across all timescales, from providing a sufficient notice of an imminent event, to helping societies learn to adapt to climate change. Early warning systems can and do prevent loss of life, but with ever more dramatic and unpredictable disasters, the long-term solution must lie in efforts to reduce people’s vulnerability to natural hazards.

The hazards (cyclones, droughts, disease outbreaks, etc.) will continue to occur and may become less predictable and more frequent and intense. The sustainable, long-term solution is to understand households’ and communities’ vulnerabilities to these hazards and tackle the underlying causes of this vulnerability.

Chapter 1 was written by Michele McNabb who is an early warning and disaster preparedness specialist currently based in Nairobi. She also wrote Box 1.3. Box 1.1 was written by Carina Fearnley, a PhD student at the Aon Benfield UCL Hazard Research Centre. Her thesis explores volcano early warnings systems and the standardization of volcano alert systems. Box 1.2 was written by Keith Ford, a risk reduction specialist based in Jamaica. Box 1.4 was written by Rohan Samarajiva, executive director of LIRNEasia in Sri Lanka. Anne Moorhead, a science writer and editor, contributed Box 1.5.

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Early warning: a people-centred approach and the 'last mile'

Before Cyclone Sidr hit the southern coast of Bangladesh on 15 November 2007, people knew that disaster was approaching. Many of them had experienced intense wind and rain before. Older people had told younger family members what to expect.

In Bangladesh, the cyclone preparedness programme, developed by the Bangladesh Red Crescent Society, with support from the International Federation of Red Cross and Red Crescent Societies, and the government of Bangladesh after a cyclone in 1970 had killed an estimated 500,000 people (International Federation, 1995), had worked with people on survival techniques. Around 5,000 trained volunteers worked through the night of 14 November to alert residents of the approaching cyclone. Megaphones and hand sirens were used to warn communities and encourage people to evacuate their homes and move to cyclone shelters and other safe places. As a result, no lives were lost in the area of Kuakata (British Red Cross and Bangladesh Red Crescent, 2008). Although more than 3,000 lives were lost and three coastal towns and 1.5 million homes destroyed throughout the whole country, this disaster was a fraction of the size it would have been had no warning been available.

The people-centred approach to early warning focuses on how individuals and communities can understand the threats to their own survival and well-being, share that awareness with others and take actions to avoid or reduce disaster. The risk of disaster is partly caused by external hazards (such as an earthquake, cyclone, surprise disease epidemic, war or economic crisis) that are difficult or impossible to stop. However, communities know that disasters are also about people being vulnerable, not being in the right place at the right time with adequate forms of protection.

People-centred early warning suggests that rather than being vulnerable, people can be capable, resilient and able to protect themselves. Three basic requirements are that individuals and institutions have the knowledge about what is a threat, that people are able to communicate a change in threat, and that they are in a position to respond. People-centred approaches to early warning, therefore, require the right support from scientific and political institutions to provide the context within which they can become strong.

A key point on which many scholars and practitioners of disaster reduction agree is that “strategies must extend beyond information provision to engage community members in ways that facilitate their adoption of protective actions” (Paton, 2006).

Photo opposite page:
A woman walks through flood waters in Tewkesbury, England, in July 2007. That year, flood waters in parts of England rose to 60-year highs, submerging huge swathes of land and leaving thousands of people without running water or electricity.

© REUTERS/Darren Staples

This is reflected in the Hyogo Framework for Action (UNISDR, 2005). People are usually very active in looking after themselves. Specifically, depending on their circumstances, they work hard to interact with and adapt to hazards, manage risks, demand rights, develop resilience and secure livelihoods. What can be observed from Bangladesh, Cambodia, Mozambique, Nepal and other examples (see Box 2.1) presented in this chapter are that the key processes of identifying a threat, communicating about it and taking action often start at the localized and personalized level; they are people centred.

Box 2.1 Early warning for floods in Cambodia

The vast flood plains and riverbanks of South-East Asia's sprawling Mekong River are home to millions of people. In Cambodia alone, nearly 84 per cent of the population lives near the river, with few options for relocation given the country's terrain. The lives of these people are inextricably connected to the Mekong, which provides water for drinking, cleaning, transportation and other universal aspects of daily life. Even traditional flooding provides benefits; the flood waters replenish soil nutrients essential for crop production.

The communities in this zone, while quite accustomed to traditional flood patterns, are now grappling with more unpredictable and frequent flooding. Climate change, environmental degradation, migration and other detrimental trends have exacerbated the communities' level of vulnerability, rendering traditional coping strategies inadequate and depriving communities of the same degree of protection or disaster recovery options that they enjoyed in the past. In order to get ahead of the curve and bolster community safety and disaster resilience, an effective, people-centred way to convey early warnings, which allows for prompt action in anticipation of an impending hazard, is an absolute necessity.

So the Cambodian Red Cross Society (CRCS) and the American Red Cross (ARC)

have joined forces to build early warning communication channels and to simplify messaging among vulnerable communities and government authorities, enabling the transmission of life and livelihood-saving information.

Community-based early warning through Red Cross volunteers

The Mekong River Commission (MRC) is a long-established, joint-government entity responsible for brokering responsible resource management of the countries that share the Mekong River. Between 2002 and 2007, and as part of a much larger MRC initiative, the CRCS and ARC played a major role in a multi-year, early warning programme funded by the United States Agency for International Development's Office of Foreign Disaster Assistance.

The programme addressed widespread needs for strengthened early warning communication channels, community ownership of the programme, training in data use and more effective participatory dialogue between the disaster response authorities and at-risk communities. This led to a programme known as the 'provision of early warning systems to flood-vulnerable communities in the lower Mekong River basin', which enabled key stakeholders in the region collectively to reduce flood risk among local populations.

In short, the primary aims of the programme were to develop simple, easy-to-use flood warnings for transmission among at-risk communities, government authorities and the MRC, and to build tools and communication techniques for rapid information flow among official decision-makers, emergency first responders and flood-susceptible communities.

Some 38 at-risk villages were selected, using pre-established criteria that included historical vulnerability to annual and flash floods, proximity to MRC water-level gauging stations, the presence of trained Red Cross volunteers and the level of interest in participating among communities and local authorities. The main aims for programme outputs included:

- flood referencing tools, materials and methods
- early warning system guidebooks and village manuals
- community feedback to integrate into decision-making

Apart from the CRCS and ARC, principal stakeholders included the Cambodian National Committee for Disaster Management (NCDM) and Department of Hydrology and River Works, the MRC and Action contre la Faim.

In August 2007, an independent evaluation team conducted a review of the programme to ascertain its effectiveness and impact, applying standardized methodology. The following five points highlight some of the more pertinent findings:

Community ownership for shared responsibility. The evaluation team found the early warning system to be very labour-intensive, and as such, it was crucial that responsibility for its development and maintenance was shared. For example, monitoring billboard data and flood markers and transmitting daily records entailed more work than anticipated. So project support committees were established in each village,

comprising two Red Cross volunteers, NCDM members, the village chief and one additional community leader. The key purpose of each committee was to ensure community buy-in and mobilization.

Broad stakeholder partnership for institutionalization. The previous point directly relates to the importance of how to ensure institutionalization of early warning systems. In an end-to-end approach, where hazard information emanates from either the community level or central locations with response mandates, early warnings are conveyed through a whole chain of stakeholders, with each entry point equally critical to data transmission.

In this case, commitment towards the programme's success came from the highest levels of government, including the Cambodian National Mekong Committee (CNMC), which emphasized the need to integrate early warning systems into government planning, such as commune development plans. Memorandums of understanding also played a large role in the success of this programme, such as the tripartite agreement signed by the CRCS, ARC and CNMC.

A community-relevant, decentralized approach. The CRCS and its volunteer networks offered the perfect means to establish a well-grounded programme that has great potential for expansion and opportunities for ongoing investment. Generally, communities immediately recognized the usefulness of the programme. Also, a decentralized approach allowed for widespread community input in decision-making and fostered critical buy-in where communities themselves benefited from a programme they deemed relevant to their needs.

Simple tools prompted replication and sustainability. The benefits of developing easily understandable and replicable tools were found to be widespread. Other villages beyond the

target area were found to be copying components of this early warning programme, such as adopting the practice of using flood markers. Additionally, local radio stations continued to broadcast flood forecasts and warnings after the programme ended.

Appropriate two-way communication technology. As with other early warning system studies, the importance of using appropriate technology to suit the programme's context cannot be overstated. In this case, back-and-forth communication was essential, as opposed to one-way transmissions. All the sophisticated equipment and data at the national level are useless to vulnerable communities if they cannot be easily transmitted and understood at the

end-user level. This held true in the Cambodian programme.

While the overall programme was deemed to be a success, there were certainly challenges to overcome, for example, securing enough funds to maintain the programme and ensuring consistent, high-quality data flow. Also, the time required to negotiate stakeholder participation and community behaviour change should not be underestimated in the planning process. Nevertheless, the Cambodian Red Cross and the participating communities are to be commended for their achievements under this programme, and for their willingness to pursue programming of such importance for promoting safer communities through disaster risk reduction. ■

The components of this approach are illustrated in Figure 2.1. While the basic elements of the process for community involvement in early warning is demonstrated in part (a) as knowledge, assessment, the warning and communication links between these, the bigger picture of how this process is a part of development and improving well-being is demonstrated by part (b) of the diagram. It suggests that the more comprehensive linking of early warning and early action with people's development aspirations is what motivates people to engage in this activity.

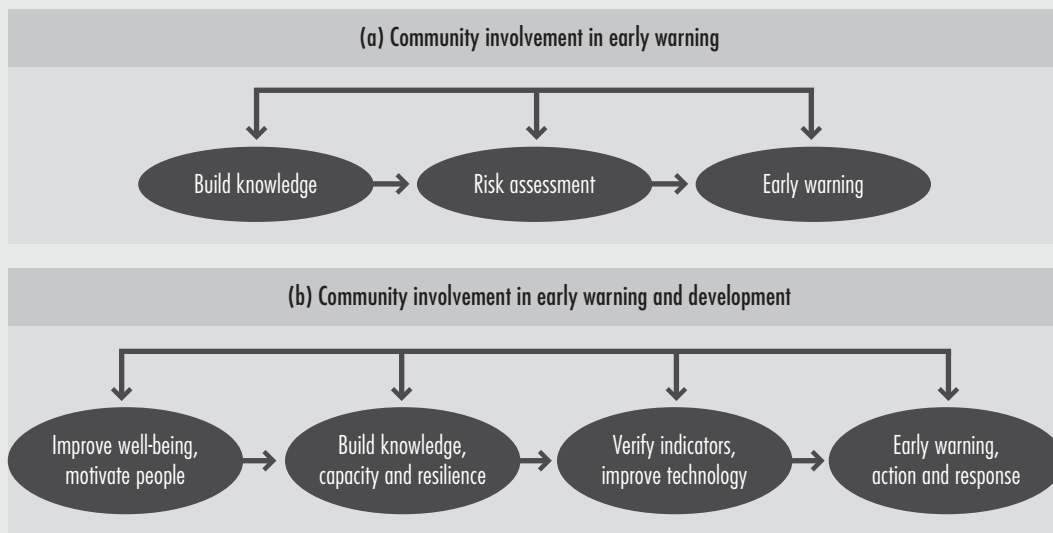
Part (b) also shows how good indicators that inform people about changes in risk, plus the technologies to be able to identify risks, are an important stage in this process. Within this simplified model, it is suggested that building knowledge and awareness goes together with capacity and overall strengthening.

Early warning is accompanied by early action, which in turn improves well-being, motivates people and further strengthens their knowledge, capacity and resilience. Communities become stronger. In Bangladesh, for example, despite frequently being subject to the greatest of disaster threats in the world, development has continued to move forward and people remain resilient.

The ideal system presented by Figure 2.1 will succeed to the extent that people's reactions to threats are more or less what is expected. Hereby lies one of the great challenges to disaster reduction programmes. For example, in the cyclone belt of Bangladesh, prior to the arrival of a cyclone, not everyone seeks to protect themselves. Some move to the cyclone shelters, while others stay at home. Interviews by the

Figure 2.1

The basis of community-based early warning



author with survivors of the Mozambique floods of 2000 suggested that whether someone heeds the warning or not may depend on influences as diverse as knowledge, power, culture, environmental attachment, flexibility of lifestyle or simply personality (Collins and Lucas, 2002).

The challenge of engaging those people who remain outside the system of early warning and action, who are also often more marginalized and not part of the development process, is called the ‘last mile’. Last mile is a term that has been adopted by some disaster managers because it expresses the sentiment that warnings and the means to respond to them often do not reach those who need it most – those within the last mile. They may be people who, for reasons of age, gender, culture or wealth, are not reached by disaster preparedness programmes.

In order to achieve the last mile, early warning systems need to engage all people at community level, to be locally owned and shown to be cost-effective. Incidentally, systems that are inclusive lead to improved well-being and development of communities at many levels (see Box 2.2).

People-centred risk assessment

Pride and satisfaction were apparent in the smiles of the leader of Munhava’s risk committee in the Mozambican town of Beira. During a community-based evaluation in his area, as part of the infectious disease risk management programme (Collins

Box 2.2 The gender perspective on early warning and early action

When Rani Begam was growing up in Bangladesh, she used to listen to her father's sad tales of how he lost his four sisters and his first wife in a cyclone.

"This inspired me to volunteer," she said. Now she is one of many Bangladeshi women taking part in a project to disseminate information on what actions to take when a cyclone or flood is approaching. Funded by the European Commission, the project is supported by the British, German and Swedish Red Cross, together with the Bangladesh Red Crescent Society. They have been working in the coastal cyclone-prone areas of southern Bangladesh to raise awareness of disaster preparation options, especially among women (British Red Cross, 2007).

Forums with 12 women members have been created – one forum for each of the 85 cyclone shelters in the area. Female volunteers teach other women first aid and other personal lifesaving measures, and how to stockpile supplies. The women are advised to tie back their long hair and wear *salwar kameez* (loose trousers and a tunic) rather than a sari, which with its great length of loose material can get caught and cause drowning. Women are also told about the different types of flags that will be raised above the cyclone shelters to signal how long they have to prepare to leave their homes.

Women tend to suffer disproportionately when disasters strike. So work on averting and mitigating the effects of disasters is very much part of creating a more equal and sustainable society for everyone. In the 2004 Asian tsunami, up to four times as many women as men died (Oxfam International, 2005). Some of this disparity between the genders can be attributed to special factors, such as the wave striking when many of the men were fishing out at sea,

while women waited for the catch on the seashore. In general, men were out and about on errands and could concentrate on saving themselves; women were at home looking after their children, and saving them was the priority.

People's reactions to disasters are conditioned by the social norms and relationships that guide their daily lives. Disasters tend to accentuate existing gender inequalities (Australian Red Cross, 2005). This applies to effective early warning systems and early action just as much as action at critical times and in the aftermath of disasters (Fordham, 2006).

Women do not have as much access to information as men, for example. Information tends to pass through male-dominated government agencies working on meteorology, managing water, agriculture, fisheries, health and disaster planning. This pattern of formal male networks is seen in the vast majority of the developed and developing world (Anderson, 2001 cited by Fordham, 2001).

Focusing on the life patterns and needs of women has become a central plank of gender-sensitive disaster preparation work. However, this can destabilize gender relationships and cause a male backlash. In a Redd Barna project in Uganda, women learned to speak out in public at meetings where there were separate discussion groups for older and married women, and for younger women and children. But some men felt threatened by the emboldened women and a number of women were beaten by their husbands for spending more time at these meetings than on domestic work (Bell, 2001).

This example highlights the need for gender sensitivity in early warning and early action, and the need to focus on relationships between men and women rather than the plight of women (or men) in isolation.

In southern Bangladesh, it used to be largely the men who knew about disaster preparedness. Now Rani's husband supports her voluntary work. "My husband worked in the army and realized that it was good for women to volunteer, but other people – particularly religious and family men – did not."

So gender sensitization workshops were held for 161 religious leaders and they have since endorsed the involvement of women. Some religious leaders asked for disaster preparedness material for their mosques and have delivered messages about the importance of women's participation during the gatherings for prayers.

"I had one bitter experience after I took part in volunteer training," said Rani. "When I returned home, some people said I had become a prostitute because I had stayed away from home for a month, being out of my house with men who were not my husband or brother. Luckily my husband supported me and helped deal with the situation."

She is pleased to see a change in people's attitudes: "Developing a good image for female volunteers has taken a long time. People now see that we are doing a good job helping others."

Many disaster preparedness initiatives have targeted women and girls in order to raise their participation while helping men and women to work together to create more effective disaster warnings and early responses.

On the southern flood plains of Nepal, CARE Nepal and three local NGO partners worked with 48 communities to target women through a door-to-door awareness campaign that reached out to women at home with their children. They also organized a skills fair in each of the communities. The women concentrated on demonstrations of improved cooking stoves, for example, while their children heard stories about past disasters and learnt about dis-

aster preparedness at a children's stall. The most popular stall, run by Nepal Red Cross Society volunteers, taught first aid. Women said that they used to think first aid was a man's job but had now gained prestige by acquiring these skills. The increased women's participation was a significant success in a culture where women are often excluded from household and community decision-making.

When the July–August 2007 seasonal flooding occurred, some Nepali communities sat and waited for relief, while the 48 *samadhan* (meaning 'problem solving') communities who had benefited from the awareness campaign put the evacuation drills into action. Lives and possessions, which would probably otherwise have been lost, were saved. As well as improved disaster-related skills, the successful promotion of gender equality was a lasting legacy (United Nations, 2008).

An ActionAid International tsunami response project in India's Andaman and Nicobar Islands brought women together to share their experiences. These women had very limited experience of meeting people outside their homes and were constrained by strong social expectations of acceptable behaviour for women. This meant that when some women had their clothes ripped off by tsunami debris, they died in their homes rather than escape and suffer the shame of running outside naked.

During the two-year project, the surviving women learnt to swim and to fish. Only by working collectively could the women learn these skills. Being able to fish not only equips them with survival skills after a disaster, but also gives them a way to earn money and gain economic independence. Thus the women's active engagement in the disaster reduction programme on the islands began to address their wider marginalization in society (United Nations, 2008).

In earthquake-prone Lima, Peru, a scheme to involve poor women in the manufacture of robust building components to withstand tremors also demonstrated that practical disaster resilience programmes empower women in poor communities. Now, the women not only make the building materials, such as roofing panels, but also build low-cost housing, train others and earn an income. The project was started in 1996 by an NGO, *Estrategia* (Strategy), and a community-based organization, *Mujeres*

Unidas para un Pueblo Mejor (Women united for a better community). It has benefited 55,000 families and is now being rolled out to neighbouring countries (United Nations, 2008).

Approaching disaster work through 'a gender-sensitive lens' (Fordham, 2006) means being alert for ways that gender stereotypes and gendered power relations interfere with equal rights for women and men, girls and boys, and how to remedy this. ■

et al., 2006; Collins and Williams, 2006; Williams et al., 2007), he, along with other members of the community, had identified the unhygienic environment as the cause of life-threatening diarrhoea. This 'local hero', working on a voluntary basis, then persuaded his community to clear and monitor the drains and clean up the public places, including removing human faeces.

His community's cooperation in these actions seemed to be motivated not only by the desire to respond to the warning of cholera in the region, but also from a pride in building their own strategy. During the cholera season that followed, the area was not affected. Local people were rightly proud of their achievement in reducing the risk of fatal disease. The often-untold stories of successful individuals who go the last mile for disaster prevention are found around the world. What inspires them and what ensures success?

Key components include community ownership of risk assessment. When risk assessment and management are governed locally and localized or indigenous knowledge is incorporated, then capacity is strengthened.

However, locally oriented and motivated people do not operate in a vacuum. They gain knowledge from what they hear via the programmes of the state, non-governmental organizations (NGOs), religious bodies and other communities, from friends, relatives and neighbours, and via the radio or other communication technologies, such as TVs and mobile phone updates (see Box 2.3).

Community knowledge of vulnerability, risk and resilience

Progress in people-centred approaches depends on supportive research and politics to help release a readily available resource within groups of local people. Communi-

Box 2.3 How to provide effective early warning messages

What is – and is not – said in an early warning has a profound effect on what people think and then do (Lindell and Perry, 1987). Research evidence on this topic has accumulated and been replicated over decades (Turner, 1976). It is ready for application and can be summarized as follows: it is vital to include appropriately three topics – source, content and style – in an early warning to maximize the odds that the public takes timely and effective actions.

Source. Emergency planners around the world embark on quests for a ‘credible’ early warning spokesperson because they think source credibility will generate public warning belief. There is actually no single credible spokesperson to be found. First, different people have different ideas about who is and is not credible. Second, people’s ideas about credibility change over time. Third, spokesperson credibility and belief in the warning message are different and the former does not guarantee the latter. In fact, if one relies on spokesperson credibility to foster warning belief, the entire enterprise is destined to fail. For example, fire fighters are the single most credible source of warning information in the United States. They have the highest sole-source credibility with 35 per cent of the population. But even they leave 65 per cent of the population behind. The most credible early warning source is not a single spokesperson at all. It is a group of different people and organizations. For example, a group that includes the mayor, a national scientific organization, the Red Cross or Red Crescent because so many associate them with disasters, a familiar local media announcer and more. Creating a mixed panel to source early warnings requires that many agree to be a source through emergency planning long before events occur.

Content. First, and most important, is to give people guidance about exactly what they should do, using words that paint a picture of what their response should look like. For example, in reference to evacuation, it is less effective to say, “Get to high ground” than to say: “By ‘evacuate to high ground’, we mean climb the slopes around town until you are higher than the tallest buildings.” Second, warning messages should tell people about the timing of their actions. Tell people when they should start and by when they should complete their protective action. For example, “Begin evacuating now, do not delay, evacuate now and be on ground higher than the tallest buildings in town no later than 16:15 this afternoon.” Third, tell people who should take the protective action and who does not need to do so, and let them know why. People in harm’s way need to hear clearly that you are talking to them. And people who are safe also need to be told so. For example, “If you are in the city limits and south of the Red River, evacuate now. If you are not in this area there is no reason for you to do anything because other areas will not flood.” Lastly, people are more apt to take protective actions if the warning informs them about the pending hazard’s consequences and how the protective action will cut their losses. For example, “The area of town south of Red River will be hit by a wall of water higher than all the rooftops that will be moving at 65 kilometres per hour; relocating to areas that will not flood will keep you safe.”

Style. The style of warning messages is about how the warning is worded and spoken, and it too influences public response. Research documents five style elements to use (Mileti and Sorensen, 1990). The first is clarity. Messages must be simply worded. Jargon should never be

used. For example, a warning for an accident at a nuclear power plant should not say, "A breach in containment may result in a transient excursion of core materials." Instead, it should say: "Radiation may leak out of the building and into the air."

The second important style element is to be specific. Warning information that is precise and non-ambiguous works best. For example, it could cost lives if you advise people to evacuate and do not explain what you mean because the word 'evacuate' will mean different things to different people. For example, "Go north away from the coastline until you are 3 kilometres inland and at least past the intercontinental highway."

A third style element to include is certainty. Provide authoritative and confident language about what you tell people. People may wonder how they can be certain about the uncertain disaster forecasts that so often come from scientists. Here is how you do it. Tell people, "We cannot know if the tsunami will actually reach our coastline or exactly how high it may be if it does, but all the experts agree that it is likely enough that everyone should evacuate now."

Accuracy is the fourth warning style element to affect public response. The people you warn need to think that they are being given accurate information. Inaccurate information or errors in information confuse people and their response. An example occurred during the 1979 Three Mile Island nuclear power plant accident in the United States. A spokesperson for the US Nuclear Regulatory Commission stated that there would be an explosion at the power plant. He was referring to a gas bubble exploding inside a pipe in the reactor building but did not say so. Many people around the plant thought he meant that the plant would explode like a nuclear bomb. Information accuracy means

telling people the truth, but it also means thinking about how people will interpret what you say.

The final warning style element is consistency. Consistent information works best. Inconsistent information can leave people with too much choice about the risk and protective action-taking. And given the choice, most people prefer to select information that says they are safe and not at risk. Consistency is applicable to a single message itself, and also applies across messages. Changes from past messages should be explained in subsequent messages. Why what you are saying is different from what others have said also needs to be explained. Inconsistencies inside a message should be removed. For example, it is inconsistent to say: "A tornado is headed for downtown, don't worry." People should be worried about that tornado. Telling them to not worry – because someone hopes to avoid starting a panic – gives them inconsistent information that erodes the effectiveness of the warning.

Interpreting nature's warnings and responding to them

Public education is especially important in the case of hazards for which only nature provides warnings. An example is a tsunami triggered by a local earthquake or mudslides triggered by heavy rain on slopes that are not monitored by technology. In cases like these, public education should teach people how to interpret natural signs that foretell disaster and how to respond to those signs. Three things have been learnt about this sort of public education. First, public education to teach residents about natural warnings and how to respond to them works best if that knowledge becomes engrained into local culture and folklore. For example, the lesson to 'duck, cover and hold' when an earthquake is first sensed. Second, special outreach to tourists

and other transient populations is essential through, for example, posting information in hotel rooms and on beaches. Third, it is important to post visual information in potentially hazardous environments for people to see when events occur. For example, signs along beaches that state: "Tsunami hazard: leave the beach and head to high ground if you feel an earthquake." Sometimes local officials are reluctant to post such signs fearing that they will cause economic downturn. However, research evidence is clear that such postings actually have no negative economic impacts at all.

Issue public warnings based on human science findings

Local government officials have the responsibility in most societies to issue warnings to people

in their jurisdictions. Even if national or international warning centres 'detect' danger, local officials typically word the actual warning messages that reach the people in harm's way. But there are too many local officials – and turnover among them is too high – to train them all about how to word early warnings based on psychological and sociological research. One solution might be to create a handbook of 'draft' public warning messages based on research. The handbook could be distributed to local officials worldwide to turn to when they must issue public warnings. A similar document might also be prepared for warning centres which sometimes directly issue warnings to the public. 'Evidence-based' draft messages could serve as a starting place for writing early warnings that are actually disseminated. ■

cation between societies at risk and the custodians of expert knowledge, finance and technologies is not just about narrowing the gap in knowledge, but integrating these resources into a genuinely people-centred system.

Knowledge and education are empowering, giving people the means to develop their own solutions. However, the language of vulnerability, risk and resilience, common in the world of disaster management and some parts of academia, is not easily understood by anyone outside a rather small 'disaster community', let alone people who may have received little education. Rather than use this language with communities, some programmes have used innovative techniques to bring additional scientifically verified information to people. For example, by way of preparedness and avoidance of diarrhoeal disease epidemics in Bangladesh, the International Centre for Diarrhoeal Disease Research (ICDDR,B) displays images on posters in high-risk communities to inform them about the harmful bacteria that can be found in the water, which must therefore be boiled or filtered before being drunk. Few words are needed. The ugly-looking pathogens accompany pictures of people suffering from cholera and are quite enough to communicate the desired warning message.

A further example of community capacity to govern early warning and action is the health security for disaster resilience project (Disaster and Development Centre, 2008; Ray-Bennett et al., 2008), which is supported by the United Kingdom's Economic and Social Research Council and Department for International Develop-

ment, and run by the Disaster and Development Centre (DDC) and ICDDR,B. This explores how secured health can have an impact on disaster mitigation, including through localized and community-based risk assessments. One of its findings in Bangladesh is that, when asking cyclone- and flood-affected communities about the greatest disaster threats they confront, they frequently refer to economic and social factors. This finding guided the programme into considering health security as an issue of social strengthening, rather than just in terms of resistance to environmental hazards. A further aspect of this approach is to examine how health enables early action in the face of prevalent and forthcoming risks. By implication, early warnings in these contexts are also about identifying the presence of a defence that is a strategy for health and for dealing with threats to everyday life.



A boy washes dishes in the flooded waters of Chokwe, Mozambique, in 2000. Since then, the flood-prone country has made excellent progress in taking early action before a flood becomes a major disaster.

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Addressing vulnerability for disaster reduction is often similar to promoting development. We know from many years of analysis about development that to be sustainable, there are environmental, social and economic aspects of life that must be addressed. For example, health threats are environmental, social and economic in origin, both in situations of extreme underdevelopment and in times of disaster. Poverty reduction programmes have consequently opted for integrated strategies that try to address the causes of ill-health on several fronts. Furthermore, health means complete well-being, including the psychosocial aspect. Recognition of the impor-

tance of psychosocial support in disaster resilience requires acknowledgement of pre-built individual and community strengths that reinforce ability for preparedness and early action (see Box 2.4).

Box 2.4 Pre-built psychosocial capacity allows early action

“Every night images of war, death and destruction keep running in my head,” said 16-year-old Zarina Ikaeva from Tskhenvali. She is one of more than 30,000 South Ossetians who fled to North Ossetia in the Russian Federation during the August 2008 conflict between Georgia and the Russian Federation. “I do not know if I will ever be able to forget this.”

As Ikaeva and her compatriots arrived in North Ossetia, they received support from the local Russian Red Cross branch. Not only were their basic physical needs covered, but trained staff and volunteers were also ready to provide much-needed psychosocial support. This early response was possible because the Russian Red Cross, especially its North Ossetia branch, has worked to build psychosocial capacity in the past years, following the Beslan school siege in 2004.

After the school tragedy, where more than 1,000 children, relatives and teachers were taken hostage in a school gym and 338 lives were lost, the Russian Red Cross provided essential psychosocial support to those who were affected. The programme continued for three years and, although it ended in 2007, there remained an awareness of the need for psychosocial support to people affected by crisis. In 2008, for example, the Russian Red Cross organized several psychosocial training courses. This meant that the local staff and volunteers were ready to respond immediately to those affected by the conflict, aiming to minimize the psychological effects of the war among displaced children and their families, and to be able to provide continued support. “To be with people and help them come to terms with their

emotions is important in the first days after the tragedy,” explained Viktoria Tibilova, a Russian Red Cross psychologist from Beslan. “But now more work is required to restore people’s faith in the future and in other people, and to help them find basic resources to live on.”

Health means complete well-being

Traditionally, humanitarian and development aid addressed only physical needs, but in recent years more attention has been paid to people’s mental and psychosocial needs. Over the past few years, an increasing number of Red Cross Red Crescent Societies has started community-based psychosocial support programmes to help affected people cope with their situation, seeking to restore their hope, dignity, mental and social well-being, and sense of normality.

Often, psychosocial support is provided in response to a crisis situation, such as a conflict or natural disaster, but then such programmes often continue and are expanded. These programmes often become a part of the general programme portfolio, and add value to the preparedness of a National Society. Since 1993, the International Federation Reference Centre for Psychosocial Support has supported this capacity-building and advocated for community-based psychosocial support as an integral part of humanitarian work.

Tsunami response gave valuable lessons to earthquake operation

When National Societies have pre-built psychosocial capacity, they can quickly organize vital support in times of crisis. This was clearly

proven in the early response of the Indonesian Red Cross Society to the 2006 Yogyakarta earthquake, which killed thousands of people and left at least 200,000 homeless. Only three days after the event, a group of trained psychosocial specialists from the American and Indonesian Red Cross arrived in Yogyakarta from Aceh, where the team had already helped more than 60,000 survivors of the 2004 tsunami through community-based and culturally relevant activities.

When deployed to the areas hardest hit by the earthquake, they began by offering psychological first aid and community-based interventions to help ease people's suffering. The capacity built in the tsunami response was invaluable to facilitate early response in 2006. The Indonesian Red Cross had carried out some psychosocial projects before the tsunami, but the focus and organization of the approach was greatly improved through the tsunami experience. "The training and guidance we received from other National Societies with experience in this field, like the Turkish Red Crescent Society and the American and Danish Red Cross, was invaluable and made us even more effective," said Intan Keumala, an Indonesian Red Cross psychosocial support coordinator.

The community-based advantage

Although the first team to respond psychosocially in Yogyakarta arrived from another province of Indonesia, the community-based nature of the work often allows an even quicker response. A member of the first team was Sujata Bordoloi, manager of the American Red Cross psychosocial support programme for tsunami recovery efforts in Aceh province. The team provided psychological first aid and assessed the situation, and found that there was a good foundation to build on. "Even though the earthquake had destroyed almost everything in the villages we visited, we found that most people were staying in their communities," said Bordoloi. "There was a sense of cohesiveness and resilience among villagers, and that even though structures were gone, the communities still remained intact."

Involving village leaders, teachers and others, the team set up a variety of activities to help the communities cope. At the same time, they continued to build their capacity and increase their preparedness, thus ensuring that crucial, early response for the next disaster. ■

The benefits of locally based knowledge for early warning for urban or rural development programmes are experienced across the globe. One example would be the farmer field schools in Mozambique, run by World Vision, where local producers are taught how to predict the likelihood of a successful harvest. The proven worth of participatory community-based strategies can be shown in preventing crises associated with food, livelihood, health, environmental and economic development, to name a few. However, some of the limiting versions of participation are when there is only superficial 'involvement' rather than ownership.

The presence of community members at a meeting to discuss the threat of an incoming crop disease might be largely irrelevant, if local perceptions are merely that someone is trying to sell a different variety of crops. Similarly, vaccine uptakes can be compromised and safety routines for fire, flood and storm partly ignored, if the needs

assessment is poor and imported from outside the community. When a community itself calls for assistance for identified risks that threaten their food and water supply, livelihood, health or basic rights, they attract the active support of their members.

It is important for community-based assessments to have access to what more specialist science has to offer, though there are clearly limits to how accessible this may be to lay people. For example, in the assessment of infectious disease risk, a combination of ecological, socio-economic and behavioural assessments may be needed, involving microbiological, societal and economic analysis. The study of the complex origins of cholera risk in Mozambique identified that comprehensive early warning of the disease would require risk assessment engaging the disease, people, the places they live, the politics of the area and varying perceptions about what might be a threat or not. All these potential 'causes' needed to be looked at together rather than separately by different types of experts who might not even work together (Collins et al., 2006).

Despite 150 years of research on this more visible of pathogens, after the great outbreaks of cholera in 19th-century London, we are still unable to predict accurately when, where and with whom it will strike. Many infectious disease pathogens, such as viruses and prions, are much less well understood than cholera, raising questions about how we should best negotiate uncertainty in that field. In these circumstances, community early warning tends to provide solutions where early reaction is based on permanent readiness in the face of varied threats. However, areas and people at higher risk can be monitored more rigorously during more obviously risky times. For cholera, this includes during flooding, infrastructural collapse and where there is malnutrition. Local radio and public health activists can transmit notice of its arrival within moments. In the same way, Radio Mozambique used radio broadcasts of locally performed plays containing warning messages to warn communities in the province of Zambezia about HIV and AIDS. Flood warnings are also being transmitted through that medium.

Techniques of community risk assessment and early warning

There are many participatory techniques that can be applied to disaster prevention (Haghebaert, 2007; Pelling, 2007). Perhaps the most well-known of the community risk assessment approaches in recent years is the vulnerability and capacity assessment (VCA) (International Federation, 2002 and 2006; Davis, 2004). There are many different versions of this, and some prefer versions that put more emphasis on resilience. It is perhaps surprising that greater emphasis has not yet emerged on combinations of capacity, resilience, strategic preparedness and well-being in these assessments, as the more likely characteristics of everyday life upon which early warning might be built. However, some excellent examples of VCA have been carried out through the work of

Red Cross Red Crescent Societies, who are largely attributed with developing and implementing the approach (International Federation, 2002 and 2006).

Techniques that communities and facilitators can use to gather information for early warning include all of the tools that exist in the rich repertoire of participatory appraisal. They include risk ranking and mapping, timelines, Venn diagrams, free listing and scenario building, together with the key ingredient of handing over the controls to the participants (Chambers, 1997 and 2005). Examples of data for detecting change include rainfall through rain gauges, river levels, a change in the number of people arriving at a health clinic, rising food prices and earth tremors. Local communities have been known also to be aware of a number of indicative early observations, such as changes in animal behaviour in advance of major environmental events. This has led to a growing appreciation of the role of indigenous knowledge in early warning and action, though a debate is often present as to whether the knowledge is better described as local (i.e., has developed in a specific location due to multiple factors from multiple sources) or indigenous (attributable historically to that setting and uniquely handed down over generations).

Beyond what lay people can measure for themselves, lies a mass of other information in the hands of those with access to the necessary technologies to sense it. However, such information is also becoming increasingly more within reach of lay people (see Box 2.5). For example, remotely sensed images in the Bay of Bengal off Bangladesh, or in the Mozambique Channel off the south-east coast of Africa, can track incoming meteorological events, such as cyclones, effectively on a minute-by-minute basis. The images can then be downloaded from personal computers around the world. This is now also the case in many thousands of settlements in previously technologically marginalized parts of the world. Lay people with an interest in early warnings need not wait for experts to provide information. For example, members of communities can engage in testing the quality of water and soil using adapted kits, in measuring the nutritional status of their families and all forms of neighbourhood watch.

Box 2.5 Early warning and early action in Orissa

On 27 October 1999, at 18:50, the All India Radio station announced that the meteorology department had issued an early warning of a deep depression in the Bay of Bengal “that may turn to severe cyclone and may hit the Orissa coast with a wind speed of more than 200 kilometres per hour”.

Natha Sethi, who lives in Padampur, Orissa, recalled that day. “We became alert for the

forthcoming cyclone and organized an emergency meeting of the disaster preparedness committee along with task force members. Following the community contingency plan that we had prepared earlier, we checked all the disaster preparedness equipment that the Indian Red Cross Society’s Orissa branch had provided for our shelter. [Various people] took the lead role in disseminating the warning message

to each household using megaphones, *kunch* [conch shells], bells and sirens, and we also started to collect dry food, drinking water (that we lifted manually to the overhead tanks), kerosene, candles, match boxes, etc., and stocked them in the shelter. Self-help group leaders prepared the community by supplying household emergency packs.”

The Indian state of Orissa is flanked by the Bay of Bengal in the east; its 480-kilometre coastline is described as a ‘very high damage risk zone’ in the *Vulnerability Atlas of India*. In addition, the rapid degradation of the region’s ecology in recent years has made it even more vulnerable to cyclones of minor intensity. In 91 of the last 102 years, Orissa has experienced natural hazards – flood events in 50 of those years, drought in 20, cyclones in 11, and other phenomena, including whirlwinds and hailstorms, in 14 years. Of the floods and cyclones, 13 and 11 respectively were particularly severe and devastated the state.

In the early 1990s, following many devastating cyclones, the Indian Red Cross, through its Orissa branch, worked with the state government to produce the Orissa Disaster Mitigation Programme (ODMP). This involved constructing multi-purpose cyclone shelters and organizing disaster preparedness activities so as to avoid the worst effects of such natural hazards. By 1995 the plan was in operation, supported by KfW, a German bank, and the German Red Cross.

Recognizing the importance of strengthening the local communities’ capacity and resilience, the Indian Red Cross worked with community-based organizations and trained volunteers, making them the basis of the disaster response team at state level and similar teams at district and block levels. Shelter and disaster management committees and task forces were set up at shelter level. This was done with the

support of the International Federation and German, Spanish, American and British Red Cross. To build up resilient, well-prepared and safer communities as well as a well-functioning state branch, various training courses were held, including community-based disaster risk management, search and rescue, first aid, psychological first aid, leadership training, and the use and maintenance of lifesaving equipment. Community awareness programmes on disaster preparedness and response were organized through mass rallies. Posters and manuals were prepared and mock drills carried out on special days.

The ODMP stood the test when the ‘super cyclone’ hit Orissa on 29 October 1999 with a wind speed of 280 kilometres per hour. The government declared a death toll of around 10,000 people but, according to unofficial sources, the number of people killed was estimated to be in the tens of thousands.

The 23 shelters constructed during the programme saved 42,000 lives. The government took immediate action, a noticeable paradigm shift from post-disaster activity to pre-disaster preparedness and mitigation. However, the concept of community-based disaster preparedness in the state of Orissa had been introduced by the Indian Red Cross, which was the pioneering institution in preparing the community for early action after warnings of a sudden-onset event such as a cyclone.

Natha Sethi recalled that, unlike other villages where no shelters existed, his community was safe from the cyclone. “The people from the nearby villages that had not reached our shelter were swept away like straw... The training imparted by the Red Cross was used at the proper time and proper place so that we could save [all the lives] in our village compared to more than 900 reported dead in the surrounding villages.” ■

Closely sensed information

Communication, alert and response systems for a wide variety of disaster events can be embedded within communities, engaging the people who are the last-mile users, so that the distance between a perceived risk, real risk, warnings and early action is reduced. This is demonstrated by several of the systems described in this chapter (Box 2.1 on Cambodia and Box 2.6 on Mozambique and risk and resilience committees (RRC) in Nepal). Local knowledge is based on a community's history and grows within a community, providing information about local people, including indication of their capacity and well-being in the face of an imminent crisis. Specialist knowledge made more accessible to the community, such as access to data on water, climate, the economy, hill slope stability, disease risks and so forth, can be integrated with a people-centred early warning system.

As disaster risk is often comprised of a complex array of social, economic, environmental, political and perceptual factors, the challenge is how to integrate this knowledge comprehensively to identify when, where and with whom early action must be taken. This requires local people to be engaged with the awareness of an appropriate set of indicators of change and the means to monitor them. It requires identifying which indicators of change need to be monitored by specialists, such as arsenic contamination in tube wells in Bangladesh and many other parts of the world, and how such information can be part of community-based information streams.

Box 2.6 Risk committees in Mozambique and Nepal

In 2005, the local health department in Beira, Mozambique and the infectious disease risk management programme (IDRMP) initiated a pilot project of cholera risk committees. The main aim was to reduce diarrhoeal disease risk through community-based risk management. This was achieved through establishing a coordinated network of risk committees in key disease risk areas. These would be effective in the reduction of diarrhoeal disease risk, through a 'system-supported community-based risk management' approach. This was a practical, low-cost strategy to enable management of diarrhoeal disease risk at the local level and to become the first stage of a community-based early warning system.

The approach places emphasis on avoiding disease epidemics through effective risk management, rather than expensive emergency aid

interventions once epidemics occur. The risk committees resulted from findings during initial IDRMP work that highlighted weaknesses in community-based responses to risk reduction and failings in communication between the community and authorities. The specific objectives were therefore to:

- improve community-based risk management through the establishment of area-specific risk committees
- improve communication channels between community risk committees and stakeholders in order to facilitate appropriate and timely risk reduction
- improve cholera risk management at the 'central' level through monitoring of risk information produced by risk committees and through responding appropriately

The committees consist of a core membership, which identifies and monitors the risk areas and, most importantly, encourages community members to manage and reduce diarrhoeal disease risk. The committees disseminate risk information to key service providers and health institutions such as city health authorities and the city council. These groups in turn provide committees with technical information and support where appropriate and possible.

The work of the committees is flexible, as it must adapt according to changing hazards and vulnerabilities in the population and environment. Participatory community-based assessments encouraged community responses, with the committees being run and managed as unique entities by the community. This approach builds organizational capacity to respond to disease risk by increasing civic knowledge of disease risks and risk reduction measures. It develops advocacy skills at the local level to enable the community to mobilize interventions and lobby the authorities and other stakeholders to address identified disease risks. Some of the disease risks are also, at the request of the community, confirmed through laboratory analysis provided by the local health authority. Although the government of Mozambique ended this programme in 2006, several of these committees continued to operate, thus demonstrating their capacity to become self-sufficient. However, others dissolved as attempts to generate their own funding failed. Evidence of the success of the approach has led to further initiatives of this type.

Infectious disease risk management was a DDC programme, supported by the UK's Department for International Development (DFID), the World Health Organization and the United Nations Children's Fund (2002–2005) and partnered with the Mozambican government and the International Centre for Diarrhoeal

Disease Research, Bangladesh. DFID/British Council, Catholic University of Mozambique and ICDDR,B currently support its sequel, the infectious disease risk reduction programme.

Examples such as this from Mozambique illustrate how risk management, early warning and resilience can be locally governed. Along these lines, a related long-term case study has been developed since 2006 for a number of communities in Nepal, one of the world's most hazardous and low-income environments. This project is to trial, on behalf of the government of Nepal, a series of risk and resilience committees (RRC) to identify the circumstances within which they can effectively enhance community-owned hazard and vulnerability mitigation, risk reduction and resilience. The RRC achieved to date are situated at a confluence of local traditions and changing government structures in two different areas of Nepal. The experience shows that establishing RRC in the community, with participatory initiatives and a wide range of stakeholders, can produce high-level acceptance, involvement and local knowledge-building. Despite the relative success of this approach, variation between the way different community groups develop their risk and resilience strategies and potential weaknesses in conceptualization of core themes and processes, means there is much still to be learnt.

Community-based approaches claim to build on existing local knowledge and experience as well as the resources, coping and adaptive strategies of local people. Pre-existing local capacities and institutions provide a foundation for community-based disaster preparedness – the overall aims of which is to empower local people by supporting them to become increasingly self-reliant (Allen, 2006). The RRC institutional framework embraces government structures, traditions and customs, political practices and public awareness to identify best ways

of enhancing local disaster resilience. They currently sit within a wider strategy for 'people-centred hazard and vulnerability mitigation for disaster risk reduction' in Nepal and Bangladesh. The initiative, based on low-level funding, also includes higher educational links. It may bring to the fore some of the circumstances within which increasing hazards can be offset by the community and be one of the strategies contributing information to the wider approach to build disaster-resilient communities.

The RRC aim to enhance disaster resilience by the communities' self-directed establishment of activities involving local knowledge-sharing and capacity-building to assess and manage risk. Two RRC were established in 2007 at Panchkhal Valley, Kavre District in central Nepal and Dhankuta Municipality in eastern Nepal. Individuals from local government, NGOs, political parties, academic institutions and other bodies were introduced to the fundamentals of disaster reduction through participatory training workshops. Localized risk records in which localized hazards, risks and vulnerabilities are detailed were designed by the RRC. At Dhankuta, participants worked in four heterogeneous groups, each ultimately drafting a risk record based on their previous experiences and needs. Risk ranking exercises, related techniques and wider community surveys were also implemented at both sites. Comparisons are made between the RRC to compare how different community decision-making, contexts and notions of risk and resilience impinge on the sustainability of the approach. The project has also provided opportunity for training at varied levels including through the exposure of community representatives to higher political levels. One executive officer of Dhankuta Municipality has disseminated the positive experiences of this approach at national, regional and international levels. Concerns about disaster vulnerability

and risks that have been identified by the RRC have been incorporated into the municipal development process with suggestion that this methodology could be used more widely, while strengthening early warning and response in the area. Ongoing questions concern the wider governance circumstances within which a people-centred approach in Nepal and elsewhere can successfully build resilience.

Findings from Mozambique and Nepal to date have demonstrated that the risks highlighted by varied institutions and authorities are often not at the fore of local community concerns. For example, cholera, earthquakes, hunger, fire and storms can rank lower than issues of governance and poverty.

In Nepal, people ranked agrochemicals high amongst their concerns, although this had not been an apparent threat to the wider team prior to this process. Some languages in Mozambique or Nepal do not have words to differentiate between hazard, vulnerability and disaster in the same way as in English. In the context of Beira, a disease risk was part defined in terms of fear. In both Mozambique and Nepal, vulnerability, not surprisingly, was found to be expressed often in social and economic terms and invokes a state of sympathy for others. Well-being has multiple dimensions with factors such as health and education facilities, water and forests featuring as some indicators.

Beyond questions of language and interpretations, communities have demonstrated they are very aware of the nature of vulnerable groups and indicated that, first and foremost, they felt responsible for disaster management themselves, rather than expecting it to lie entirely with central government. At Beira, a key risk reduction identified by the community was to create voluntary cleaning brigades. At Panchkhal, Nepal, a key strategy was to enhance agricultural productivity. Motivation to develop the RRC approach to date

appears to have varied between communities within the same country. Small details in the interpretation of the purpose of RRC may lie at the core of explaining some of these differences. However, there is a willingness to engage risk reduction issues whether real or perceived, and these can be used by the RRC to inform newcomers to the community. In Nepal, the RRC approach has led to the community using a baseline survey approach to risk data, putting up hoardings (13 at Dhankuta) to make people aware about risk, vulnerability and possible disaster, and providing support to a bereaved mem-

ber of the community. In Beira, the Munhava risk committee created an assistance fund for families with members in hospital. In both cases, it is clear that community groups want to link risk reduction and early warning functions with matters of everyday life. This is a clue to the sustainability of this approach for the future.

DFID and the British Council partner with Kathmandu University, B.P Koirala Institute of Health Sciences and the government of Nepal to support the DDC's people-centred hazard and vulnerability mitigation in Nepal and Bangladesh programme. ■

Risk management and governance of people's early warning and early action

Few societies have experienced institutionalized systems of early warning and action that answer the needs of all. From Hurricane Katrina and Cyclone Nargis to the persistent famines of Africa, reliance on external agents, expertise and national-level governance has not been sufficient to prevent a disaster. Systems of governance founder, leaving people unsupported and at risk. Hall (2007) points out that while community-based strategies are important, the place of early warning within the context of effective emergency management essentially includes the roles and responsibilities of a further four 'primary participants': emergency managers, scientists, the media, and public officials. The time to develop early warning for early action locally, from within as well as from without, has been a priority for decades.

The people-centred risk and resilience approach suggested in Figure 2.1 starts with the motivation of the individual and their desire to achieve better well-being. Community risk and resilience strategies can help stimulate that process for local groups. The infectious disease risk reduction programme in Mozambique (see Box 2.6) found that area-specific risk committees were able to assess and intervene in health hazards and vulnerability in relation to varied types of health threats. An established community group or committee feels empowered to communicate, on behalf of the people it represents, with other institutions such as local government or NGOs that can then help facilitate targeted risk reduction. Possible actions, such as cleaning a suburb, putting up road warnings for traffic, fire or flood warnings, require that risk reduction be backed up by verification of risk perceptions. Where necessary, links to skilled services such as laboratory analysis may be needed, but also basic advice on managing risks through improvements in local authority services, such as rubbish collection.

Community associations, groups or committees engaging with risk reduction issues might be more effective where warnings are directly combined with environmental interventions, income generation or neighbourhood security activities that motivate the participants. In the Mozambique health risk committees, for example, some groups managed to link the committees to making blocks for latrines and another with marketing of fish. The rights and security aspect of risk committee work also involved the broader early warning agenda in trying to uphold rights to neighbourhood hazard reduction, including through hygiene policing.

The application of community-based disaster management has gained much interest around the world. Beyond the pioneering work of the Red Cross Red Crescent in disaster preparedness that underpins many of the initiatives, good examples have been provided by La Red in South America (La Red, 2008) and a number of international and local NGOs around the world. Disaster management authority is delegated institutionally in varied ways in different countries; in those approaches that are more people-centred, the common feature is the decentralization of access to knowledge and decision-making.

In the United Kingdom, the government established local and regional resilience forums around the country in the wake of the Civil Contingencies Act of 2004 (UK Government, 2004). For the moment, these still give an impression of being separate from local communities, and there remains little public knowledge of their existence, let alone early warnings for which they might be responsible. They consist primarily of representative strategic service providers, such as the fire and rescue services, police, ambulance service and so forth. In India, community-based strategies have been attempted on a wide scale, through village-level governance mechanisms called *panchayats* (Wikipedia, 2009), to incorporate disaster risk reduction. One key lesson from this approach is that separate local committees for individual threats are less useful than strengthening the key local governance mechanism and mainstreaming the disaster risk reduction agenda to deal with multiple threats.

For people-centred approaches, a number of key questions remains. First, is there evidence of the need for new forms of local risk and resilience governance, such as through risk and resilience committees (Box 2.6) or similar, or are we really looking at small adjustments to existing societies using existing community routines? It remains to be more fully considered within which types of current world political systems do communities engage more with strategies to reduce risks. However, the experience of risk committees in both Mozambique and Nepal supports the findings that establishment of these groups provides a mechanism that serves to stimulate early warning and action. RRC can be low cost and linked to a sustainable monitoring system, adaptable to local knowledge and perception, and perceived as effective within the community. They become a stimulus for risk reduction coordination and can be converted to first response groups if necessary. The added benefits of commu-

nity-based warning and action strategies are disaster risk reduction, health risk reduction, community strengthening, good governance, cost effectiveness, sustainable development and preparedness.

Reaction to risk and the imposition of risk

People's reactions to risks, as explained earlier, depend on multiple past and present influences and any knowledge that might be available via a risk assessment process and early warnings. There is, however, an overall uncertainty as to the balance of individually driven motivation to manage risk versus that which is motivated by institutions and external intervention. Influences on individual and group reactions to health risk that were gauged in terms of actions taken during displacement from the Mozambique floods of 2000 and in the contexts of urban epidemics more recently, found that:

- Basic knowledge of risks in the community was generally good, but that the material ability to intervene was limited.
- Perception of risks varied, though the view that illness could be avoided by addressing issues of dirt, stagnant water, flies, food, storage and lack of treatment of water, hygiene and living conditions was widespread.
- Motivating factors included fear, the desire to be respected, first-hand experience of disease and any proven successes of a strategy.
- Constraining factors included the infrastructure, lack of finance and the basic means to intervene (i.e., with chlorine, a latrine, or just being heard).
- There was varied risk avoidance associated with attitudes and a sense of responsibility towards peer groups, local community and civic authorities (Collins and Lucas, 2002; Collins et al., 2006; Williams et al., 2007).

In Bangladesh, vulnerability was found to increase as a result of late responses to warnings and complex processes of decision-making. People's reactions to risk when confronted by cyclones, including Sidr in 2007, could make them more vulnerable to disaster (Alam and Collins, 2009). As people are used to facing multiple hazards each year, their responses to warning depend upon the intensity of wind speed they feel, previous hazard experiences, local beliefs about cyclone occurrences and/or a cyclone signal hoisted by the Bangladesh Meteorological Department (BMD). If the symptoms of previous hazards coincide with a BMD warning of about 6–7 on average, people start to prepare to save belongings or decide to leave their homes to go to a cyclone shelter or other stronger buildings nearby. Before that, they adopt a 'wait and see' technique, to observe whether the cyclone intensity is moving upwards. The women indicated that, in most cases, the decision to take early action to leave home depends upon the male head of the household, and if he is not at home, they and the rest of the family wait for his return before taking action. Due to conservative religious beliefs, some male heads of households prefer not to move to cyclone shelters, thinking the process of relocation unsuitable for female members of household (see Box 2.2). Households also consider the problems that can arise in cyclone shelters, such as limited space, lack of privacy and poor sanitation.

Other reasons for not heeding the warnings can be reluctance to leave domestic animals, concern about belongings in general and the potential loss of their only means to a livelihood should they not stay to protect it. A family may decide to move only when the visible severity of the cyclone increases and warning signals go up. However, by then it may be too late because rainfall and the severity of the wind have increased. Roads to the cyclone shelters may be blocked, damaged or destroyed by combined rain and wind. Fear of injuries by flying debris is another factor deterring people from moving to cyclone shelters once the winds increase in force.

Many of the principles mentioned in this chapter have been in the context of African and Asian examples. However, the issues are often applicable to higher-income countries. For example, in 2008, one year after widespread floods in the United Kingdom, a seminar was held in London attended by members of parliament and key stakeholders involved in flood management policy. At the meeting, the author of this chapter posited that the time may have arrived for the UK public to be given greater opportunity to engage in locally owned prevention and response activities.

This would include the greater involvement in identification of risks, vulnerabilities and hazards, counteracting social downturns in society. It would link to strategies for potential economic and environmental benefits in difficult economic times and would enhance environmental sustainability. This would advance together with developing preparedness and prior response in addressing multiple hazards and risks, identifiable by the communities of the UK.

Rights and responsibilities

The people-centred approach reinforces the important truth that it is people, not institutions, who should have rights. Institutions should be established in the interests of people. Early warning systems are, therefore, systems or institutions that must serve people's needs.

Setting minimum standards in early warning might be a reasonable target for the people-centred approach and those responsible for assisting the well-being of communities. Responsibilities, on the other hand, lie in part with individuals, so that taking effective early action relates also to personal decision-making, the quality of community cohesion, values and ethics.

More comprehensive evaluation might suggest the weighting of personal responsibilities against those of local civic institutions. It is unlikely that large-scale standardization of ideas in this respect would be possible across cultures, varying political systems and contrasting economic and environmental circumstances. However, common threads around the question of 'what are communities entitled to expect' are likely to be recurrent in most contexts.

Conclusion

Community-based risk and resilience assessment is the beginning of a process whereby local people take the lead in building their capacity to manage their own disaster risk reduction and early warning processes. Participatory initiatives in communities with a wide range of stakeholders can produce high-level acceptance, involvement and local knowledge-building. While community-based development or disaster reduction groups are not new, concerted examples of people-centred risk and resilience building in the interests of well-being and early warning remains largely underutilized. This is evident in the ‘developed’ world, where strongly institutionalized and top-down approaches to risk assessment and early warning still dominate.

Integrated (community) risk reduction is a people-centred approach to address uncertainty through comprehensive disaster risk assessments. It involves people’s participation, appropriate frameworks, monitoring and evaluation, so that citizens take some ownership of risk assessment and management. It requires knowing the who, when and where of risk, and the circumstances of changes in hazards, vulnerabilities and capacity, and well-being. It is expected that risk assessments, records and other techniques will form the basis of producing municipality-level disaster risk reduction policies and plans, and these should be made to function as an early warning mechanism.

Investment in development might offset many of the impacts that environmental and other crisis events produce. Critical service support in an early warning framework can provide the additional mix of information that communities need to offset incoming hazards and vulnerabilities. Empowering people, sensitizing institutions, delineating the responsibilities of the state, and legislating the rights and responsibility of individuals and other stakeholders are included in the role of an early warning system.

A requirement is that early warnings and early response systems protect less able people who cannot engage effectively in risk reduction. Local resilience forums (such as in the UK) might have much to offer, but could learn from the experiences of regions engaging initiatives along the lines of local risk and resilience committees, in which there may be greater opportunity for community ownership of the process, rather than being governed by expert knowledge and service institutions alone. However, questions remain about the efficacy and sustainability of different variants of RRC operating in contrasting contexts and with more and less community control. The approaches outlined above need to be calculated in terms of the lives and vast amount of money that might be saved through investing in people-centred early warning and action.

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Early warning, early action: bridging timescales

In the face of rising risks and rising uncertainties, effective early action is more important than ever. What the examples below will show is that such early action works best when it spans a range of timescales, not just providing a more rapid response to a disaster, but also anticipating it days, hours, months, years and even decades in advance, and over time reducing the risk of a range of hazards. That bridging of timescales is the key to early warning and early action: “routinely taking action before a disaster or health emergency happens, making full use of scientific information on all timescales” (International Federation, 2008).

This chapter shows how information on all timescales can inform such early action and highlights challenges in putting longer-term early warnings to use. Those challenges are being overcome. Practical early action, based on early warnings at all timescales, does pay off, reducing risks and saving lives.

A growing knowledge base for early action

Action on all timescales is possible, informed by an ever-growing range of early warnings. Global computer models and satellite images, regional centres of expertise, national meteorological offices and other government agencies, local field reports and community observations – they all allow us to better understand what risks are appearing, and what is likely to happen given what we have learnt so far. This allows us to anticipate a wide range of threats much more effectively than before. At the shortest timescales, a warning of an impending storm can help us to evacuate ahead of the disaster. At intermediate timescales, a seasonal forecast based on El Niño may give us a ‘heads up’ that the upcoming storm season could be particularly severe or that a continuing drought could result in food insecurity. At the longest timescales, future climate change scenarios, along with other trends such as urbanization, environmental degradation and population growth, present an early warning of rising risks.

However, no early warning has any effect without early action. Numerous examples illustrate how reliable information about predicted hazards was not sufficient to avert a disaster, including rapid-onset events like Hurricane Katrina in the United States, as well as slow-onset ones such as the food crisis in Zimbabwe (see Chapter 5, Box 5.3).

With the shortest timescales, a key example of early action is evacuation, removing people and assets from threatened areas. In some cases however, such as Cyclone

Photo opposite page: Some of the worst floods in decades affected Ghana in 2007. Although the floods were forecast, no early action was taken. Here, Ghanaians have to wade across a flooded river, carrying their bikes, to reach the market.

© Noora Kero/International Federation

Nargis, evacuation is hardly an option, given not only the topography and the large distances involved, but also the lack of evacuation logistics (transport and planned locations for evacuation, for example) and the local infrastructure. This brings us to the actions on longer timescales – that is, to prepare for an effective response on the shortest timescales and to reduce risk by enhancing the reliance of communities and societies. Over years or even decades, such disaster risk reduction may include adjusting development plans and establishing, upgrading and enforcing land zoning, building codes and infrastructure standards, but also working closely with local communities to assess and address the risks they face – particularly when these risks are rising. Depending on the type of risk and local circumstances, many risk reduction measures can be taken, ranging from planting trees to reducing the occurrence of landslides, to disease awareness and prevention campaigns, to water harvesting and storage systems to cope with periods with little rain. In terms of disaster preparedness, early action also includes updated contingency planning, logistics and volunteer mobilization.

Early action to reduce risk also covers all levels. At the most local level, a household can store food in higher places with the onset of a flood or, on a longer timescale, construct a house on stilts. Likewise, a farmer can conserve water or plant drought-resistant crops in anticipation of drought conditions. Simple brochures, such as the *Safety at home* and *Safety in the community* materials distributed by the American and Bulgarian Red Cross, are very effective in helping people to protect themselves and their family in times of disaster, and similar information exists for use in schools and the workplace. Basic public health education also saves lives (see Boxes 3.1 and 3.2) and related programmes lead to early action (see Box 3.3).

Box 3.1 Disaster risk reduction: listening to the voices of children

When floods, hurricanes, earthquakes and other disasters strike, it is often children with their fragile bodies and minds who are most vulnerable to death and injury, and to the traumas of separation and abandonment if family members are scattered or killed. They are especially vulnerable also to the longer-term effects of disasters, such as intensified poverty, hunger and disease.

On average, children make up more than half of all people requiring immediate help in crisis situations, and the international child rights and development organization Save the Children estimates that around 175 million children

a year will be affected by disasters over the next decade (Save the Children, 2008).

Many countries recognize this special vulnerability of children, and now include teaching about natural hazards and disaster preparedness in their school curricula. About 40 per cent of countries responding to a United Nations survey at the World Conference on Disaster Reduction, held in Kobe, Japan, in 2005, said that they provided such education. There are also many stories of children taking the initiative in helping their families when crises happen because of what they have learnt in school (see Box 3.2 on earthquake drills in Iran).

Take, for example, Tilly Smith, an 11-year-old schoolgirl from the south of England who was on holiday with her family in Phuket, Thailand, when the tsunami struck on 26 December 2004. Having learnt about tsunamis in geography class just two weeks previously, Tilly, who was on the beach with her mother, father and sister, recognized the 'sizzling' froth on the surface of the sea as a danger sign and urged her family to leave immediately. Her father relayed Tilly's warning to the lifeguard who cleared the beach before the waters began to rise. Everyone who had been on that particular stretch of shore survived, and Tilly gives credit to her geography teacher. "If it wasn't for Mr Kearney I'd probably be dead and so would my family. So I'm quite proud that he taught me that at the time he did," she says. Education can make the difference between success and failure, and sometimes life and death, says Andrew Kearney, and there is no substitute for it. "Without education people are powerless; with education, as can be seen here, they are very powerful in terms of directing their own lives" (UNISDR, 2005).

Besides national efforts, there are some highly imaginative international programmes aimed at raising awareness among young people about natural hazards. One example is an educational kit developed jointly by the United Nations Children's Fund and UNISDR, which includes a board game, *Riskland* (UNISDR, 2004). By answering questions about hazards, players advance along the winding paths on the board and pick up information about how to reduce those hazards along the way. The kit can be adapted to reflect local conditions and is already available in six languages, including Haitian Creole and Nepali, with 15 more language versions in the pipeline.

Another innovative programme is GLOBE (Global Learning and Observation to Benefit the

Environment), a worldwide community of teachers, schoolchildren and scientists, connected via the internet. Launched in the United States in 1995 with the key aims of enhancing "environmental literacy and stewardship" and inspiring "the next generation of scientists", GLOBE now involves more than 20,000 schools and 40,000 specially trained teachers in 110 participating countries. Using materials developed by GLOBE for classroom and field activities, pupils and teachers collect data for international research projects identified by scientists, who act as mentors. Since 2001, for example, schools in the Canadian Arctic, where the effects of global warming are particularly dramatic, have been monitoring the weather and the state of the snow and ice, as well as timing the seasons by events such as bud burst and the first hatching of insects. The children are encouraged to talk to hunters' and trappers' associations and to share whatever they find out with their communities as well as supplying the data to climate scientists.

Starting in 2011, GLOBE will run a special campaign on climate change and hopes to draw in 1 million schoolchildren worldwide, with a key aim of empowering them and their communities to take action on climate-related environmental issues. However, since the 2005 Kobe conference, there has been growing recognition that children could and should be playing an even more active role in disaster prevention, and that they should have a voice in policy-making.

"The UN Convention on the Rights of the Child quite clearly states that children have a right to participate in decisions that affect their future," says Nick Hall, who manages the child-centred disaster risk reduction programme (CC-DRR) for the international development and child rights organization Plan, a pioneer of this approach along with a handful of other agencies, including ActionAid, the Institute of Development Studies in the UK and Save the Children.

They have formed the Children in a Changing Climate coalition. "Children also have a right to protection, and underlying everything is our conviction that we should be working to realize their rights as best we can," says Hall. "But an added stimulus for Plan is the recognition that disasters in the world are getting worse and more frequent, and that most of the development work we do in 49 countries is seriously threatened by disasters."

Today Plan has CC-DRR projects in nine countries. One of the best established is in El Salvador, the most densely populated country in Central America and also one of the most disaster-prone. Floods and landslides are a huge threat in the hurricane season, because the small, overcrowded country has been virtually stripped of trees. To try to address this specific issue, children in one community are planting trees. In another, they are planting a type of tough, deep-rooted grass to try to stabilize denuded hillsides.

A project starts with children, ranging in age from 8 or 9 to late teens and recruited from one of the many youth groups that Plan works with in and out of school, undertaking a risk-mapping exercise to identify the threats to themselves and their communities. This stimulates discussion about how the risks can be managed, particularly by the young people themselves. "Because their experiences and perceptions of risk are different from adults, children often come up with things that adults wouldn't notice," says Hall, underscoring the value of giving children a voice in their own affairs. "In one village in El Salvador, besides the obvious hazards, the children identified bars as a danger to kids because of drunken men around, and a dark area of woodland on the road out of the village that was risky for girls because of sexual harassment."

The Children's Emergency Committee in one village, Petapa, identified the improper dump-

ing of litter as a major hazard that spreads disease, causes contamination and often blocks waterways. They now run clean-up campaigns in cooperation with the adult committee. They also persuaded the village authorities to put a railing alongside the path to their school that has a steep drop to one side. And when they identified the unregulated extraction of sand and stones from their river as a cause of erosion and flooding, they ran a campaign of direct action, blockading the road, erecting placards and pleading with lorry drivers who came to collect materials. On one occasion some youths, buoyed by past achievements and the fire of conviction, climbed on to a lorry roof until the driver agreed to leave.

Asked by an external review team what they would say to other children about disasters that may occur in their communities, members of Petapa's Children's Emergency Committee cited the following key points (Mitchell et al., 2008):

- Disasters are not natural; get yourselves organized.
- We've expressed ourselves and we respect ourselves.
- We were told as children that we couldn't make a difference, but we can.

When asked what would make them safer, they said strong houses, safe shelters, a fire brigade, telephones and knowledge. They also said trustworthy police and trust in young people.

In the Philippines, a children's group supported by Plan was similarly empowered to persist in their campaign to have their school moved to a safer site when their analysis showed that it was particularly vulnerable to landslides. Many parents, unconvinced by the confusing evidence of risk and concerned that their children would have to travel to a different community each day, opposed the move. But the children went them-

selves to the meteorological department to gather the information that won them their case, and together with their parents they erected a temporary school under canvas in a safe site until a new building was put up.

The children's groups in Plan's programme have access to small grants of up to US\$ 500 to take their ideas forward. This part of the programme is designed in large part to allow children to demonstrate their abilities and build their credibility in the eyes of sceptical and resistant adults. Such attitudes are a major challenge to CC-DRR programmes, which recognize that to make a real and lasting impact children also need a place in mainstream discussion and policy-making forums concerned with disasters.

Plan's staff, therefore, have parallel tasks: to work directly with children and to work with relevant adults to create an enabling environment for children's participation in disaster risk reduction.

This involves meetings and workshops with everyone from parents, teachers and local authority figures, to government officials and the media.

"If you're looking at children as advocates for change, you need to ask what are the advocacy opportunities? And what better one than the climate change negotiations, because that really does affect their future," says Nick Hall. Representatives from a few children's groups attended the conferences in Bali, Indonesia, in 2007 and Poznan, Poland, in 2008. They paved the way for a bigger role at the international climate conference to be held in Copenhagen in December 2009, when a delegation of around 30 children will attend.

"Whenever there's a crisis in a negotiation, everyone says: 'Don't forget it's our children's future that we're talking about'," explains Hall. "We're saying, 'Well, yes it is, so let's give them a chance to speak'." ■

Box 3.2 Earthquake drills for Iranian students

Located in one of the most active seismic regions of the world, the Islamic Republic of Iran has experienced many destructive earthquakes, which cause many fatalities and injuries as well as major destruction of buildings. Earthquakes such as the one in Bam on 26 December 2003 show that children are among the most vulnerable groups in society.

Iran has a very young population with 36 per cent aged less than 19 years, so it is vital to instil a 'safety culture' from an early age. Iran is the only country to hold a nationwide earthquake drill once a year for all students.

Children and schools are the key components in the country's earthquake risk reduction activities. Such activities not only help their safety during earthquakes, but can also play an effective role in the dissemination of knowledge

and preparedness among the society and family.

A young boy was interviewed on Iranian TV after the Bam earthquake. "Were you hurt?" the interviewer asked him. "No," he replied, "I was in a safe place... in the corner of my room... we had learnt [about this] in school before."

The annual earthquake safety drill for students has been developed by Iran's International Institute of Earthquake Engineering and Seismology (IIEES), with the main objectives of improving and increasing the children's skills, response and preparedness as well as becoming 'safety messengers' in their homes and family. The idea was first tested in 1995 in five primary schools (one in each region of the country) but it was decided that, due to the lack of awareness among young children and textbook education,

the planned programme was not suitable for primary-school level. In 1997, after the programme was revised, it was tested in three high schools in Tehran. A second drill then took place in all 1,059 high schools in Tehran. After a comprehensive evaluation of the first three drills and further revision of the programme, a fourth drill was carried out in 15,499 high schools in Iran simultaneously on 29 November 1998.

The level and type of activities of the drill have been continuously updated and its coverage expanded. Since November 2003, the drills are held annually on 29 November in all 154,804 Iranian schools, from primary level upwards, with more than 14.3 million students taking part. If 29 November should fall on a holiday, the drill takes place on either the day before or the one afterwards.

For some time before national drill day, educational materials such as posters and drill guidelines are produced and distributed to schools, and for one week beforehand, various educational and scientific programmes about

earthquakes and safety are broadcast on radio and TV. This includes a special TV programme on the drill itself.

On the morning of 29 November, the 'earthquake and safety' alarm is broadcast for 30 seconds on national and regional radio. This marks the start of the drill when all students perform the correct procedure of 'drop, cover and hold'.

In order to ensure the successful implementation of the drills, the School Safety Drill Council was formed, consisting of representatives of the ministries of education, of science, research and technology, and of the interior, the national broadcasting organization, the Red Crescent Society of the Islamic Republic of Iran and the IIEES.

After conducting the drill, every province provides the council in the IIEES with comprehensive reports on the different activities related to the drill such as school competitions, media coverage, educational activities (producing films, books, games, etc.). The council acknowledges the best reports and practices. ■

Box 3.3 Early action to avoid deaths from heatwaves in France

In 2003, France suffered the hottest summer in 50 years. That year, an exceptionally severe heatwave claimed more than 15,000 lives. After this tragedy, the public authorities established the national heat emergency plan, which is activated every year from 1 June to 31 August, in order to reduce the risk of deaths from heatwaves.

The French Red Cross, in its role as auxiliary to the public authorities and with its 45,000 volunteers and 556 health and social facilities, was mobilized in a large-scale operation in the summer of 2003 (helping vulnerable people, distributing water, assisting health facilities and emergency services). Since then, it has played an active part in implementing the national plan.

Based on its own heat emergency guide and plan, it prepares and implements a series of actions in coordination with the public authorities and in accordance with local resources and needs.

The French government's national heat emergency plan is updated every year and proposes information, warning and general organizational procedures. The current plan establishes three levels of action to be implemented during the summer period, according to the intensity and length of heatwaves.

Seasonal monitoring level 1. This level is active for the entire duration of the heat emergency plan and involves the implementation of climate and health monitoring procedures by

state services. The staff concerned ensure that surveillance, mobilization and warning systems are working properly and implement the mechanism to identify vulnerable people. The French Red Cross conducts a census of people who are deemed most at risk, defines options for action and works in cooperation with the district authorities to register people at risk.

Warning and action level 2. In the event of a heatwave, action is taken in the affected areas, on the recommendation of the Minister of Health. Once this level comes into operation, the French Red Cross mobilizes its resources in readiness for a rapid response as soon as it is required and, at the request of the local authorities, implements the planned actions.

Maximum mobilization level 3. In the event of a heatwave with serious health implications affecting a large part of the country and complicated by side effects that could undermine public order (for example, electrical failure or drought), the Prime Minister takes the decision to requisition all necessary resources to deal with the disaster and puts the Minister of the Interior in charge of efforts to manage the heatwave. At this level, the French Red Cross, at the request of the public authorities, launches the actions it has undertaken to implement for this level and is ready to act when required.

The national heat emergency plan established by the Ministry of Health provides for French Red Cross intervention at various levels. It plays a vital role in strengthening solidarity and dealing with the problem of isolated vulnerable people, particularly those most at risk from the effects of a heatwave. It also mobilizes its volunteers to carry out specific activities, targeting the most vulnerable sectors of the population by:

- encouraging isolated elderly and disabled people to register with their district authorities
- reinforcing or establishing social emergency medical service (EMS) rounds

- opening air-conditioned day centres for homeless people
- making home visits to isolated elderly people

As auxiliary to the public authorities, the French Red Cross makes its teams of volunteers available to assist in operations, such as:

- strengthening and supporting telephone help lines
- supporting hospital emergency services
- supporting EMS and fire-fighting teams
- distributing water to motorists stranded when motorways are blocked
- providing volunteers to assist in opening public air-conditioned places

When necessary, the French Red Cross can provide reinforcements to assist the staff of homes for the elderly, children's nurseries, home care services and emergency shelters, including those run by the Red Cross as well as by other institutions.

The French Red Cross also carries out prevention efforts to raise public awareness (for example, providing advice on how people can protect themselves in a heatwave, such as drinking plenty of fluids and using a fan), particularly at first-aid posts, and distributes water in crowded places, such as tourist sites.

Although the mild summers of 2007 and 2008 did not require specific action to be taken, in 2006 the French Red Cross mobilized its network to deal with the effects of extremely high temperatures (level 2 or 3), deploying over 3,500 volunteers.

Efforts focused primarily on assisting homeless people and isolated elderly people, supporting establishments and services, such as homes for the elderly and hospital emergency services, and providing first-aid teams.

On 17 July 2006, the public authorities in western France activated level 2 of the heat

emergency plan. The stifling streets of the town of Saumur were deserted, and the local Red Cross branch started on its rounds of elderly people living on their own. Sophie, Catherine and Monique, the three volunteers on duty that day, prepared their battle plan. The most problematic cases were to be dealt with on the first day, focusing on the most vulnerable sectors of the population, including those who are completely on their own, those who are no longer in full pos-

session of their faculties and those who have serious medical conditions. On recognizing the Red Cross uniform, an elderly lady opened her door quickly. In the dim interior of her pleasant, impeccably kept apartment, 87-year-old Suzanne invited the volunteers to sit down for a moment in her living room. "I'm so happy to know that someone is thinking of me. You can't imagine how hard it is and how much my heart is warmed by what you do," she said. ■

At the largest scales, the international community, including the major development agencies, can adjust financing mechanisms to provide funding for disaster risk reduction and response ahead of disasters, rather than only after the fact, and mobilize new and additional financing to address the rising risk of climate change. Governments can, for instance, review land-use plans and establish stronger building codes to reduce risk or facilitate effective preparedness and response, including through laws facilitating regional and international disaster assistance. Humanitarian organizations can mobilize resources ahead of a disaster to reduce its impacts (see Box 3.4) and support local capacity to reduce risk.

Box 3.4 Disaster Relief Emergency Fund

The International Federation is in the process of strengthening its entire early warning, early action system from improved forecasting and analysis of data to efficient early warning systems at community level, in collaboration with partners such as IRI, NASA and the Red Cross Red Crescent Climate Centre. In its discussion paper *Ways Forward on Humanitarian Financing* in 2008, the Inter-Agency Standing Committee commented: "Humanitarian preparedness stands to gain most from improved localized response capacities." It also underlines that emergency funding mechanisms cannot always support local response or emergency preparedness.

The International Federation's Disaster Relief Emergency Fund (DREF), while providing emer-

gency funding as start-up funds for major response operations, also has the flexibility and rapidity to fund small-scale local disaster response and emergency preparedness. Red Cross and Red Crescent Societies can request grants to allow them to prepare for response to imminent crises, whether for forecasted weather-related events, to fight the outbreak of epidemics or to prepare for civil unrest or population movement. The eligible costs are listed as:

- mobilization and equipment of volunteers, including transport costs, per diems, visibility items
- activation of community early warning procedures
- evacuation of people at risk

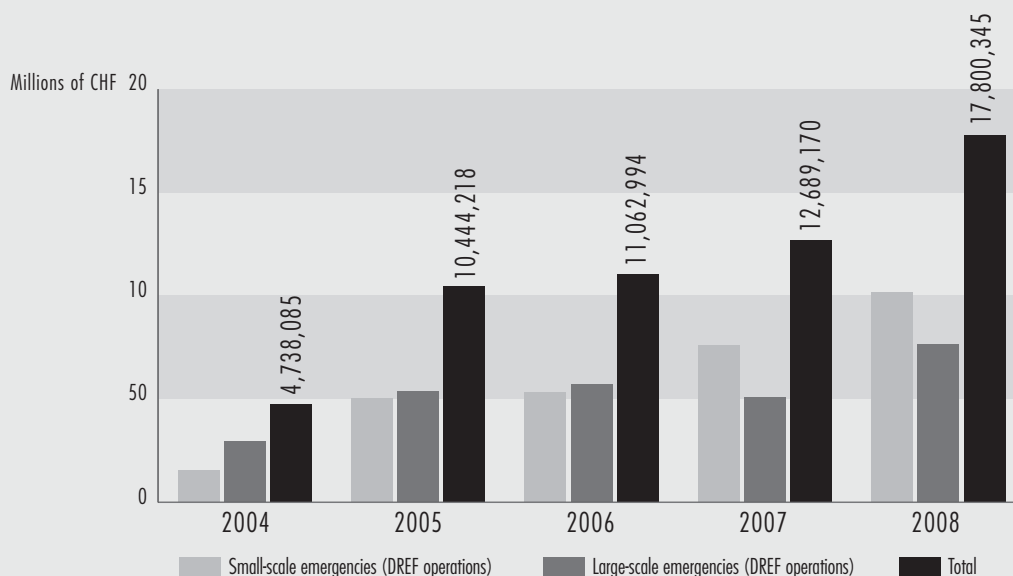
- preparation of shelters
- pre-disaster assessment of capacity to respond to imminent crisis
- activation and implementation of existing contingency plan
- pre-positioning of relief supplies, logistics and human resource assets
- provision and pre-positioning of additional resources, both human and material
- communications (both telecommunications and media)

DREF has been used in the past to prepare for imminent crises, in hurricane preparedness and, for example, in Guinea at the beginning of 2007, for the implementation of contingency plans for population movement following growing civil unrest. Emergency preparedness allowed the Red Cross Society of Guinea to save many lives and to be acknowledged for its humanitarian work by the government, military and members of the public.

In 2008, better access to forecasting and data led to several pre-emptive large-scale operations to prepare for expected damage from excessive rainfall, including in West and Central Africa in July (as outlined in Box 3.5). However, while DREF underwrote the operation to a level of 483,000 Swiss francs, donors have not supported the emergency appeal sufficiently to allow the allocation to be reimbursed to the fund. This may indicate that donors are not yet able to find or use funding to support emergency preparedness.

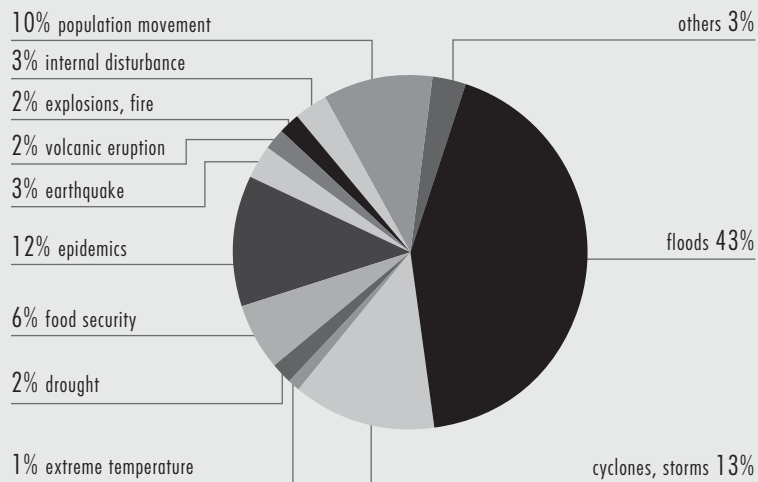
Since 2004, the use of DREF has grown from 4.7 million to 17.8 million Swiss francs in 2008. The biggest increase is in grants for small-scale disaster response as Figure 1 below shows. The majority of operations funded in 2007 and 2008 are in response to weather-related disasters. It is here that the International Federation anticipates using DREF more and more to support early action and to allow communities to act ahead of disasters and reduce injuries and the loss of life and property. ■

Figure 1 DREF allocations by type 2004–2008



Source: International Federation, 2009

Figure 2 DREF 2008 – types of operations



Source: International Federation, 2009

Risks and uncertainties: the case for bridging timescales

But how do all these time and spatial scales and different types of information fit together? Or more fundamentally, do they really need to fit together? Wouldn't it be good enough if development planners focus on development, humanitarian actors on disaster preparedness and response, and local communities just prioritize their own well-being? Couldn't we ignore climate change when we worry about early warning for impending cyclones? And likewise, couldn't we tackle long-term trends in risk by addressing basic vulnerabilities, rather than by preparing for response?

Indeed, vulnerability to natural hazards is often so obvious that some people ask why we even bother to worry about trends in risks or scientific information about changing hazards. When more and more people crowd into slums on dangerous flood plains, we don't need scientific information for a diagnosis of rising flood risks. When population growth in pastoral areas results in increasing numbers of cattle, overgrazing and land degradation, which then threatens food security, we do not need to know about changes in the local climate to understand why people are at risk and what sort of solutions would be needed. When a coastal road has been rebuilt three times in 20 years exactly as it was before due to storm and flood damages over two decades, we don't need scientific evidence to understand that we need a different approach. All of these examples demonstrate that information by itself is not the

panacea. In many cases, the general diagnosis is clear: we need to tackle fairly obvious vulnerabilities in order to address the rising risks.

But increasingly, faced with significant trends in hazards and impacts, risk reduction and disaster preparedness based on past experience no longer suffice. In Bangladesh, many villages are used to occasional – although sometimes deadly – flooding. However, in some areas, communities have reported that floods seem to be arriving faster and fiercer than 30 years ago. In one village, a small ditch that can often be crossed in one jump becomes a severe barrier in time of flood; children and elderly people in particular get caught in the rising waters before they even reach a shelter. A very simple bamboo bridge, over that normally insignificant ditch, now saves lives. This bridge was only built when people realized, in the context of a community consultation supported by CARE, that current and future floods might come faster and stronger than before. Most of the time, this bridge would not be necessary, but once villagers recognized the changing nature of hazards, it made perfect sense to them to construct it.

Another example comes from Mozambique. In 2000, the Limpopo River basin experienced very strong rainfall for many days as a result of cyclones. Experts knew that it would result in serious flooding of a magnitude never experienced before by rural communities downstream. That warning reached only a few communities, as most of them had no electricity or radio – and even some that did receive the warning did not evacuate.

People in this region had previously been able to predict floods successfully by observing ants. Ants build their homes underground; when groundwater rises, they leave their nests – and people know that the water is rising. On this occasion, the flood came so rapidly there was no time for the groundwater to rise or for ants to react before the river overflowed. A person who had heard the experts' alert drove to another village to tell them to evacuate, but the local chief asked why he should believe that early warning. Since the time of his ancestors, floods had only occurred after ants left their homes. This time the ants had not moved and yet a stranger had come to his village asking everyone to leave at once. As in most of the Limpopo valley, many people did not evacuate. About 700 people drowned (Red Cross Red Crescent Climate Centre, 2007). While in many other cases traditional knowledge is still very valuable, in more and more areas it is becoming increasingly unreliable because past experience does not necessarily apply to present and future risks. Only by establishing a long-term dialogue with communities, building on past knowledge but also explicitly addressing changes in risk, can short-term early warnings become truly effective.

Likewise, when redesigning a coastal road, it no longer suffices to base the design, monitoring and maintenance on past experience. For instance, analysis by the Asian Development Bank (ADB) of infrastructure in several Pacific island countries identified significant changes in return periods of extreme flood events over the coming years (for instance, from 1-in-20 years at present to 1-in-5 years by 2050). Such

changes significantly affect the optimal design of the infrastructure, such as a stretch of road at Kosrae in the Federated States of Micronesia (ADB, 2005). Some changes in design and planning are ‘no-regrets options’ which will pay off regardless of the precise details of how climate change will materialize – land-use planning and associated regulations, building codes and infrastructure standards as well as community development projects, all contribute to risk reduction even under the current climate. However, they become much more effective and sustainable when they incorporate current and future climate extremes and variations.

These cases demonstrate that trends in risk are relevant for efforts to reduce the impacts of disasters, and we need to use the early warnings about changing risks in our early actions.

Table 3.1 Timescales for early warning, early action

Example 1

Flash flood	Example of early warning	Example of early action
Years	Increasing risk of extreme rainfall events due to climate change Deforestation on hillsides increasing risk of flash floods Increasing population in slums in areas at high flood risk	Continually update risk maps and identify changing vulnerable groups, community-level activities to reduce risk through concrete actions like reforestation, reinforcement of houses, etc.
Months (seasonal)	Forecast of strongly above-average rainfall for the coming season	Revisit contingency plans, replenish stocks, inform communities about enhanced risk and what to do if the risk materializes, e.g., clear drains
Weeks	High ground saturation leading to high probability of flash floods during next high rainfall event	Alert volunteers and communities, meet with other response agencies to enable better coordination, closely monitor rainfall forecasts
Days	Forecast of heavy rainfall that may result in flash flood	Prepare evacuation, mobilize volunteers, get warnings and instructions out to communities at risk
Hours	Very heavy rainfall almost surely leading to flood	Evacuate

Example 2

Cyclone/ hurricane/ typhoon	Example of early warning	Example of early action
Years	Risk of intense cyclones rising due to climate change More people moving to areas vulnerable to cyclones	Continually update risk maps and identify changing vulnerable groups, recruit additional volunteers, establish new areas of work, work with communities to assess and reduce risk, establish early warning communication systems, evacuation routes and shelters
Months (seasonal)	Forecast of above-average cyclone activity for the coming season	Revisit contingency plans, replenish stocks, inform communities about enhanced risk and what to do if the risk materializes
Weeks	Forecast of likely development of cyclones in a particular stretch of ocean	Alert key staff, pay extra close attention to potential storm warnings
Days	Forecast of a cyclone that is likely to hit a stretch of coast (but not yet where it will make landfall)	Prepare evacuation, mobilize volunteers, get warnings and instructions out to communities, clear trees from around houses, stock batteries, torch, food supplies, radio, etc.
Hours	Cyclone warning: cyclone is about to hit your city	Evacuate to shelters

Example 3

Drought	Example of early warning	Example of early action
Years	Rising risk due to climate change, increase in population in fragile areas, land degradation (for instance, due to overgrazing)	Continually update risk maps and identify changing vulnerable groups, establish new areas of work, work with communities to assess and reduce risk, share successful techniques for adapting
Months (seasonal)	Forecast of food insecurity based on factors such as below-average rainfall, below-average harvests, rising food prices and government instability	Coordinate with government and World Food Programme (WFP), revisit contingency plans, inform communities about enhanced risk and risk mitigation strategies
Weeks	Reports of food shortages in a particular region	Coordinate with government and WFP, distribute food

Example 4

Malaria	Example of early warning	Example of early action
Years	Rising risk of malaria in areas that were malaria free in the past, due to rising temperatures	Continually update risk maps and identify changing vulnerable groups, establish new areas of work, work with communities to assess and reduce risk
Months (seasonal)	Forecast of enhanced risk of malaria outbreaks in particular areas, based on rainfall and temperature (as observed and forecast for the coming months)	Coordinate with government and World Health Organization, revisit health plans, prepare local health and care facilities, sensitize communities about enhanced risk, distribute bed nets
Weeks	Reports of malaria outbreaks in a particular region	Sensitize communities, facilitate access to treatment

Risk assessment and early warning as a basis for early action

Such action, of course, first requires a good understanding of baseline risks and vulnerabilities. Global databases, such as the Centre for Research on the Epidemiology of Disasters' (CRED) EM-DAT and MunichRe's NatCat, and analyses such as that of natural hazard hotspots (Dilley et al., 2005), reveal patterns of past hazards and vulnerabilities that pinpoint high-risk areas and can help to prioritize risk reduction efforts. At a more local scale, the underlying patterns of risk exhibit far more variable characteristics, with risk varying considerably within very small areas. The most vulnerable groups of people, such as migrants moving from rural areas into the cities, often end up in the most risky areas. Accurate risk maps, showing people and assets at risk, can be a key tool to inform plans and activities.

In principle, in the face of changing risks, such assessments should consider not just past data, but also include future projections. This applies to the global and national assessments in the hotspots study, but equally to tools and practices at the local level. Participatory risk assessments, such as the Red Cross Red Crescent's vulnerability and capacity assessment, contain many elements that already look at trends in risk as experienced locally and can be a useful instrument to help communities address rising risks themselves. However, they do not systematically integrate relevant scientific information on such trends. Efforts to improve these linkages are under way, but it has proved difficult to create capacity among facilitators, often Red Cross Red Crescent volunteers, to convey the relevant information adequately to communities. It is especially challenging to go beyond a few pilot cases, where facilitators can be hand-

picked and trained one-on-one by experts, to the large number of such dialogues that are needed (van Aalst, Cannon and Burton, 2008).

One reason for that challenge is that we are not just facing rising risks across the board, we are also facing rising uncertainty. We know the climate is changing, but we do not yet know what precisely to expect in terms of changes in extremes in specific locations – scientists simply do not yet know. In many cases, the direction of the trend may be clear: a higher risk of heatwaves, more variability in rainfall, possibly more intense storms. In some places, climate scenarios provide quite precise and relevant information, for instance on a later start of the rainy season in parts of southern Africa. But in other places, such as large parts of West Africa, even the direction of the trend in average rainfall is uncertain. More generally, at any one place, the implications of general trends (such as average regional rainfall) for local risks (such as local flooding) can be quite unclear. Often, the main message may be: be prepared for more surprises. And that's where the early warnings at shorter timescales come in.

'Regular' weather forecasts and hydrological models do provide more precise knowledge for a specific response, at a timescale of hours or possibly days. Even highly anomalous weather events – much too infrequent and/or localized to obtain reliable statistics from climate models – can be forecast through regular weather forecasting systems. And unusually wet or warm seasons can sometimes be anticipated through the use of seasonal forecasts, which can bridge the short-term weather forecasts and long-term trends in risk. Such forecasts, which are getting better every year, can provide an indication, several months ahead, of likely average conditions and risks of extreme (although only for particular regions and sometimes also certain parts of the years).

For instance, the International Federation of Red Cross and Red Crescent Societies' West and Central Africa zone office has become increasingly concerned about the risk of increasing rainfall variability, in light of a series of heavy rainy seasons as well as general concerns about the rising uncertainties brought on by global climate change. So the zone office has been looking into more systematic use of climate information on shorter timescales. The region started monitoring and applying new tools developed in partnership with the International Research Institute for Climate and Society (IRI) at New York's Columbia University. An IRI intern spent several months in Dakar, Senegal, acting as a bridge between the providers of scientific information and those who could benefit from it and developing better ways of packaging information and using it for decision-making.

Based on that groundwork, the zone office was alerted by a seasonal forecast ahead of the 2008 rainy season, which showed a strongly enhanced risk of heavy rainfall and thus flooding (see Box 3.5). The International Federation used that information, well ahead of the season, to launch an emergency appeal based solely on the imminent threat of flooding in the coming months. Several National Societies were able

Box 3.5 West Africa: bridging timescales for more effective humanitarian flood response

In May 2008, the International Federation's West and Central Africa zone office in Dakar, Senegal, took advantage of the new partnerships with climate professionals on both sides of the Atlantic, including the African Centre of Meteorological Applications for Development (ACMAD) and IRI, to try to prevent history in West and Central Africa repeating itself.

The floods across Africa in 2007 – the continent's year of rains – were the worst in several decades. Hundreds of thousands of people were displaced in nearly 20 countries. Nearly 300 died as a direct consequence of the flooding.

In West Africa, Ghana suffered most. An estimated 400,000 people were affected in one way or another. "Ghanaians never experienced anything like [these] floods," said Mustapha Ali Idris, minister for Ghana's northern region.

A vast swathe of territory from the Atlantic coast to the Red Sea experienced very serious flooding. But part of the tragedy of the 2007 floods in West and Central Africa, emphasized Peter Rees, the International Federation's head of operations support, is that they were forecast.

The most authoritative voice on likely conditions for the July–September rainy season over West Africa emerges from an annual forum of international scientists that, in 2008, was held in the Niger capital, Niamey. The first relevant PRE-SAO (a French acronym for 'seasonal prediction in West Africa') forecast was issued by ACMAD on 21 May 2008, and warned of warm conditions over the tropical Atlantic, with a high probability of 'wet' and 'very wet' conditions.

"All sources – national, regional, international – converged and asserted with one voice that the upcoming season was highly likely to be much wetter than usual over most parts of West Africa," said Arame Tall, a Columbia University graduate student working on climate as

an intern at the Dakar zone office. So when the International Federation's disaster management coordinator in Dakar, Youcef Ait-Chellouche, also noticed that forecasts pointed to above-average rainfall in essentially the same countries that were flooded in 2007, he acted quickly.

A wholly pre-emptive appeal for flood preparedness based on seasonal forecasts, the first of its kind, was issued by the International Federation on 11 July – worth nearly US\$ 750,000 and covering the entire at-risk region. This appeal set a new precedent for donors and the disaster management community.

Even though IRI downgraded the risk slightly in its late July forecast, a whole series of flood events in West Africa quickly made these forecasts seem, to a lay person's eye, almost clairvoyant.

The emergency appeal and a revised version in September enabled the International Federation to provide, according to Ait-Chellouche, "tactical support to National Societies for action during disasters, especially with relief stocks positioned in Dakar, Accra and Yaoundé". In addition, regional disaster response teams were trained for flood response, and learned how to interpret six-day rainfall forecasts that could be used to monitor upcoming flood risks. Visas were requested and medical insurance acquired in advance, so that the teams could be mobilized within 24 hours of a flood emergency.

Based on past flood seasons, explained Ait-Chellouche, the zone office could anticipate the needs of affected people. They would be displaced and need good, drinkable water and household items. Houses would have to be rebuilt or repaired, water sources would be contaminated and sanitation facilities inoperable. Crops would be ruined and access to markets, health-care and other essentials would be minimal due

to collapsed or submerged roads and other infrastructure. The risk of water-borne diseases and malaria would be increased. With this knowledge, the Red Cross Red Crescent was able take appropriate early action that enabled a rapid response when the floods arrived, through pre-positioned supplies, contingency plans and the ability to mobilize trained volunteers quickly.

"While there was no very big emergency, a series of widespread smaller emergencies occurred, especially in Benin and Togo – but together they are just as serious and difficult to manage," said Ait-Chellouche.

He went on to add: "Usually disaster managers have to 'run after the events' and try to do their best to adapt to emerging challenges. Climate information gives the disaster manager a sort of advance and anticipation and helps us to link disaster response to risk reduction activities and build a more integrated approach in disaster management."

Just at the end of the flood season, in September 2008, IRI issued its seasonal precipita-

tion forecast for October, November and December, this time predicting above-average rainfall for the dry season.

The zone office held a community meeting to consider what might be at risk if the dry season was wetter than normal. Farmers quickly raised concerns for crops, mostly nuts and cereals that are typically dried outdoors in these months. If there was going to be rain during this period, the crops could easily rot, putting food security and livelihoods at risk.

In partnership with the World Food Programme and the Food and Agriculture Organization, the zone office identified the exact drying period for certain crops in the region. Staff then contacted regional National Societies, asking them to inform farming communities that rain was possible during the harvest drying time, and they should be prepared to cover or shelter their crops in case of rain, keeping an eye on short-term rainfall forecasts. This simple bit of information enabled many farmers to preserve their drying harvest. ■

to operate much more effectively than if they had just waited for the disaster to happen. The new use of seasonal forecasts, motivated partly by the concerns about increasing uncertainty in rainfall extremes in the face of climate change, resulted in the awareness of the upcoming heavy flood season, passed on from regional to national and local levels. This was followed by much closer monitoring of hydrological conditions and six-day rainfall forecasts, and a better response by several National Societies once the floods arrived – based on warnings and actions at all timescales.

Challenges and opportunities

The potential for better use of early warnings at all timescales is clear, but of course their usefulness depends entirely on the specific context: the quality of the scientific information at various timescales, the type of risk being addressed and the local capacity to act, also in light of other priorities. Nevertheless, some general challenges and opportunities emerge.

Providers of scientific information

Many scientific agencies have a mandate to inform development plans and programmes, and are eager to support humanitarian organizations with new forecasts and tools. However, they often work in a rather supply-driven mindset. They present their information as a given and assume it is self-evidently relevant to the outside world. In practice, many of those early warning products are almost impossible to understand by non-experts. They are often overly technical, sometimes including large uncertainties. As a result, the raw products do not naturally lead humanitarian actors to a decision (such as, “Do we mobilize volunteers in light of the expected flood conditions?”).



Cyclone Nargis hit Myanmar in May 2008 and left more than 135,000 dead. Warnings were given but early action was not possible.

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Simon Mason, an IRI climate scientist, is very much aware of such difficulties. He recently showed a graph in a presentation to humanitarian workers and joked, “While a picture may say a thousand words, a scientific graph often says a thousand incomprehensible words.” This is certainly true for many local Red Cross Red Crescent volunteers, who are the first to respond in times of disasters and also the ones with a long-term relationship of trust with local communities. These people

are the experts on local vulnerabilities, but they are not trained in the interpretation of scientific information. Even among technical staff at national headquarters of Red Cross Red Crescent Societies, in government ministries and in development or humanitarian agencies, several steps need to be taken to get from complex scientific forecasts to operational decisions. Scientists cannot make that translation for the end-users of their information, but neither can they expect the end-users just to pick up the raw science products and run with them. Instead, a continuous dialogue, initially filled with confusion, is needed between providers and users of the information, so that both sides understand its opportunities and limitations.

Challenges for humanitarian organizations

Clearly, the key challenge for humanitarian organizations is the rise in risks by itself. In that context, early warning, early action is not a challenge, but an opportunity. Many humanitarian agencies are aware that it is no longer enough to be prepared for the last disaster, without taking account of significant trends in risk. They are advocating for, and investing in, disaster risk reduction. They are also reviewing their preparedness and response mechanisms based on new information at a range of timescales: translating new information into operational decisions, reviewing contingency plans in light of trends in risk and updating standard procedures to integrate early warnings at longer timescales. None of this is trivial and the dialogue with knowledge providers is not always easy for action-oriented organizations, but it is happening.

People who work at the community level in particular face a special challenge. The example of the community in Mozambique waiting for ants to come out of the ground as their trusted early warning system shows that even a very certain warning based on credible scientific information, passed to a particular community in time, did not have the right effect. Traditionally, people have assumed that the effective functioning of early warning systems requires, firstly, prior knowledge of risks faced by communities and other users of the early warning information; secondly, a technical monitoring and warning service for these risks; thirdly, an effective strategy for dissemination of understandable warnings to those at risk; and finally, knowledge and preparedness to act (Traore and Rogers, 2006). Two additional elements are now needed: awareness that risks are changing (and which new risks may arise) and, especially, a way to communicate new knowledge about future conditions that can be understood and trusted. This requires a long-term dialogue with communities and local institutions that may not immediately trust outside information about one of the few things they consider themselves experts on – what to expect from the local weather and climate.

Such dialogues now need to be built into the work of humanitarian organizations working at community level. Many pilot programmes linking disaster risk reduc-

tion and community-based adaptation, sometimes supported by the Red Cross Red Crescent or international non-governmental organizations (NGOs), such as Practical Action, CARE, Cordaid and others, have demonstrated the effectiveness of such approaches. The challenge now is to scale up and reach beyond a few pilot communities.

Another more general challenge for humanitarian organizations links to that of donor agencies: mobilizing financial resources for early action, including long-term risk reduction and preparedness ahead of imminent disasters rather than just response after the fact.

Challenges for the donor community

Donor agencies, for their part, can no longer afford to provide funding for disasters primarily after the fact, for relief, recovery and reconstruction. The cost is rising and compromising regular development investments. Both development assistance and humanitarian action can be made more effective by increased emphasis on early action (see Box 3.6.)

Box 3.6 Early action pays

There are relatively few good quantitative economic analyses of the benefits of investments in early action. But where such analysis has been done, the evidence is overwhelming: the cost-benefit ratio of disaster risk reduction ranges from 1:2 to 1:4 (Mechler, 2005; several examples are also provided by the ProVention Consortium, 2009).

In the Pacific, for instance, the benefits of early action to reduce disaster risk to development are demonstrated by two cyclones in Samoa. In 1991, Cyclone Val caused damage of 230 per cent of real gross domestic product (GDP). Three years later, Cyclone Heta resulted in damages amounting to 'just' 9 per cent of GDP. This difference is, of course, partly caused by the track of the storm (even though Heta was in fact a more powerful storm at 170 knots compared to 140 for Val), but also by the investments in risk management after Val (World Bank, 2004).

According to the World Bank: "Shoreline protection systems designed to cyclone standards

performed well, with relatively minor damage, compared to sub-standard coastal protection systems in adjacent areas" (Bettencourt et al., 2006).

Several analyses of risk management options for infrastructure and buildings in the Caribbean support that conclusion. For instance, the costs of adjustments in the design of a deepwater port in Dominica would have cost only 28 per cent of the repair costs after it was damaged by tropical storms (US Agency for International Development and Organization of American States, 1998).

For the United States, according to the US Multi-Hazard Mitigation Council: "On average, a dollar spent by FEMA [US Federal Emergency Management Agency] on hazard mitigation (actions to reduce disaster losses) provides the nation with about \$4 in future benefits. In addition, FEMA grants to mitigate the effects of floods, hurricanes, tornados and earthquakes between 1993 and 2003 would save more than 220 lives and prevent almost 4,700 injuries over

approximately 50 years” (Multihazard Mitigation Council, 2005). And these analyses were not restricted to large-scale infrastructure. In case study analyses, community early warning systems resulted in benefit–cost ratios of the order of 17.9 (Freeport) and 3.5 (Jefferson County).

These results match similar analyses in developing countries. For instance, small-scale mitigation works in Nepal (building of check dams to prevent erosion and save land and crops), carried out by the Nepal Red Cross with support from the British Red Cross, provided a benefit–cost ratio of 18.6 (Venton et al., 2008).

For humanitarian response, there are very few clear quantitative analyses of the economic benefits of early action. Many key benefits come not just as cost–benefit analyses, but in terms of absolute numbers of lives saved and injuries avoided – a much more central measure of success for humanitarian organizations. A clear example is Mozambique, where substantial investments in disaster risk reduction and preparedness prevented a repeat of the disaster of 2000 when similar floods appeared in 2007 and 2008 – through mass evacuations.

Both effectiveness and efficiency do matter, and it is clear that in many cases, early action

helps on both fronts. And earlier action, based for instance on seasonal forecasts of a heavy flood season rather than a flood occurring just hours after a warning, holds particular potential for cost savings and increases in effectiveness. For instance, a seasonal forecast may allow the purchase, and pre-positioning in flood-prone areas, of water purification tablets and other flood emergency supplies months in advance. They can then be shipped to likely affected areas based on a six-day forecast, and immediately put to use just before and during the actual emergency.

In contrast, the traditional response, waiting for the emergency to occur and then flying in the tablets from much further away, not only takes longer, but also results in higher procurement and transportation costs. As an example, preliminary analyses of the 2008 West Africa flood response by Red Cross Societies in the region, which was supported by a regional preparedness appeal based on a seasonal forecast of likely extreme rainfall, suggest that the combined cost of preparedness and response per beneficiary was about a third lower than the costs of response alone in 2007, the previous heavy flood season (Braman, 2009). ■

Regular development financing should, first, pay more attention to risk reduction – as an investment opportunity with good development benefits rather than just an additional upfront cost. Ideally, such investments would be integrated in regular sectoral development investments or community-level livelihoods programmes. Indeed, many countries have affirmed their commitment to risk reduction through the Hyogo Framework for Action, supported by the United Nations International Strategy for Disaster Reduction (UNISDR). International mechanisms such as the Global Facility for Disaster Reduction and Recovery are starting to address some of the need for additional investments in risk reduction, particularly by mainstreaming it into regular development. Compared to disaster damages and spending on relief, recovery and reconstruction, however, such efforts still remain limited.

There are also implications for humanitarian financing. The rising number of disasters (see Chapter 5, Figure 5.1, and CRED data in Annex 1) leaves the humanitarian departments in donor agencies little flexibility: every dollar available is needed for immediate humanitarian relief, the demand for which has been growing steadily.

Even though the disaster risk reduction agenda is often also part of these departments' responsibility, their most appropriate response to the rising risks should not be to reallocate the financial support that is needed for humanitarian assistance but rather to become advocates for risk reduction, financed through regular development investment channels.

An additional reason to look for other channels for funding for risk reduction, and not just the humanitarian aid departments in development agencies, is that these do not have the links to central sectoral development planning that are required to integrate risk reduction properly. Also, their funding modalities are focused on short relief projects rather than sustainable risk reduction. Even the World Bank, which does not provide relief immediately after disasters but plays a major role in post-emergency reconstruction, has concluded that despite the increased awareness for the need for risk reduction just after a disaster, such reconstruction projects may not always be the best vehicle for risk reduction investments, due to their limited duration and the (justified) focus on simply getting infrastructure back in place and the economy back on track (World Bank Independent Evaluation Group, 2006).

But besides becoming better advocates for disaster risk reduction, donors should ensure that every single dollar spent on relief is spent as effectively as possible. This can be achieved by better use of early warning information for early action in terms of disaster preparedness and response. Such action does require additional flexibility in humanitarian financing. Donors should support continuous revision of contingency plans and updates of emergency stocks in strategic locations. More importantly, they should finance preparedness based on credible warnings of imminent hazards, hours, days, sometimes even months ahead of an expected event, well before the graphic media headlines. In some cases, early action may even prevent a hazard from ever becoming a disaster. What should count is that more lives are saved and more adverse consequences avoided, often at lower cost.

However, when supporting such early action, donors should also accept some uncertainty. A few hours in advance, meteorologists usually know quite well where and when a large storm will hit – but by then it may be too late for some of the most effective actions. With a few more hours' or even days' anticipation, there may be signs of an extreme event becoming more likely, allowing preparations for a much more effective response. Several months in advance, the best information available may say that a storm season is very likely to be relatively intense, with an increased risk in all areas that could potentially be hit – not where and when a disaster will occur. But there is

no need to wait for that complete certainty. Knowing that a risk is substantially higher than normal does justify a higher level of alert, particularly preparing to take early actions that will be useful regardless of when and where the disaster strikes (which may include seemingly mundane measures such as getting visas for trained responders from neighbouring countries to accelerate response or establishing emergency stocks within a region at risk).

Such early action, based not on information about disasters already unfolding but early warnings of imminent crisis, saves more lives and livelihoods, but also results in more cost-effective relief operations. For instance, water purification tablets save lives by preventing the spread of water-borne diseases after flood events. Stocks of such tablets established at strategic locations in a region ahead of an expected heavy flood season will, once somewhere in the region is flooded, not only reach the intended beneficiaries faster, but also at much lower cost than if they were to be flown in with a dedicated cargo flight from an international hub. However, acting on risk information only, rather than responding after a disaster, does mean that the early warning will sometimes get it 'wrong'. For instance, a forecast of an 8 per cent likelihood that there will be an especially heavy flood season or hurricane-force winds at a certain time and place means simply that these conditions are very likely to occur. There is no certainty. In fact, based on this forecast, we actually expect the predicted conditions not to happen in 20 per cent of the cases. This is a risk: will people still respond the next time around if nothing happened after the previous warning? The only solution is to be honest and explicit about the uncertainties, but not to let that stand in the way of decisive early action. Typically, such early action in the face of uncertainty would include awareness-raising, closer monitoring of emerging hazards, as well as no-regrets measures which remain of use even if the immediate risk does not materialize, such as capacity-building, emergency stocks and community-based risk reduction – all of which reduce the potential impact of future hazards for years to come.

Conclusion

Practical early action, based on early warnings at all timescales, pays off. There is no crystal ball to predict far into the future when and where individual disasters will occur, but there is a lot we do know. It is like rolling a dice: we never know when a particular number will appear, but at some point every number comes up. Confronted with global warming and growing vulnerability, we also know the dice is loaded. A growing range of early warnings can tell us how, by predicting patterns, trends and seasonal risk of individual events. Early action, making the best use of that full range of information, offers the best hope of beating the odds, anticipating the upcoming sides of the loaded dice.

This chapter and Box 3.6 were written by Maarten van Aalst, associate director of the Red Cross Red Crescent Climate Centre. Box 3.1 was written by Sue Armstrong, a UK-based

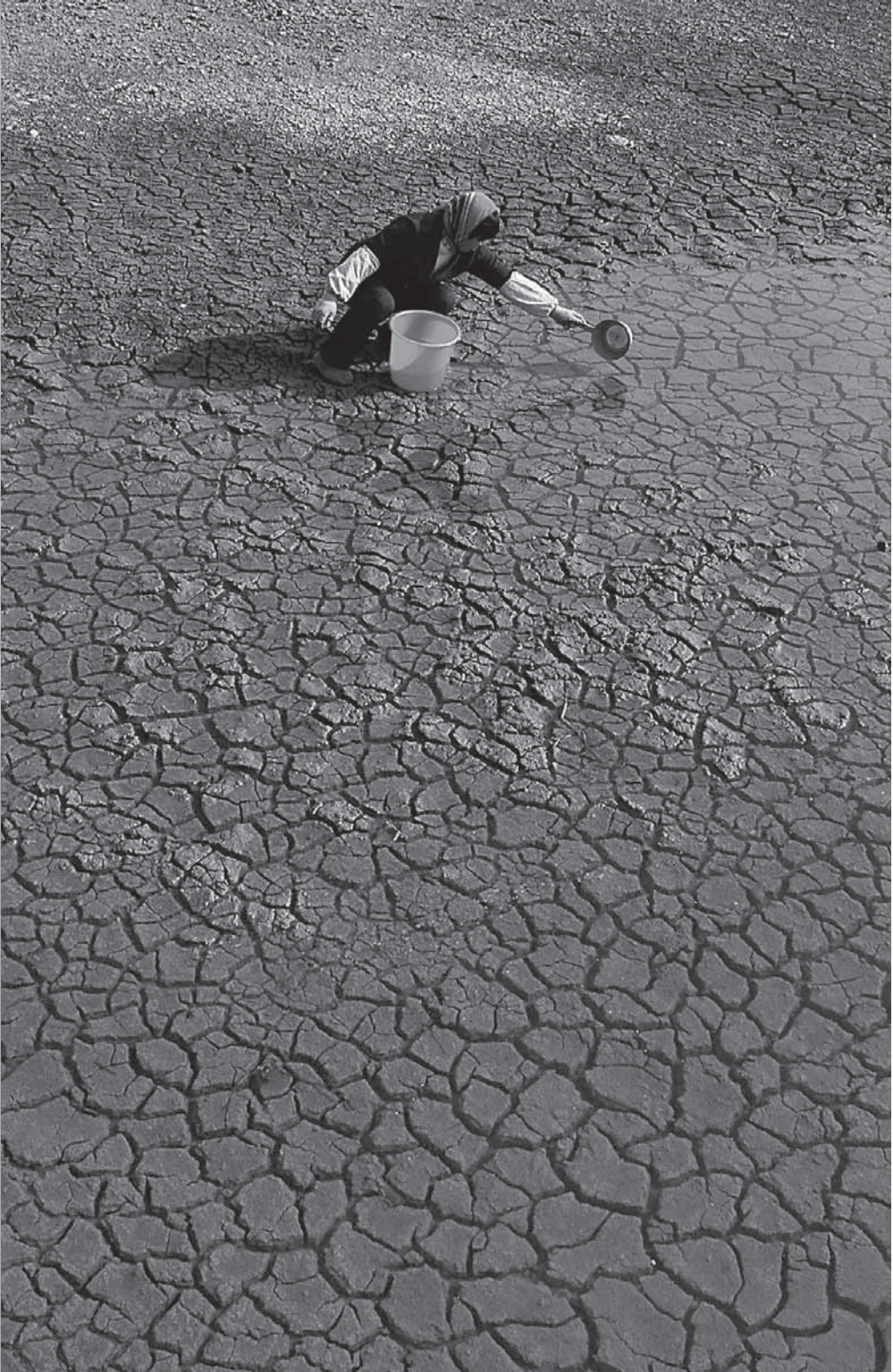
CHAPTER 3

writer on health and science. Farokh Parsizadeh, research associate at the International Institute of Earthquake Engineering and Seismology, Iran, wrote Box 3.2. David Marcon, who is national health promotion officer at the French Red Cross's Social Welfare Department, contributed Box 3.3. Elizabeth Soulié, at the International Federation in Geneva, wrote Box 3.4. Box 3.5 was written by Alex Wynter, a freelance journalist working for the Red Cross Red Crescent Climate Centre, with inputs from Youcef Ait-Chellouche, disaster management coordinator for the International Federation's West and Central Africa zone office, and Lisette Braman, consultant to the zone office and the Red Cross Red Crescent Climate Centre.

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Climate change – the early warning

Climate change is offering us the ultimate early warning. There is a vast amount of scientific evidence uniting experts the world over, which points to a highly changeable climate for the coming decades and beyond. True, there are uncertainties attached to these predictions, but it is very likely that extreme weather events – floods, droughts and storms – will become both more frequent and more severe. They may occur in areas where they were previously either unknown or extremely rare. Sea levels will rise as ice caps melt. These, and perhaps other unknown changes in the world's climate, will increase the risk of climate-related disasters.

We know more about this impending 'disaster' than any other in history. It potentially threatens more lives and livelihoods than any other disaster the world has faced. But are we acting on this early warning? So far, the risk posed by climate change has been addressed on a piecemeal basis. Some countries and communities are well on the way to protecting themselves; others, though often aware of the danger, have no means to act.

The latter are mostly the poorest countries and communities around the world, and they are already struggling with the effects of climate in their day-to-day lives. In sub-Saharan Africa, for example, a large proportion of the population is dependent upon small-scale rain-fed agriculture and is therefore highly vulnerable to drought. People's homes are generally not built to withstand extreme weather, and they are unable to take out insurance to protect themselves financially. Yet paradoxically, they are the people least responsible for climate change, which is almost entirely due to fossil fuel use in developed countries.

The threat of disaster resulting from climate change is twofold. First, individual extreme events will devastate vulnerable communities in their path. If population growth is factored in, many more people may be at significant risk. Together, these events add up to potentially the most significant threat to human progress that the world has seen. Second, climate change will compound the already complex problems of poor countries, and could contribute to a downward development spiral for millions of people, even greater than has already been experienced.

According to the United Nations Development Programme (UNDP) in its *Human Development Report 2007/2008*: "As the incremental risks created by climate change intensify over time, they will interact with existing structures of disadvantage. Prospects for sustained human development in the years and decades after the 2015 target date for the MDGs [Millennium Development Goals] are directly threatened" (UNDP, 2007).

Photo opposite page:
A resident collects
rainwater from a dried-
up reservoir on the
outskirts of Yingtan
in Jiangxi province,
central China.

© REUTERS

Action is needed on two levels. Effective early warning systems (EWS) can reduce the impact of individual extreme events, and such systems need to be in place. But more important is action to reduce vulnerability over the longer term, so that communities are able to cope with climate variability and extremes, and unpredictability, and continue to prosper in spite of them. That unpredictability is perhaps the most immediate challenge that climate change brings – and already people are struggling to cope with weather patterns they no longer recognize. “It’s cold when it should be warm and warm when it should be cold,” said a fisherman in Tonga (see Box 4.1).

Box 4.1 Talking change: the interface between science and experience

Community members on the remote Pacific island atoll of Ha’apai in Tonga had never heard of the term ‘climate change’ before. But it turns out they knew more about it than they could ever imagine. “The initial introduction to climate change can be challenging to present and I have to change the message according to what people can understand,” says Peti Viokoso of the Tonga Red Cross Society. “I have to make sure we get to the point where we are speaking the same language, but once people begin to talk about the changes they have noticed to their surrounding environments, they don’t stop giving examples.” Talking about climate change when presenting the Red Cross’s disaster preparedness and first-aid programme means that people can begin to understand one of the factors that is influencing their lives.

Fishermen use traditional knowledge about the seas, taught to them by their fathers and passed to their fathers by their fathers’ father. But things are all wrong these days, they say; the fish are confused and not breeding when

they would usually breed. It becomes difficult to know when is the right time to fish for different types of fish because they are no longer behaving as they used to. “People in the communities very much rely on resources that are vulnerable to changes caused by climate change,” explains Veikoso. “For example, in the outer islands, people are dependent on the sea’s resources as their main source of income. However, changes in weather patterns cause disruptions to these and this causes more vulnerability.”

Using tools such as seasonal calendars and historical timelines also resulted in further stories and more discussion about climate change. Local communities noticed changes in flowering and fruiting times of plants. They told the Tonga Red Cross about them – and began to realize that some of the changes could be caused by global warming. These sorts of anecdotes can be fed into the development of national adaptation plans for dealing with climate change to ensure that they are based on the needs and concerns of communities. ■

Mainstreaming climate risk management is the main early action that is needed. In fact, people already practise climate risk management in the broad sense. Farmers use weather forecasts or traditional methods to predict when the rains will come, and use this information when making climate-sensitive decisions such as when to sow and when to apply fertilizer. If possible, people site their homes away from flood plains. In other words, people try to minimize the risks the climate poses to them. But the

term ‘climate risk management’ has also been used more recently to mean a more systematic approach to incorporating climate into decision-making. As climate change begins to make its presence felt, such an approach can help people and organizations at all levels to cope better with climate and its uncertainties.

Climate risk management has emerged in direct response to the threat of future climate change, yet it is firmly rooted in the present. The rationale behind climate risk management is improved management of climate risk *today*, as a way of preparing to manage future risks. Those future risks may be largely unknown, but by learning to incorporate climate risk into decision-making now, we are paving the way for development to continue and people to prosper, whatever the climate brings tomorrow. Climate risk management is essentially early action for climate change.

However, there is still a need for greater coordination between two communities, the newer one of climate change adaptation and the older one of disaster risk reduction:

“Although the relationship between disaster risk reduction and climate change adaptation is increasingly recognized by researchers, policy makers and practitioners within both communities, the two communities have yet to develop coordinated efforts towards reducing climate change risks and vulnerability, which includes increasing the capacity to cope with and adapt to rapid changes, complex emergencies, and considerable uncertainty about the future. Thus far, many of the discussions taking place on adaptation to climate change are not well-informed by disaster risk reduction strategies, tools, frameworks and experiences.

“At the same time, the disaster risk community has not fully incorporated climate change dimensions and information on climate impacts into its work. The risk of more complex, frequent, intense or unpredictable extreme weather events associated with global temperature increases, changing precipitation patterns and sea-level rise, coupled with both gradual and non-linear changes to ecosystems and natural resources, suggests the need for a renewed focus on the ways that disaster risk reduction and adaptation can influence the context in which climate change occurs.”

(O’Brien et al., 2008)

Adaptation entered into the United Nations Framework Convention on Climate Change (UNFCCC) agenda in 2007 when an action plan was adopted at the Bali (Indonesia) climate change conference. At the 2008 climate change conference, held in Poznan, Poland, adaptation was strongly addressed and the humanitarian agencies of the Inter-Agency Standing Committee (IASC) were much in evidence stressing the

humanitarian impacts of climate change and the importance of adaptation actions chiefly around disaster risk reduction. The strengthened cooperation of the IASC agencies was manifest in meetings with climate negotiators to raise awareness of risk management and risk reduction as key components of adaptation actions. IASC agencies not only agreed on the priorities, they also submitted a paper to the UNFCCC's ad hoc working group to promote concerted action around four key recommendations (IASC, 2008):

- Recognize the necessity and relevance of disaster risk reduction strategies and risk management mechanisms as a first line of defence against the impacts of climate change. Such strategies and mechanisms are particularly relevant in the immediate term, while capacity to address longer-term adaptation strategies and programmes is being developed.
- Build upon existing strategies and mechanisms for disaster risk reduction and risk management. Ensure that UNFCCC institutional enabling environments and regional supporting mechanisms for knowledge-sharing, capacity-building and technology support, build on existing mechanisms, tools and capacities for disaster risk reduction.
- Take account of, and manage, the humanitarian consequences of climate change and protect human security, through the systematic reduction of disaster risks. This must include not only prioritizing social and economic development, but also strengthening emergency preparedness, response and recovery mechanisms at all levels.
- Ensure that substantial and additional human and financial resources are available for disaster risk reduction and risk management. Ensure that the criteria for funding are consistent with the priorities of the Hyogo Framework for Action.

Climate change and disasters: facts and predictions

What do we know about the future climate? Normally, we base our expectations for the future on what has happened before, but with climate change in the picture we can no longer simply extrapolate from the past. Instead, we can take what we know about the past and combine it with the best that science can offer to try and predict the likely future.

There is no doubt that climate change is already with us. Because of the greenhouse gases we have released into the atmosphere since humans began burning first coal and then oil, the global average temperature is rising at a rate faster than ever before measured. Temperatures are currently an average of 0.7°C higher than they were 100 years ago, and 11 of the 12 warmest years since 1850 occurred between 1995 and 2006. These temperature changes have been accompanied by distinct changes in rainfall patterns, more frequent and more severe extreme weather events, and a rise in sea levels (IPCC, 2007).

What will happen next? We know that the 'stock' of greenhouse gases currently in the atmosphere will cause temperatures to continue to rise for many decades, even if all emissions were stopped today. An increase of 2°C over pre-industrial levels is broadly agreed to be a critical 'tipping' point, beyond which dangerous climate change becomes increasingly likely. How much the temperature actually rises will largely depend on national and international mitigation efforts in the coming years (see Box 4.2), but most scenarios are bleak (IPCC, 2007).

Box 4.2 Mitigating the effects of climate change

Climate change is already with us, but the challenges we may face in the future depend to a large extent on measures taken now to reduce greenhouse gas emissions into the atmosphere. While everyone is talking about mitigation, however, action is lagging far behind.

Fundamentally, we need to start using alternative, cleaner energies and, where we do burn fossil fuels, we must use them much more efficiently. There are already many options, from hybrid and electric cars, to more energy-efficient appliances, to solar, wind and tidal power. Energy efficiency and conservation need to be placed at the heart of transport, construction, urban planning and manufacturing.

A new technology, which 'captures' carbon and stores it so that it does not reach the atmosphere as carbon dioxide, is ready and waiting for large-scale trials. Another vital approach is to conserve natural 'sinks' that hold carbon – forests in particular, but also grasslands and soils.

A concerted effort is needed to motivate people, businesses and governments to embrace the changes needed. Developed countries, which are almost entirely responsible for the greenhouse gases released into the atmosphere so far, should be leading the way. Targets for cutting emissions need to be backed up by new energy policies that make the targets achievable. Some countries have such policies in place, but most do not.

A starting point is to put a price on carbon – either directly through a tax on carbon emissions or through a 'cap-and-trade' system. Under such a system, a government sets an overall carbon 'allowance' and businesses can trade their parts of that allowance; those who can reduce emissions can sell their part of the allowance to others, hence there is an incentive to reduce emissions.

These measures are appropriate for developed countries, as they have the necessary resources and access to technologies. It is a very different story for most developing countries where many people do not have electricity in their homes and have no option other than to cook over open fires. The approach needed here is to combine sustainable development with mitigation efforts, and this offers 'win-win' opportunities. Saving the rainforests will conserve biodiversity and open up livelihood options, for example, and improved energy efficiency has many development benefits, not least economic.

Action is needed at all levels, from individuals and communities to governments and beyond. The problem is a global one; actions must be coordinated within a coherent framework at international level. The Kyoto Protocol was an attempt to provide this, but waning commitment undermined its impact. Now, the next phase is being negotiated. Will the world finally unite to address climate change seriously? Failing to do so could be disastrous. ■

The consequences of these higher average temperatures on the climate have been the subject of much debate, but there is now general agreement among climate scientists on what we might expect (see Table 4.1). Droughts, floods, storms and heatwaves all look set to increase, in both frequency and severity. Sea levels will continue to rise. It is important to note, however, that things may be much worse than these predictions. The real threat is a destabilized global climate with catastrophic ecological, economic and social impacts. Climate scientists are talking about ‘surprises’ – both ‘imaginable surprises’ but also ‘true surprises’.

Table 4.1 Recent trends and projections for extreme weather events for which there is an observed late 20th century trend

Phenomenon and direction of trend	Likelihood of future trend based on projections for the 21st century
Warm spells/heatwaves – frequency increase	Very likely*
Heavy precipitation events – frequency increase, or proportion of total rainfall from heavy falls increase	Very likely
Area affected by drought – increase	Likely
Intense tropical cyclone activity – increase	Likely
Extreme high sea level (includes tsunamis) – incidence increase	Likely

Source: Adapted from IPCC, 2007

*Very likely = >90% probability of occurrence, according to expert judgement. Likely = >66% probability of occurrence.

While scientists are anticipating surprises, many people are already living with them. Across the world, weather patterns that people once knew and relied upon are changing. Floods are higher than ever before, cyclones are threatening areas that were previously safe and droughts are affecting more regions and more people. And where people are taken by surprise they are usually unprepared and vulnerable.

Climate information

“In planning for adaptation to climate change, information is power” (UNDP, 2007). Climate information comes in various forms. Potentially the most useful is forecasts. These are produced by various climate science groups around the world, for different periods from just a few hours ahead to seasonal forecasts up to three months in the future, and beyond for climate change projections. There is obviously an inverse relationship between the reliability of forecasts and their distance into the future, which is captured to some extent in probability estimates. Short-term forecasts are important for decision-making during unfolding disasters. They can save lives. But

longer-term forecasts offer great opportunities for early action ahead of a climate threat; they can save crops and livelihoods, homes and infrastructure. Seasonal forecasts may be particularly useful – for farmers before the growing season and for emergency and medical services prior to the cyclone season, for example. These are derived from sea and land surface temperatures, to which the atmosphere has been shown to respond slowly over several months. Scientific and technical progress in recent years has greatly increased our understanding of the climate system and enhanced this level of forecasting (though there will always be uncertainties).

The other main types of climate information are historical data and real-time data, which are important for setting a context for current and future weather and for identifying trends, among other things.

Despite its importance, climate information is currently one of the ‘weakest links’ in climate risk management. The problem is fourfold. Much of the information that exists fails to reach potential users in a useable format (if at all), information is lacking about some of the regions of the world where it is most needed, the information is normally too technical for end-users and in most situations the information users have no proper resources to act or utilize the information they receive. All these problems can in fact be addressed relatively easily; all that is needed is commitment and funding.

Information where it’s needed

How can existing information reach those who need it? An example from Mali shows how it can be done. For the last 25 years, a group of farmers has been involved in a project that supplies them directly with weather information and advice to help them with critical decisions, such as when to sow seed and when to apply fertilizer.

The information comes from a variety of sources – the African Centre of Meteorological Application for Development, the International Research Institute for Climate and Society (IRI), the national meteorological service, the World Meteorological Organization (WMO), extension agents and farmers themselves who have rain gauges in their fields. The information is ‘processed’ by a technical team and provided as weather forecasts and practical advice to farmers, mainly through local radio. Yields and incomes have been shown to be higher as a result (IRI, 2007).

Regional climate outlook forums (RCOFs) provide another good example of getting climate information to those who need it; in this case, seasonal forecasts to sector planners and decision-makers. Facilitated by WMO and pioneered in Africa, the RCOF process begins with meetings of regional and international climate experts to agree on a regional forecast for the season ahead. The forum itself then brings together climate scientists and representatives from the user sectors to identify impacts and

implications of the forecast and to develop appropriate responses. Training workshops on seasonal climate prediction are also part of the process, to strengthen the capacity of national and regional climate scientists, as well as special outreach sessions involving the media, to develop effective communications strategies.

Many parts of the developing world now benefit from RCOFs, but there is still a need to scale up further to cover all countries and to improve the usability of information for end-users. Meanwhile in some areas, as a 'spin-off' from the RCOFs, specialized sector-oriented forums have been set up, such as malaria outlook forums in Africa.

Addressing the second information constraint – lack of information – is perhaps more straightforward. More weather stations are desperately needed in most developing countries. In Africa, for example, there is on average just one-eighth of the number of stations recommended by WMO (Washington et al., 2006). This lack of stations is perhaps not surprisingly accompanied by a lack of capacity in climate services – people who have the skills to collect, analyse and process climate data into useable formats. Again, commitment and funding can solve the problem.

Global trends complicating climate change effects

Whether the changing climate, with all its uncertainties, contributes to more disasters that affect more people, does not depend merely on what happens with the weather. Climate change and the accompanying risks will be superimposed on an unequal world, where vulnerability to disasters is directly linked to poverty. There are also other global trends that further complicate the picture.

Population growth is perhaps the most obvious. The population explosion of the 20th century is predicted to continue until at least the middle of the current century, with most of the growth happening in less developed parts of the world – where 80 per cent of the world's population were already living by the end of the 20th century. More people will need more resources, and the limited resources that exist are already under threat from unsustainable use.

This is before climate change is factored into the equation. There will be many millions more people on the planet in the coming decades. The question is, will they be millions more people who are vulnerable to climate disasters or will they have the knowledge and capacity to cope with whatever the climate presents?

Linked to population growth and unsustainable development practices are a range of worrying environmental trends, such as loss of biodiversity, changes in hydrological systems and freshwater supplies, desertification and land degradation. In the words of the World Resources Institute (2008):

“Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fibre and fuel. This has resulted in a substantial and largely irreversible loss in the diversity of life on Earth.

“The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of non-linear changes, and the exacerbation of poverty for some groups of people. These problems, unless addressed, will substantially diminish the benefits that future generations obtain from ecosystems.

“The degradation of ecosystem services could grow significantly worse during the first half of this century and is a barrier to achieving the Millennium Development Goals.”

Climate change, therefore, is just one of several global trends that threaten the stability and sustainability of our planet. Addressing any one trend in isolation is not the way forward. What is needed is an integrated approach that gets to the heart of the policy failures and inequalities that have contributed to these problems and that leave many people vulnerable to their impacts. Climate risk management offers a starting point from the climate perspective, but it will need to be integrated into a broader sustainable development strategy that addresses the failures of current approaches.

Climate risk management

Climate risk management is about incorporating climate into decision-making at all levels. It is about enabling and supporting the use of climate and related information by decision-makers, and particularly those who are directly at risk from the climate. With this information, people can make better decisions. They can learn to cope with increasing climate variability day to day. They can protect themselves in advance of extreme weather, but can also take advantage of favourable weather and can learn to address the issue of uncertainty.

Climate risk management is important for all climate-sensitive sectors, including agriculture, food security, water resources and health, as well as for climate-related disaster risk reduction. Agriculture, for example, is highly dependent on the climate and farming communities are often vulnerable to climate extremes, such as drought or flooding. Yet, as IRI points out, “Agricultural crises can often be predicted. Responses can be planned and executed before the adverse impacts of climate shocks result in hunger or famine” (IRI, 2007). If climate information can be routinely included in

planning and decision-making, farmers can not only cope with changes in the weather, but may also be able to benefit (see Chapter 5). Weather forecasts are obviously potentially very useful, but risk transfer tools such as index insurance may also have an important role (see Box 4.3).

Box 4.3 Managing weather 'surprises' through index insurance

Insurance plays a major role in helping people cope with climate-related disasters, but only in certain parts of the world. In developing countries those who are most vulnerable to disasters are generally unable to insure themselves. But this may change with a new type of insurance, called index insurance, which is currently at pilot project stage in several developing countries.

Index insurance is different from traditional insurance in that it pays out in response to the weather itself (through an index), rather than to a consequence of the weather, such as crop failure. A simple weather index is rainfall where, for example, the insurance aims to protect a small-scale farmer against drought. The insurance pays out if the rainfall over the growing season is below an agreed threshold. This is obviously very closely aligned to crop failure, but doing it this way has several distinct advantages for developing countries. An important one is that transaction costs are kept low; high transaction costs are one of the main limitations to insurance markets in developing countries. With traditional crop insurance, insurance company representatives must visit the farmers' fields to verify crop damage, but this is not needed with index insurance. Instead, reliable weather data are needed, for example from a nearby weather station. Thus index insurance is financially more viable both for private sector insurers and for small farmers.

Another benefit is that payouts can be made quickly, so that farmers avoid having to sell assets to survive during a crisis. And, if farmers are insured, lenders are much more likely to extend credit to them so they can buy fertilizer,

for example, and increase crop yields when the weather is good. For these reasons, index insurance has a role in helping people out of poverty traps, as well as through crises.

The first project in Africa began in Malawi in 2005. Groundnut farmers who farmed within 20 kilometres of a weather station were able to insure themselves against drought through a rainfall index-linked contract. If the rainfall data from the nearest weather station showed a deficit in one or more critical stages of the growing season, the insurance paid out. The insurance was combined with a loan scheme. Over the following two years, the project was extended to maize and tobacco farmers. Still in the early stages, the project has revealed some limitations of index insurance, but it also shows a great deal of promise. Quent Mukhwimba is one of the farmers in the project. He has been able to improve his yields in good seasons by using his loan to buy improved seeds, and is doubly pleased because "in case of severe drought, I do not have to worry about paying back loans in addition to looking for food to feed my family".

Another project in India, which began in 2003, has successfully scaled up and now has more than 100,000 clients. Contracts have been improved over time and include cover against low or high rainfall, extreme temperature variations and weather-linked diseases, among others.

It is not only farmers who can benefit from index insurance. Governments can also take out index-based insurance so that they can

quickly mobilize funds in the event of a disaster. Normally, governments must wait until a crisis happens before declaring a state of emergency and waiting for donors to respond. By the time relief aid comes through, people have often had to sell their assets and have lost their livelihoods. With index insurance, funds are available much more quickly and can save livelihoods as well as lives.

The Ethiopian government, with the World Food Programme, is currently piloting this approach. They have developed a 'livelihood loss' index that reflects crop (and income) losses at different stages of the growing season if the rains fail. The insurance is helping bridge a gap between early warning and early action, by ensuring funds are available when they are needed.

Index insurance is, however, far from being a simple solution. Contracts must be drawn up on an individual basis and the client needs to fully understand what she or he is – and is not – covered against. Basis risk (when insurance payouts do not correlate with actual losses, that is, there are losses but no payout or a payout is triggered even though there are no losses) confounds the process. Good weather data are needed, but are not always available in developing countries. Capacity-building will also be critical so that index insurance can be managed at the local level. Furthermore, a regulatory framework is needed. However, if these hurdles can be overcome and index insurance successfully scaled up, it could have a wide-scale impact on many people's lives. ■

Water resources will need careful, climate-sensitive planning in the years ahead. Population growth and urbanization are already challenging water management systems in many parts of the world. Climate risk management can promote more efficient use of water resources and reduce the impacts of climate change.

Many infectious diseases are affected by climate. Here, climate risk management can save lives in the very immediate sense. Malaria epidemics, for example, occur when conditions are favourable for the mosquito that carries the parasite.

An early warning of these conditions through forecasting means that early action can be taken: medical supplies and treatment centres can be ready and waiting ahead of the epidemic, for example (see Box 1.5 in Chapter 1).

Climate risk management can play a critical role in preparedness for climate-related disasters. In the Pacific region, for example, it is recognized that:

“The most effective instruments for risk management of natural hazards are those that address current risks. The adverse consequences of storm surges, king tides [unusually high tides], tsunamis and cyclones need to be addressed now through hazard mapping, vulnerability assessments and assets-at-risk inventories. Coastal assets and infrastructure can be protected now rather than repaired after damage from extreme events.”
(Bettencourt et al., 2006)

Here, climate risk management may mean building additional robustness into infrastructure, ahead of extreme climate events that may not have been seen before. With sudden-onset climate-related disasters in particular, the unexpected needs to be anticipated and catered for as part of early action.

According to the Red Cross Red Crescent Climate Centre (2007), climate change “does not mean that we need new programmes...The new reality requires only that climate change be mainstreamed into disaster management, health and care, as well as other weather-sensitive areas of work (such as food security or water and sanitation).” This is climate risk management in action.

Dealing with ‘surprises’

Facilitating access to, and understanding of, climate and related information is the crux of climate risk management and will be vital in the years to come to help people deal with variable and extreme climate.

But how can ‘surprises’ be built into this approach? By definition they are unexpected, so how can we prepare for them? “Preparing for the unpredictable is what is called for” (Red Cross Red Crescent Climate Centre, 2007).



Unpredicted and unexpected weather is already becoming a part of life for many people in climate ‘danger zones’. “I don’t remember we ever had floods like this before. The water rose so quickly to four metres, reaching our second floor,” said Deasy Sujatiningrani of the floods that hit Jakarta, Indonesia in February 2007.

Far away in Kenya, “the weather is upside down” according to Abdishakur Othowai Abdulla, drought project manager for the Kenya Red Cross Society. “In the months that used to be rainy there may not be rain,” he said. “The winters that used to be cold are no longer cold. When it rains it floods and that kills people. When it doesn’t rain there’s a drought and that kills people, too.”

Not surprisingly, people are struggling to understand these changes. Unexpected events are challenging traditional knowledge, for example on when to plant or harvest. Traditional early warning systems are also no longer reliable (see Chapter 3).

The challenge may be essentially one of communication. Where traditional methods have been undermined by rapid change, science could step into the breach, but only if people can access and understand it. In Mozambique, farmers watched a video on climate change, which helped them to understand that they were not being ‘punished by God’, and that climate change was occurring around the world.

With information and understanding comes empowerment, enabling us to face surprises. But surprises are almost always multi-faceted and, as such, need to be addressed in a holistic approach. An Indonesian Red Cross Society project is showing how climate can be included in the ‘real-life’ picture, along with other risks people face day to day.

Over 100,000 people living in slum areas of Jakarta are the focus of the programme. Increased flooding is the main threat climate change brings, but there are several ‘causes and effects’ that play their part and cannot be ignored. Vulnerability to flooding is due to diverse physical and social factors, such as poverty and living in low-lying areas, while the floods threaten agriculture and fisheries, infrastructure and transportation, drinking water supplies and health, among others.

Combining community-based risk reduction activities with microfinance, the programme aims to help people anticipate and prepare for a range of shocks, while providing a financial safety net for the times when crises do occur.

Communities are educated about factors that contribute to increased risk, such as poor waste management, and they are trained in emergency first aid, evacuation and early warning. Awareness of climate change is integrated into training. Red Cross volunteers are also being trained in how to mobilize, support and motivate self-help groups in these areas (see Box 4.4).

Photo opposite page:
Living with the
consequences of
global warming:
damage to a police
station on Sagar Island
(West Bengal, India)
as a result of rising
sea levels and coastal
erosion.

© REUTERS/Jayanta Shaw

Box 4.4 Using video for community-level climate risk management

A major challenge for the Red Cross Red Crescent Movement and other humanitarian organizations is how to scale up successful pilots addressing climate risk. It is clearly not feasible to dispatch technical experts to every location where poor people are threatened by extreme events. Community-level initiatives need to provide information and knowledge in a form that is accessible and useful to local decision-makers.

Audiovisual technologies are increasingly affordable for capturing, processing, storing and disseminating information. Videos and other communication tools, if combined with participatory approaches, may help extend the benefits of available information to all those who could take advantage of it, in a way that is sufficiently tailored to local needs and constraints. While other disciplines, such as the health sciences, have been dedicating considerable efforts to developing and evaluating intervention strategies that involve the use of video for people at risk, the humanitarian sector has yet to seriously consider such technology for the community-level management of changing climate threats.

The Red Cross Red Crescent Climate Centre has been working with Red Cross and Red Crescent Societies to develop video tools since 2005 in order to support awareness, action, advocacy and analysis. The first pilots were developed informally with volunteer film-makers in Argentina, Bangladesh and Mozambique, and more than 20 video tools had been developed for community-level work on the issue of climate change by the end of 2008.

Why should the humanitarian sector use video for climate issues?

The making of, and discussion about, a video can provide an ideal mediation space to bring

together the multiple stakeholders needed to address extreme weather events and climate change. Participatory video is a particularly relevant methodology, which aims at involving a group or community in shaping, creating and filming their own film, from producing a storyboard to interviewing people and operating the camera.

Participatory video establishes trust and treats local knowledge with respect. It is increasingly used in community development and anthropological research. It has the potential to create spaces for transformation by providing a practice of looking 'alongside' rather than 'at' research subjects. This is fully aligned with the growing recognition that end-users of information need to be co-producers of new knowledge. For example, through a participatory video project in Malawi, subsistence farmers proposed six simple yet innovative measures to manage increasing flood and drought risks, and crafted a 12-minute video aimed at sharing these ideas with neighbouring communities.

The rationale for investing in video was built on the awareness that community adaptation is essentially about change in human behaviour, and such change is more likely to happen when people find both intellectual and emotional reasons to think and act differently. Audiovisual tools can help communicate scientifically complex issues in simple ways, with reliable accuracy, and using aesthetic approaches that can inspire and motivate, sometimes in surprising ways.

For example, after a workshop on flooding and climate change with Mozambican farmers, participants watched a four-minute video from a similar workshop held in a flood-prone Argentinian shanty town. After seeing the short film on a laptop screen, one of the women farmers

said to the workshop facilitator: "I had followed your explanations of global warming, but didn't fully believe you... We've had the 2000 floods that killed so many people and since then two dry spells, and like everybody else I thought it was God punishing us, or that the ancestors were angry... and we can't do much about it. But now in the film I see that white women in the other end of the world have the same problem we have! So maybe it is true that the global rainfall is changing, and so if I *can* do something about it, I will." The video had touched this farmer in a way that motivated her to consider changing crops to adapt to different climatic conditions.

In the Caribbean region, the European Commission helped National Societies to develop a set of short videos to promote community-level hurricane preparedness. Importantly, the very making of these videos created a remarkable spirit of collaboration between the Red Cross and stakeholders such as technical experts, media, government agencies and communities at risk. After joining a workshop on participatory video and climate change organized by the Bahamas Red Cross Society, the National Emergency Management Agency (NEMA) called for a high-level government meeting attended by about 30 people to discuss adaptation needs and support the Red Cross video work. Today, the Bahamas Red Cross and NEMA have a core team of instructors who travel together to the different islands to lead workshops on disaster preparedness and risk reduction.

Similarly, in the context of a two-year programme on integrated community-based risk reduction and climate change by the Indonesian Red Cross Society, a participatory video initiative was carried out in a flood-prone shanty town in Jakarta. Self-selected staff and volunteers contributed strong facilitation skills and joined local residents (both adults and children) in making a short film. A local screening, followed by an open discussion on the issues addressed in the video (such as flooding, waste management, violence and health) established a platform for dialogue and the exploration of transformative action.

While progress on this front has been remarkable, much remains to be done in order to establish teams involving climate adaptation experts, film-makers, vulnerable communities and humanitarian or developmental organizations working with the poor in the field. The literature from other disciplines and the Red Cross Red Crescent experience suggest that the video production process needs to be frequently in use and deeply collaborative, with constant feedback and involvement from the affected stakeholders into the creative process. Team dynamics and complementarities need time to mature into a shared understanding. ■

For more information about video-mediated approaches for community-level climate adaptation and the Red Cross Red Crescent experience, see Suarez et al. (2008). Examples of short films can be found at www.climatecentre.org.

Early action – now

There is a lot we do not know about climate change. But we do know who is vulnerable and we know how to reduce that vulnerability. Action can be taken today to help people manage climate risks – both current and, with experience, those of the future.

While there are some good examples of climate risk management in practice in various parts of the world, it is at the moment mainly an ad hoc activity, carried out on a limited scale. Climate change threatens many millions of people and their livelihoods. For climate risk management to make a real difference in reducing their vulnerability, it needs to be mainstreamed into development and disaster risk activities, at all levels.

How are the main development and humanitarian actors addressing this need? And equally important, how are they working together to provide a coherent strategy for effective action? The short answer is, a lot remains to be done. This section looks at some groups that are beginning to think about how to incorporate climate risk management into their activities. It is not an exhaustive account of all the different groups' efforts; rather, it offers examples of how some of them are tackling the climate issue.

The International Federation of Red Cross and Red Crescent Societies set up its Climate Centre in 2002. The aim is to integrate climate into regular activities:

“Addressing the rising risks is not something new – we just need to integrate the notion of changing risks into everything we do, aware that the range of extreme events may be growing. We must enhance our ability to respond and help people to reduce their vulnerability.”

(Red Cross Red Crescent Climate Centre, 2007)

With many National Societies working under the Red Cross Red Crescent banner, experiences so far have been diverse. The Climate Centre is trying to bring together these experiences to develop a shared approach that will support and improve their ongoing humanitarian work. Climate risk management fits this bill (see Box 4.5). Work on managing climate risks is based on experience, knowledge, tools and investment that the Red Cross Red Crescent has been making in community-based disaster preparedness, disaster risk reduction and disaster response.

“We are working on preparedness for climate change,” explains Maarten van Aalst, associate director of the Climate Centre, “but we’re looking at a different kind of programme. We are focusing on people and communities – after all, that is where disasters are felt. We are asking communities to think about how risks are changing, how this will affect them and what they need to do about it.”

The programme showed its worth in Nicaragua in September 2007 when Hurricane Felix devastated the Caribbean coastline. Disaster preparedness workshops carried out throughout the region for several years prior to the hurricane meant that people were not taken completely by surprise and thus were able to remain calmer during the crisis and to make better decisions.

“The training organized here by the Red Cross helped a lot,” says Romero Rivera Bayardo, pastor of one of the local churches where people took refuge. “It gave us direction, information, strategies about how to act in a natural disaster – before and after.”

One of the main areas of focus for the core components of disaster risk reduction activities of Red Cross Red Crescent Societies includes risk assessment and identification, and the establishment of community-based early warning and prediction. This follows on the principle that accurate and timely information saves lives and helps mitigate economic damage, regardless of the nature of the hazard. Successful community-based early warning systems have been profiled in Bangladesh, Cambodia, Dominican Republic, Honduras, Jamaica and Mozambique (see Chapter 2 for more on community-based early warning systems).

For example, in 2002, following deadly landslides, the Costa Rican Red Cross began working directly with communities to introduce early warning systems. This was done on the understanding that the communities themselves would follow through and operate the system. Nine months after the disaster another, very similar, landslide occurred. This time the losses were cut dramatically. Community training had increased people’s coping strategies.

Community-based disaster preparedness is a cornerstone of all Red Cross Red Crescent disaster risk reduction programmes. It inherently seeks to build the capacities of communities by supporting them to identify and address specific disaster risks. In effect, reducing vulnerabilities and increasing coping strategies to resist and recover from disaster impacts as well as building resilience to future hazards.

After the Indian Ocean tsunami, the Indonesian Red Cross Society stepped up its activities, using both vulnerability and capacity assessment and geographic information systems, to identify local risks and relevant solutions for recovery and community-based programmes in the affected areas of Aceh and Yogyakarta. Maps were created to illustrate survey results, shelter locations and housing construction areas. The maps have been used by the Indonesian Red Cross to identify further needs and coordinate use of Red Cross Red Crescent partners’ resources.

The Mongolian Red Cross Society, through its regional disaster preparedness centres, has developed a series of regional hazard maps (marking drought areas, earthquake-prone areas, dangerous lakes, hazardous mountains and water sources) in consultation with nomadic herders and volunteers. The regional maps have been consolidated into a national hazard map, which was shared with the government and is used by the National Society to assess its preparedness and response needs.

The dissemination of information and the role of advocacy, education and awareness-raising are paramount to building a greater consciousness of the risk factors faced by

communities and the ways in which these can be addressed within a range of different programmes. This can lead to a reduction of future vulnerabilities and the identification of dangers, assessment of capacities and vulnerabilities and solutions.

According to statistics, 38 National Societies run community education programmes with schools while 28 societies run similar programmes among neighbours. School-based disaster management activities have been profiled in Algeria, Indonesia, Kazakhstan and Central America.

In Algeria, the Red Crescent's community education programme with schools has been extended to more than 164 schools, 372 teachers have been trained and 60,000 students have been sensitized. The Algerian Red Crescent and its partners (which include the ministries of education, health and the interior, universities, public health and civil protection institutions, and the American and Spanish Red Cross) have developed training materials for use in the programme.

Box 4.5 Preparing for climate change – taking the first steps

In El Salvador, the Salvadorean Red Cross Society joined the Red Cross Red Crescent Climate Centre's preparedness for climate change programme in 2007.

Mirna Zelaya of the Salvadorean Red Cross explained that in the beginning, not many people had a good knowledge of the issue, but this has changed following a process of research and network-building to lay the foundations for working on the issue of climate change. "We have begun to understand it and what we can do about it," said Zelaya.

The four-step programme was developed to improve understanding of climate change among Red Cross and Red Crescent Societies with the aim of integrating it into their programmes and addressing the humanitarian impacts.

El Salvador has done just that. Their journey started with a national workshop on climate change that involved their staff, board members and volunteers. They also engaged with their national meteorological office and environment department to improve their understanding of

the issue, the trends and projections for their country and to obtain a picture of who was doing what and who was responsible for what in the country already.

It soon became apparent that climate change would exacerbate situations that are already present, such as water-related health problems. "If we don't work on these problems," said Zelaya, "we will become even more vulnerable."

Next, a deeper analysis of the humanitarian consequences of climate change was undertaken in the country, as well as an investigation into the implications for the National Society's programmes.

A background document was created and distributed to a wide range of stakeholders; it concluded that disasters are becoming more complicated in El Salvador. For example, Red Cross intervention programmes in the region of Usulután have reported winds of hurricane strength where they have never been experienced before, posing new challenges for disaster response. Hydro-meteorological changes have

been especially apparent since the 1970s, particularly a reduction of surface water from rivers in the dry season. In the east of the country, there has also been an astonishing decline in rainfall of up to 800 millimetres in the past 70 years.

All of these changes have very real human impacts. Farmers have indicated that winters are more difficult to predict thus affecting crops. Zelaya reflected on the importance of understanding how climate change impacts these changes but also how factors such as deforestation can aggravate the situation.

Diseases are also undergoing changes. The country's dengue season used to appear in April every year, but this is no longer the case. Due to changes in seasons a few years ago, dengue has started to appear in March, meaning that the response to the problem lasts for a larger part of the year. "We have to work very hard to avoid the mosquitoes and dengue," commented Zelaya.

The third step in the programme was a regional workshop, hosted by the Salvadorean Red Cross, to engage with other Central American Red Cross Societies tackling the issue. Topics shared at the meeting included engaging with government and non-governmental organizations (NGOs), and scientific, education and research centres as well as engaging volunteers on the issue.

Learning from each other's approaches was key, including an understanding of which communication tools were effective. It also presented the opportunity to enhance regional collaboration.

Regional and national communication with meteorological and knowledge centres has resulted in the enhancement of partnerships for early warning. After all, increased climate risk creates an opportunity to increase use of climate information. With the assistance of the International Federation, a cooperation agreement has been signed with the Salvadorean meteorology

department that will be an integral part of a nationwide pilot project for early warning systems in Central America.

The three main activities will include assisting with the design of the communication chain for early warning delivery, using forecasts for timely decision-making and promoting more active participation between the Salvadorean Red Cross and the meteorology department. The agreement will enable the Red Cross to obtain the information it needs to undertake effective community risk reduction measures.

In its final step, the National Society is developing an action plan that aims to reduce the impacts of climate change. Young people are very interested in climate change and the Red Cross's youth groups have prepared a 'nature and youth' campaign for action in 2009. This will include instructions on how to take care of water resources and tree planting initiatives.

The Red Cross also wants to work with the Education Ministry and reach many more people by integrating climate change into disaster training in the coming year. "We want to work not only on explaining what the problem is," said Zelaya. "We want people to work to avoid the problems of the future."

In its future plans, the Salvadorean Red Cross also wants to communicate what climate change is to a wider audience and permeate the entire organization to identify the most important areas to work on.

They aim to further their reach to schools and communities as well as form closer alliances with NGOs or governments: "For us it is important to work together. We can't get anywhere if we work alone in this situation of climate change. We have to work together with every organization to find synergies. We have to work and work and work! We can't be islands," stressed Zelaya. ■

In 2005, the Kazakh Red Crescent Society, in collaboration with the United Nations Development Programme, local non-governmental organizations and the Ministry for Emergency, developed material for a project for schools on earthquake preparedness, including training courses, a cartoon strip and four videos.

Community-based climate risk management empowers those who are directly in the path of climate change. It provides them with options that they might not otherwise have, allowing them to cope better with climate variability and uncertainty. However, to be fully effective, it needs to be supported by an enabling policy framework at both national and international levels. Are governments, and the international community, providing this? Again, the answer is that much more needs to be done, and urgently. Less developed countries are struggling with an uphill task. Climate risk management needs to be built into all aspects of policy, but this is an immense challenge.

Box 4.6 The importance of multi-stakeholder dialogues and collaboration

Around the world, as civil society has taken on board the issue of climate change, it has sought dialogue with governments and local authorities, with meteorological offices, universities and other centres of knowledge, and with fellow NGOs. By reaching out to others, civil society organizations have enhanced their networks and their response to climate change. A well-informed, coordinated and multi-sectoral approach is essential to enable greatest efficiency and impact.

In Tuvalu, a small Pacific island nation often associated with the rising impacts of climate change, WWF (formerly the World Wildlife Fund) is a founding member of the Tuvalu Climate Action Network that brings together government, church, NGOs and the Red Cross.

The group promotes cooperation in relation to climate change by pooling resources, raising awareness of the issue and sharing skills and knowledge. The network nominated a civil society representative to attend the conference of the parties to the Kyoto Protocol on their behalf.

Some members of the group also conducted joint activities for World Environment Day,

such as planting *pandanus* (screwpine tree) along the coastline and a nationwide quiz among youth groups. Such activities combine well with messages promoting disaster preparedness and a cleaner, safer environment.

When Red Cross Red Crescent Societies begin discussing climate change with their partners, they sometimes have to explain that they haven't 'gone environmental'; it is the humanitarian consequences of climate change on which they wish to focus.

One of the lessons learned at the Nicaraguan Red Cross has been the value of the Red Cross Red Crescent as a bridge between the climate change world and that of disaster risk management.

In most countries, climate change is dealt with by environment-related government departments focusing on pollution issues, with little involvement of disaster-related sectors. The Red Cross Red Crescent can facilitate dialogue and strengthen the disaster management component in national climate change policy.

In southern Africa, the Mozambique Red Cross Society has brought government agen-

cies together with community leaders at national, district and local levels to share information about extreme weather and the need to develop more resilience to storms, floods and droughts.

The Malawi Red Cross Society is working with its meteorological service and rural community leaders to ensure that subsistence farmers can receive, understand, trust and act upon the climate information provided by scientists. ■

National Adaptation Programmes of Action (NAPAs) are intended to outline a country's most pressing needs and develop a framework for integrating climate risk into national planning. But only a relatively small number of countries have completed NAPAs, and most of these programmes of action are less than adequate. A better approach is to mainstream climate through Poverty Reduction Strategy Papers (PRSPs).

PRSPs set out national development priorities and form the basis of funding arrangements with major donors, yet they currently pay scant attention to climate and climate risks. Incorporating climate into these planning documents will be a very good start to addressing both the current climate-poverty trap conundrum and the threat to future development that climate change represents.

Donors can perhaps lead the way at higher policy levels. Most are beginning to take climate seriously, perhaps driven by evidence that many of their activities and investments are in jeopardy if they ignore the climate risk. The African Development Bank (AfDB), whose focus region is perhaps the most vulnerable to climate change, has made a significant effort to incorporate climate into its activities.

Daniele Ponzi, manager of the sustainable development division, explains: "The bank is developing an innovative climate risk management and adaptation strategy to both climate-proof its own portfolio of operations and also provide support to regional member countries. The aim is to build adaptive capacity and enhance resilience to climate change at both country and regional levels."

But according to the AfDB, governments must play their part, too:

"African governments have a special role in establishing the policy frameworks to encourage adaptation by individuals, communities and businesses – in particular to tackle the wide range of constraints that limit the current capacity for adaptation by these groups... Another element for success is that the primary in-country stakeholders are not the environment ministries or meteorological offices, but the sectoral decision-makers in the line agencies, such as water, agriculture and energy departments (sometimes complemented by central agencies

such as finance and planning); as well as individuals, the private sector and NGOs working in the sector.” (van Aalst et al., 2007)

The African Development Bank is also supporting a programme called ClimDev Africa, which is attempting to tackle the climate information deficit in Africa. Activities under the programme aim to mainstream climate information into development practices throughout Africa and make improvements in climate observations, climate services and national policies related to climate information needs.

Climate information is key, and climate information providers will need to be at the centre of a coherent and coordinated climate risk management strategy. The World Meteorological Organization provides leadership for cooperation between global and regional climate centres and the national meteorological services to facilitate the collection of climate data, their standardization and their exchange, as well as to develop climate forecasts and future climate scenarios.

According to Maryam Golnaraghi, chief of WMO’s disaster risk reduction division, customized information for climate-sensitive sectors is what is most needed. “Decision-makers are looking for relevant information to support their decisions,” she said. “We’re trying to strengthen cooperation at international, regional and national levels, so that this type of information is produced on the basis of the latest scientific knowledge, and using the latest tools, and it can be made available for risk management at national levels.”

Climate science is no less important – indeed, it is crucial to sound policy, planning and practice. But it must be guided by real needs, and then reach out to and be useable by those who need it. According to Stephen Zebiak, director general of IRI, we need “continued advancement of the underpinning science, more demonstrations of improved outcomes in practice, increased awareness, demand and uptake of climate risk management and continued attention to education and the building of capacity globally”.

Conclusion

The early warning on climate change has unequivocally sounded. The climate change conference in Poznan, in December 2008, was the first meeting of the UNFCCC where adaptation was strongly addressed and the humanitarian agencies were very much in evidence, stressing the importance of adaptation actions chiefly around disaster risk reduction.

We have an opportunity for early action and we must seize it right now. Vulnerability to climate extremes, variability and uncertainty can be addressed today, to build resilient communities that can cope with whatever the climate brings in the future.

To achieve this, climate needs to be mainstreamed into sustainable development strategies that address current inequalities and failings. Climate information is needed in decision-making processes at all levels, from individual farmers deciding what crops to plant, to urban planners and infrastructure designers, to policy-makers. Sound and relevant climate science must provide the foundation for generating such information, and a concerted effort among the main actors is needed to carry forward this agenda in a coherent and coordinated way.

Chapter 4 was written by Anne Moorhead, a science writer and editor. She also contributed Boxes 4.2 and 4.3. Boxes 4.1, 4.5 and 4.6 were written by Rebecca McNaught, and Pablo Suarez wrote Box 4.4. Both contributors are staff of the Red Cross Red Crescent Climate Centre.

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Food insecurity: what actions should follow early warning?

Food shortage, starvation and famine are often the most devastating consequences of a disaster. Food stocks, food production and other sources of income are vulnerable to drought, floods or other calamities. As income and assets diminish, households resort to increasingly desperate coping strategies. When such strategies are exhausted, the result is starvation and death. This chain of events was tragically illustrated by the catastrophic famines triggered by drought in the Sahel and Bangladesh in the 1970s and in the Greater Horn of Africa in the mid-1980s.

These famines resulted in various international calls for action to eliminate chronic and transitory hunger, including the 1996 World Food Summit, the Millennium Development Goals (one of which is to halve, between 1990 and 2015, the proportion of people who suffer from hunger) and the right to adequate food and the fundamental right to be free from hunger embedded in international law (the term 'right to adequate food' is derived from the International Covenant on Economic, Social and Cultural Rights, which to date has been ratified by 160 states). The Hyogo Framework for Action (2005–2015) also commits signatories to the progressive reduction of risk, including the risk of malnutrition.

Although there has clearly been progress in preventing the recurrence of the scale of mass starvation last witnessed in the 1980s, a similar pattern of food crises – albeit not as catastrophic – has continued more or less unabated since then. For example, the same sequence of events is yet again being played out in the Greater Horn of Africa with 20 million people facing hunger (International Federation, 2008). In its 2008 appeal, ActionAid gives voice to the suffering caused by the failure of the previous two years of rain in northern Kenya.

“I had thirty head of cattle a year ago. I am now left with only one which is so emaciated that it can barely stand,” says 82-year-old Apollo Kibet... Women in the village go about gathering poisonous wild berries that they boil for hours on end to remove the toxins from them. These fruit, known as Sorich, are what people in the region have come to regard as food... “I have to set out by 7 am for me to get these wild fruits and prepare them in time for tonight’s meal,” says Mary Ngoleyang, 32, and a mother of three... The inhabitants have

In the picture opposite, hungry children collect maize fallen from trucks at the side of a road in south-west Zimbabwe. Despite early warning, people throughout the country are facing chronic food shortages in 2009, following years of drought and chronic socio-economic insecurity.

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started eating carcasses of their dead animals portending a serious health risk. If humanitarian assistance is not forthcoming soon, humans will also succumb to the drought.”

As well as such moving personal accounts of the unfolding tragedy in the Horn of Africa, more measured analysis and reporting from the region reveal widespread hunger and malnutrition:

“The nutrition situation in Kenya has been described as ‘critical’, particularly in the north-west drought-prone region of Turkana. Nutritional survey results indicate that levels of global acute and severe malnutrition have almost doubled since 2007.

“Therapeutic and Supplementary Feeding Centres are overstretched, with many people unable to access the treatment they require. Most people in this region still rely on food relief; any reduction in aid provision would inevitably result in increased mortality and morbidity.”
(*The Lancet*, 2008)

Furthermore, the current crisis in the Horn is far from unique. Transitory hunger and malnutrition, as a consequence of natural hazards or man-made crises, remain a major global challenge. The organization CARE International, for example, estimates that the number of people confronting a food emergency has risen to 220 million – almost twice as many as in 2006 (CARE, 2008).

Ever since the events of the 1980s, there has been a growing conviction that severe hunger as a consequence of natural disasters is neither necessary nor acceptable. A recent press headline sums up this feeling: “Ethiopia – another famine, another avoidable disaster” (*The Times*, 2008).

All types of disasters may impact on food consumption and nutrition. However, food requirements arising from natural hazards are predominantly associated with slow-onset droughts and concentrated in sub-Saharan Africa. While significant levels of malnutrition and hunger remain global problems, in other regions these problems are typically chronic in nature or predominantly related to conflict.

These slow-onset disasters are largely predictable. Furthermore, resources are available to ensure that no one, anywhere in the world, at any time, should go hungry.

This chapter asks why this state of affairs persists. Is it inevitable that natural disasters should be associated with extreme hunger and suffering? Specifically, what is the contribution of early warning and early action? Within this area of work, what emerging approaches demonstrate promise and need to be scaled up? What obstacles

impede finding more effective responses and where is the creative energy necessary to identify innovative solutions?

The history: early warning and famine prevention

Over the last three decades, increasingly sophisticated approaches have been adopted to prevent, mitigate and prepare for food crises. Arguably the greatest effort and expense has gone into improving early warning systems (EWS) as a mainstay of emergency preparedness and famine prevention.

A simple definition of an early warning system in a food security context is a “system of data collection to monitor people’s access to food, in order to provide timely notice when a food crisis threatens and thus to elicit appropriate response” (Buchanan-Smith and Davies, 1995). In theory, such a system should provide decision-makers with timely information so as to act to prevent shocks – natural, political and economic – from turning into disasters.

Considerable progress has been made in establishing food security-related EWS at global, regional, national and community levels. These systems are developed and maintained by multiple stakeholders including donors, national governments of highly food-insecure countries, United Nations (UN) agencies and civil society. Given the prevalence of food insecurity in sub-Saharan Africa, specific attention has been paid to establishing food-related early warning systems in this region. Regional intergovernmental organizations have played a central role in supporting regional and sub-regional systems, including the Intergovernmental Authority on Development, the Permanent Interstate Committee for Drought Control in the Sahel (CILSS) and the Southern African Development Community.

These systems were established with the primary aim of preventing mass starvation. An underlying assumption was that the principal risk to adequate nutrition arises from variations in domestic agricultural production. Production may determine both food availability and incomes in rural areas (for example, through the sale of cash crops). Consequently early warning systems were designed to closely monitor climatic factors that impact directly on agricultural production, as well as other hazards such as pests, which may cause diseases or destroy entire crops. Innovative remote sensing technologies have been used to great effect in order to monitor climatic variations and to model crop yields. To varying degrees, in some systems crop indicators have been complemented by other socio-economic and welfare indicators, including live-stock production, market prices and malnutrition rates.

This type of early warning system has been widely adopted and institutionalized by national governments. However, the functioning of many systems remains sub-opti-

mal. Significant constraints to their operations are regularly encountered. These include technical factors (tools to integrate systematically food security indicators into a clear statement about the severity of a crisis and the implications for response options), institutional issues (managerial independence and analytical autonomy and the ability to recruit and train a diverse group of food security analysts) and financial limitations (principally continual reliance on donor funding).

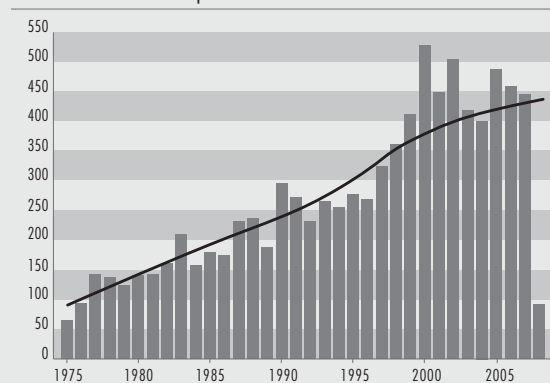
In general, though, the evidence suggests that established early warning systems have performed relatively well and, overall, have been effective in alerting countries and donors to imminent food crises due to production failures (FAO, October 2006). Today, such systems generally monitor the most vulnerable areas and populations. It is rare for decision-makers not to be warned in advance of slow-onset events such as drought and crop failure.

This combination of analytical and response capacity has largely prevented a recurrence of outright mass starvation, as seen in 1984, in food crises attributable to natural hazards. Data on recent disasters indicate a declining number of mortalities, despite the rising number of disaster events (see Figure 5.1).

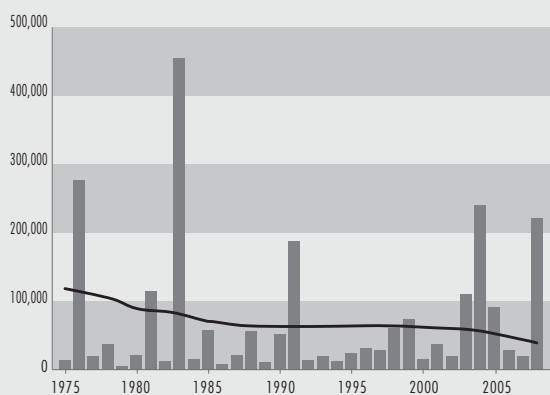
Figure 5.1

Number of disaster events rise, while fatalities decline

Natural disasters reported 1975–2008



Number of people reported killed in natural disasters 1975–2008



Source: EM-DAT The International Disaster Database

Expanding the scope of early warning beyond natural disasters

While the ‘traditional’ early warning systems have been designed to monitor, analyse and report on the impacts of natural disasters, there is growing evidence that the complexity of food crises is increasing. A rigorous analysis of several recent food crises (that were at first assumed to be largely driven by harvest failure) has revealed multiple and overlapping causes (Trench et al., 2007). The impact of meteorological, hydrological and climate change-related hazards needs to be assessed and analysed in the context of concurrent changes in poverty levels, conflict, pandemic diseases and economic developments. The combination of these causal factors influences both the overall level of needs and the most appropriate responses.

For example, an analysis of the 2001–03 and 2005 food crises in southern Africa identified no fewer than four overlapping crises in the region. While harvest failures in 2001 and 2002 provided the immediate trigger, these hit a region already suffering weaknesses in governance, with a population ravaged by the HIV and AIDS epidemic and where extreme poverty was growing. These shared characteristics were, in turn, overlaid by specific national level trends and triggers (Maunder and Wiggins, 2007).

The conclusion drawn from this analysis was that many of these factors interact with, and compound, vulnerability to natural disasters. The various causal factors need to be understood and monitored to appreciate properly the scale of the needs and to plan a tailored response. This, in turn, implies that EWS need to include a broader, context-specific range of environmental, social and political indicators.

In particular, interpreting the impact of natural disasters within the context of changes to levels of structural poverty remains a major challenge for many early warning systems. Such contextual factors have been at the heart of explaining where early warning is deemed to have ‘failed’ in recent crises. Niger’s 2005 food crisis illustrates how natural hazards and economic shocks, added to existing chronic food insecurity, quickly led to famine conditions (see Box 5.1) – despite accurate agro-climatic monitoring and timely early warning.

An analysis of current emergency operations highlights the fact that the major ongoing humanitarian crises are predominantly those caused by conflict or complex emer-

Box 5.1 The Niger crisis of 2004–05: lessons on early warning and early action?

The Niger food crisis in 2004 and 2005 was a severe but localized food security crisis in the regions of northern Maradi, Tahoua, Tillabéri and Zinder in south-eastern Niger. It was caused by an early end to the 2004 rains, desert locust damage to some pasture lands, high food prices and chronic poverty.

This crisis is often cited as a failure to react early enough to prevent a humanitarian crisis. It provides an important case study to guide the development and use of early warning and response systems, so it is therefore useful to consider what happened and what lessons have been learnt for preventing a recurrence of similar events in the future. The crisis evolved slowly over the course of 2004 and 2005. However,

a significant response only materialized after the scale of the humanitarian crisis was highlighted by international media.

In late July 2005, for example, Jan Egeland, then UN emergency relief coordinator, reported at a UN news briefing in Geneva that “over the last few days, the world has finally woken up, but it took graphic images of dying children for this to happen. More money had been received over the last 10 days than over the last 10 months” (UN, 2005).

Eventually a large-scale humanitarian response did ensue: “Between January and October 2005 some 230,000 children under the age of five, including 60,000 who were severely malnourished, were treated by NGOs –

surpassing past records of relief intervention. Despite this large-scale effort, thousands of children died of hunger-related causes" (Mousseau and Mittal, 2006).

But another report noted: "If the test of good humanitarian action is that it should be timely, proportionate, appropriate and effective, the response to the crisis in Niger has to date arguably failed on all counts" (HPG, 2005).

Many reasons contributed to the failure to act early enough and prevent such a tragic outcome, and several analyses have been made in the wake of the immediate crises to analyse these factors and the interplay between them. Among the plethora of issues discussed, the performance of the early warning systems has come under particular scrutiny.

The Sahel region, including country-level coverage for Niger, is well covered by EWS. The UN's Food and Agriculture Organization (FAO) has the Global Information and Early Warning System, the United States Agency for International Development (USAID) finances the Famine Early Warning System Network and the European Union has invested in the AGRHYMET, a specialized institution of CILSS. Between October 2004 and July 2005, these systems produced no fewer than eight major assessments that highlighted the growing problems in Niger. In early November 2004, CILSS and FAO took the unusual step of organizing two simultaneous press conferences, in Dakar (Senegal) and Banjul (Gambia), to report on the situation in the region.

But these EWS were largely focused on drought and the weather-related threats to food production resulting from variations in the timing and intensity of rains, as well as pest and disease outbreaks. However, it became clear that the crisis had far more complex roots than drought and the locust invasion. Niger did not face an exceptional drop in aggregate production in the 2004–05 agricultural year; produc-

tion at the end of 2004 was only 7.5 per cent below the national food requirement (Mousseau and Midal, 2006); but most of the shortfall in production took place in the lowest productivity (relatively northern) areas of the country.

Another important factor is that food markets within the region, especially between Niger and northern Nigeria, have long been closely integrated. In 2004, Nigeria took drastic steps to increase domestic grain production, by reducing rice imports from the world market. The intended effect was to push up grain prices sharply in Nigeria and provide strong incentives to increase production, but this price increase 'spilled over' into lower-income Niger, where staple food prices nearly doubled in 2005. As one report explained: "Part of the problem seems to be that 'food availability' approaches – as distinct from approaches focused on food access – continue to drive policy... Weather conditions in 2004–05, and the locusts, have had a relatively modest impact on national grain production. But, as Amartya Sen pointed out more than 20 years ago, famines can still occur when aggregate food availability is sufficient, if prices are too high for poor people to access enough food" (HPG, 2005).

Better monitoring and analysis of markets is clearly one part of the solution.

Whereas the grain price rises were (with some difficulty) manageable in Nigeria, in Niger they affected a large percentage of the population living in absolute poverty. Acute malnutrition is rampant there even in years of good agricultural production. Indeed, some analysts still disagree about whether there was a real *crisis* or whether it was a 'chronic emergency' that received international media attention for a short time (McNabb, 2008). Others hold that 2004–05 was more a price and income crisis than simply one of food supply.

There is certainly an argument for further strengthening early warning systems. But as

Clay (2005) points out: "It is genuinely difficult to anticipate [such] a crisis. EWS are being asked to determine when and where problems of chronic poverty and malnutrition that have a strong seasonal dimension are becoming so acute that exceptional emergency measures are required."

This in turn links to the question of what are the most appropriate mechanisms to deliver a timely, appropriate response to highly vulnerable populations that can easily be tipped over the edge to hunger.

The variety of causes translated into problems in defining appropriate responses and whether the response belonged within the remit of long-term development policies or a short-term relief response: "There was uncertainty as to whether it was a 'production-crisis', a 'market crisis', 'a crisis caused by long-term poverty' or even a 'crisis of malnutrition caused by cultural practices', and if so whether the solutions were to be found with the government and development agencies or with a relief intervention" (Harrigan, 2006).

According to the Humanitarian Policy Group (2005): "The problem seems to have been less the quality of the information about the food security situation, and more the way that information was interpreted, and the analysis developed on which subsequent decisions about response were based."

Although this discussion highlights the challenges for early warning, the Niger case also demonstrates the highly complex interaction of factors that can lead to unmitigated acute food insecurity. The relatively bountiful years, with record harvests in 2000, 2002 and again in 2003, may have introduced a certain complacency regarding food security. Donors were slow to react to initial appeals by the government in November 2004, and pledges only picked up after intensive media campaigning by international relief organizations. Having received little international support in 2004, the government then focused on political priorities (with elections in February 2005), managed the situation to the best of its own limited resources and downplayed the scale of the crisis until well into 2005.

In conclusion, the Niger example reinforces the analytical challenge for EWS. It reminds us that food crises are highly correlated to underlying poverty and the state of essential public services – with natural hazards as the tipping factor. As Eilerts (2006) wrote: "The most immediate challenge lies in accepting that we can no longer limit our monitoring and analysis to the strict confines of 'food security' and food-related crises. Livelihood emergencies of many different types, in many different places, will produce many of the next food security or famine crises. Indeed, identifying what not to monitor will be among our most difficult tasks." ■

agencies. The emergency appeals for the complex emergencies in Sudan, the Democratic Republic of the Congo and Somalia dominate the requests for donor resources (ReliefWeb, 2008).

The problem of forecasting, monitoring and responding to conflicts is not the only concern here. There are significant overlaps between the incidence of natural disasters and complex emergencies. Between 1998 and 2003, at least 140 natural disasters occurred in countries where complex political emergencies were also present (Buchanan-Smith and Christopolos, 2004). Climatic variations or extremes can also increase competition for scarce natural resources and exacerbate

tensions. Therefore, better methods to forecast, assess and respond to food needs under conditions of restricted access must be a priority. Technically, establishing and integrating conflict monitoring and response within EWS remains an intractable problem.

The core role of EWS in preventing mass mortality through the monitoring of agro-climatic indicators remains highly relevant, given the continued susceptibility of African agriculture to the increasing frequency and intensity of extreme climate events (droughts, floods, tropical cyclones and hailstorms) associated with climate change. However, EWS have not proved sufficiently flexible to identify and monitor emerging sources of risk in all cases. This problem is illustrated by the laboured attempts of many EWS to incorporate the implications of the recent global food price rises, the global financial crisis and, before this, the HIV and AIDS pandemic. This is partly due to the complexity of the issue and to the fact that most EWS, being country- or region-specific, are poorly prepared to tackle complex global phenomena.

Linking early warning to decision-makers

Linking early warning to early action has long been recognized as a critical bottleneck (Buchanan-Smith and Davies, 1995). There is a well-identified requirement to ensure that analysis and reporting are geared to meeting the needs of decision-makers. A technically sound food security analysis will be of little use if it fails to address the real questions that decision-makers want answered. Thus, increasing attention has been given to how best deliver analyses and recommendations that directly support decision-making on timely, appropriate, proportionate and effective responses to food crises (Darcy et al., 2007). Particular effort has been focused on developing standards for comparing the severity of needs in different contexts, standards that are necessary to support impartial decision-making.

The Integrated Food Security Phase Classification (IPC) is an innovative attempt to systematize the situational analysis and relate it more clearly to the actual needs of decision-makers. The transparency and comparability of the analysis are related to trigger points for action. Furthermore, the IPC provides a framework explicitly to link the analysis of the determinants and extent of food insecurity to recommendations on appropriate response options (see Box 5.2).

The IPC has been piloted in several countries in East and Central Africa with varying degrees of success. While recognizing that the IPC has a limited influence on many upstream issues (including data availability) and downstream issues (of the uptake of recommendations), it provides a constructive approach to improving the consistency, comparability and degree of consensus in the analysis, and it deserves further support to promote its wider application.

Box 5.2 The Integrated Food Security Phase Classification – linking analysis to action

While individual early warning systems have been generally effective in alerting emergency response agencies to impending crises, the objective ability to compare the relative severity of these crises remains extremely limited.

As long as major humanitarian organizations, UN agencies and national governments use different scales for classifying food-related crises, there will be confusion about which situations are most severe. This lack of comparability has contributed to a situation where the global humanitarian response often fails to assign priorities for delivering assistance on an impartial basis, solely determined by real need (Darcy and Hofmann, 2003).

Faced by multiple, simultaneous food crises, decision-makers need to understand which ones are most critical and where to intervene first within each crisis, with limited resources.

The Integrated Food Security Phase Classification was developed to address this need. The IPC offers a 'common currency' for classifying levels of food insecurity. It provides a scale comparable across countries and different seasons, in order to make it easier for donors, agencies and governments to identify priorities for intervention.

The classification system is defined by using threshold levels of a number of key reference indicators, including those relating to mortality, nutritional status and food consumption. The use of quantified thresholds introduces a rigour and transparency into the analysis that are often lacking in this area of work. The IPC identifies five main phases or categories of food insecurity:

- Generally food secure
- Chronically food insecure
- Acute food and livelihood crisis

- Humanitarian emergency
- Famine/humanitarian catastrophe

The IPC is not an assessment method *per se* nor does it replace existing information or classification systems. Rather, it builds on whatever information is already available and uses a 'convergence of evidence' approach. It brings together data and information from many different sources. Classifications are based on well-documented evidence and the whole process is transparent.

The IPC can, therefore, be adapted to a broad range of information systems with regard to data availability, methodological approach and human capacity. This both minimizes costs and makes it easier for governments and agencies to assimilate it into established systems.

It is also vital to communicate findings in a visually compelling way that can be easily understood by a wide audience. The IPC uses maps to give a very clear, intuitively understandable picture of the overall situation. The analysis and maps describe the current or imminent situation for a given area, along with a prediction of future trends and whether the phase may worsen or improve (see map).

The IPC goes further than just categorizing the severity of the crisis as it explicitly links the situation analysis to potential responses. The IPC advocates for responses that meet three broad objectives: mitigating immediate outcomes, supporting livelihoods and addressing underlying and structural causes.

However, while the IPC provides a basis for indicating the appropriate types of responses, it stops short of a full evaluation of response option analysis and recommendation. Further detailed appraisal is still needed to determine what responses are most appropriate and fea-

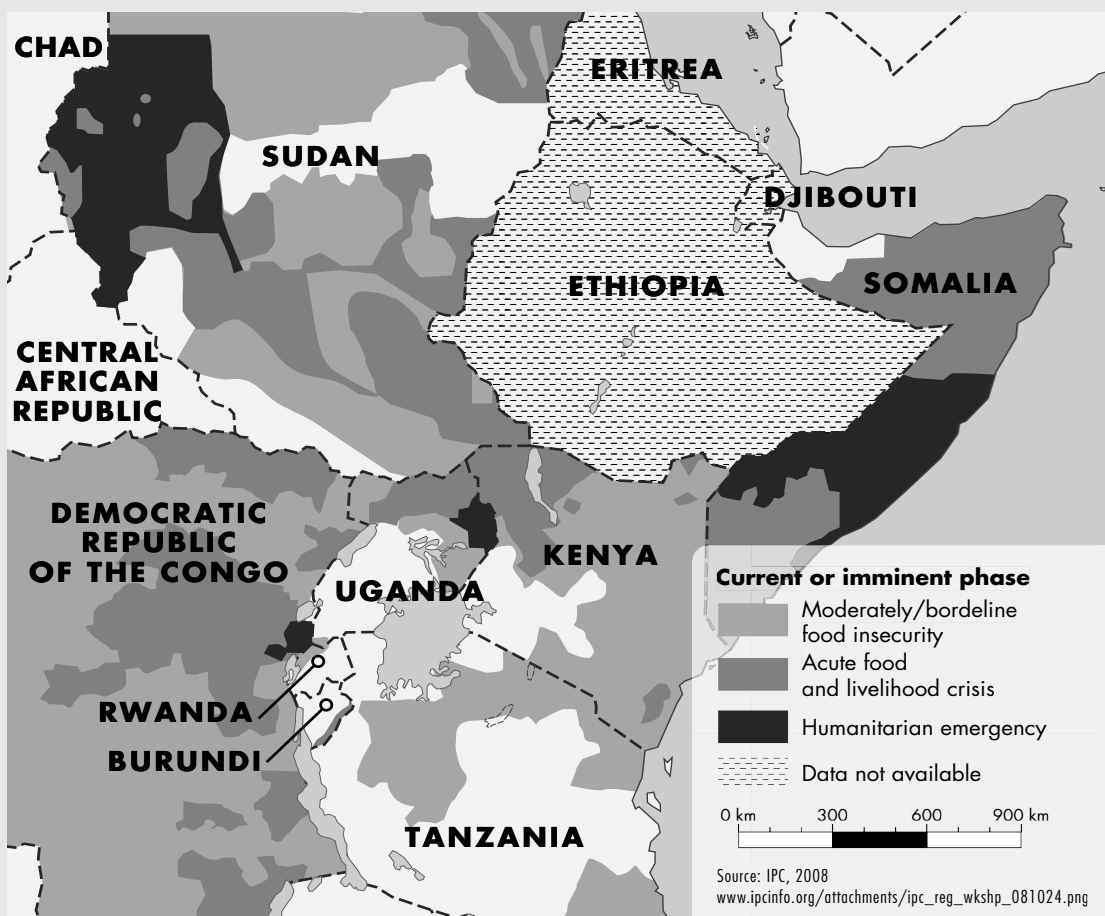
sible in different scenarios in the light of, for example, local capacity and ongoing interventions.

The IPC may also contribute to more coordinated interventions. The development of the IPC statement depends on developing a consensus among representatives of all the main food security-related organizations, including the national government. This can foster better collaboration and coordination of response efforts.

The potential of the IPC is balanced by a number of well-documented constraints. Not least of these are the often poor availability and quality of the data relied on for the analysis. Where data are scarce, there is little choice but to determine the phase almost exclusively based

on expert judgement. While the IPC can help to advocate for improving data collection, monitoring, information systems, methodologies, capacity-building of analysts and other important prerequisites for food security analysis, it helps make the best use of limited data by encouraging a participatory and convergence approach to analysis.

On the response side, there is a real danger that the IPC might overly focus attention on the most extreme situations of food insecurity and divert attention from developing livelihoods crises and important opportunities for risk reduction. However, this problem may be related to the overall decision-making processes, rather than a specific criticism of the IPC itself.



Originally developed in Somalia by the Food Security Analysis Unit, IPC maps are now being produced in Somalia and Kenya – where the IPC has been officially adopted by the government. IPC-related activities have also been substantial in southern Sudan and Burundi, while start-up activities are taking place in the Democratic Republic of the Congo, Tanzania and Uganda.

IPC-related training, awareness-raising activities and pilot tests have also taken place in southern Africa and Asia. Lessons learned from

using the IPC in different countries will help further refine the system.

IPC global partners include FAO, the World Food Programme (WFP), Care International, the European Commission's Joint Research Centre, the Famine Early Warning System Network, Oxfam Great Britain and Save the Children UK and US. ■

For more information, see the Integrated Food Security Phase Classification web site: www.ipcinfo.org

Does early warning stimulate early action?

Ultimately early warnings, however accurate and complete, are only as useful as the responses that they elicit. However, in situations of food insecurity and famine, the evidence reveals a damaging tendency by the appropriate authorities to wait until the situation reaches a critical phase, and only then to react with a lifesaving response.

Emergency aid continues to be made available too late and on too short term a basis, and is targeted too heavily at saving lives rather than protecting vulnerable livelihoods as well. As one commentator described:

“By the time the response finally comes, they [the victims] may have liquidated productive assets, withdrawn children from school or engaged in environmentally or socially destructive activities. Although they did not starve, they are poorer and more vulnerable to the next disaster. This downward cycle is seen in the increasing numbers of destitute and chronically vulnerable populations throughout Africa.”
(McNabb, 2008)

A detailed retrospective analysis of the 2006 crisis in Kenya provides a good case study of the failure of early warnings to lead to early action (see Figure 5.2). The quality and credibility of the early warning signals were not called into question in this case; indeed, Kenya has been at the forefront of developing and institutionalizing innovative EWS. However, a meaningful response only occurred when the situation was acute – that is, at a stage when 11 million people required food, malnutrition rates were exceeding emergency thresholds and estimates showed that over 70 per cent of livestock had died in some locations (HPG, 2006).

“Many humanitarian actors have expressed frustration that the drought has had such a disastrous impact. They point to widely available research which shows that, if urgent action is taken early in a crisis to protect livelihoods, the effects of drought on pastoralists can be mitigated and the need for a massive emergency response to save lives can be reduced. Yet agencies, donors and national governments proved unable to address the crisis effectively in its early stages. Livelihoods interventions have been limited, and the response has focused overwhelmingly on food aid.” (HPG, 2006)



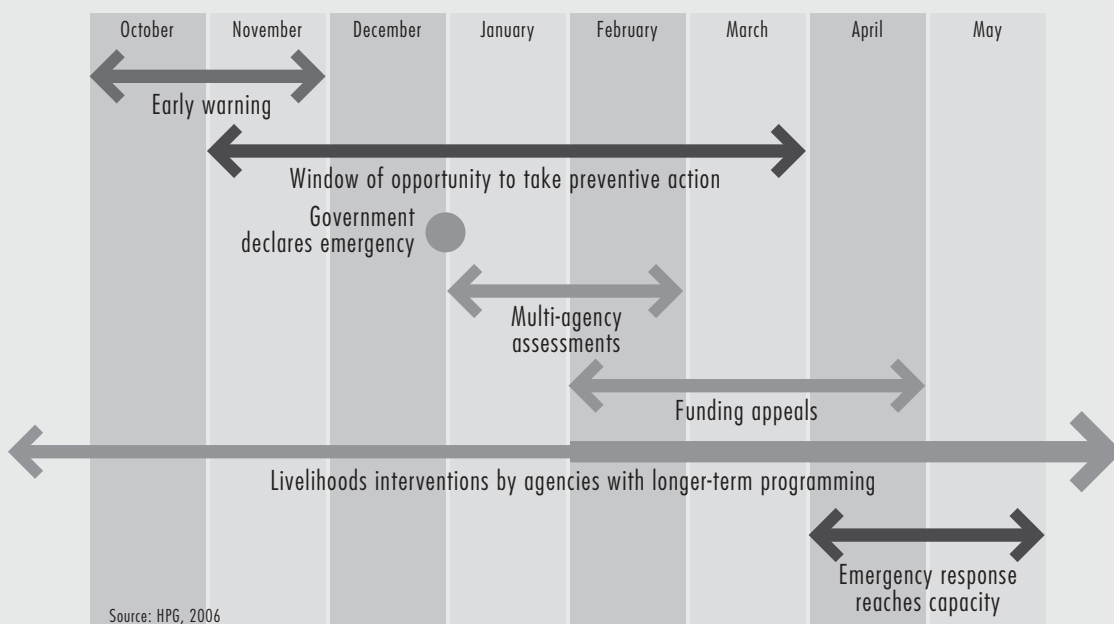
It has been argued that the failure of early warning to stimulate appropriate early action is a reflection of the fact that EWS are designed to meet the needs of the responders (principally the international humanitarian system) rather than the real needs of those vulnerable to natural disasters (Maxwell et al., 2008 citing Glenzer, 2007). The priority is to raise an alarm that mobilizes resources to prevent mass mortality. However, this only occurs after some livelihoods have been destroyed and some lives have been lost. The implication is that the bottom-line concern is to contain the damage, not to prevent it. However, from the perspective of affected households, a more appropriate trigger point is the preservation of livelihoods, rather than ‘just’ the saving of lives. See Box 5.3 for examples of attempts to provide early warning that will stimulate early action – in this case, an appeal for financial assistance to prevent the loss of lives and livelihoods in Zimbabwe.

After the failure of yet another rainy season, farmers in Kenya watch their cattle, their only source of food and income, die of thirst and hunger.

© Kenya Red Cross Society

Figure 5.2

Timeline of key events in Kenya, October 2005–May 2006



Box 5.3 Early warning in Zimbabwe

In March 2008, the Zimbabwean government, along with FAO and WFP, issued an urgent warning of the rapidly deteriorating food security situation in the country.

The warning was largely expected by the humanitarian community given the underperforming 2007 harvest. An exceptional accumulation of factors created an unprecedented situation. Adverse and chronic weather patterns, deterioration of infrastructure, shortage of agricultural inputs and drastic socio-economic decline conspired to leave millions of people without access to sufficient food.

A joint FAO and WFP crop and food supply assessment mission in June 2008 painted a clearer and grimmer picture of the crisis. The report estimated that almost half of the country's

population (5.1 million people) would be food insecure by the beginning of 2009 unless significant steps were taken.

At the beginning of August, the Zimbabwe Red Cross Society (ZRCS), supported by the International Federation, launched an urgent international appeal for almost 28 million Swiss francs.

The immediate priority was to provide monthly food assistance to more than 260,000 people who were either infected or affected by HIV and AIDS and therefore acutely vulnerable to food insecurity and its related ills (for people taking anti-retroviral treatment, sufficient food is essential).

The second component was the provision of agricultural support to about 100,000 people

in an effort to mitigate another poor harvest, an initiative linked with ongoing and long-term water and sanitation programmes.

Thousands of ZRCS volunteers across the country began to distribute food in October. Working in partnership with WFP, the volunteers provided families with packages of maize, beans and cooking oil.

However, though the warning of impending food insecurity was timely and clear, the response from the humanitarian sector as a whole was hampered by a range of factors. Operations were complicated by the unresolved political situation, with the movements of non-governmental organizations restricted following the two rounds of national elections in March and June 2008.

Throughout the country, especially in rural areas, the little food available was typically

overpriced and being sold in foreign currency due to the continued and rapid devaluation of the Zimbabwe dollar. This made it difficult for the average person with no access to foreign currency to purchase these commodities. Supplies of agricultural inputs, equipment and fuel were erratic, while prohibitive costs also made farmers unable to cope.

The country faced yet another year of chronic food shortages, a fact that sits uncomfortably alongside the recent deadly outbreak of cholera. At the end of 2008, many people were resorting to eating wild fruits and many households were selling personal assets in order to alleviate the dire food shortages. At the beginning of 2009, an estimated 5.9 million Zimbabweans were food insecure – a number beyond the worst case scenario issued some seven months earlier. ■

Table 1 Projected national requirements for Zimbabwe 2008–2009

2008–2009 needs 2008	Expected harvest requirement	Government import	Deficit
2,080,000 tonnes	848,000 tonnes	850,000 tonnes	382,000 tonnes

Table 2 Estimates of food insecure individuals in rural and urban areas 2008–2009

Province	July–September 2008	October–December 2008	January–March 2009
Manicaland	285,400	535,100	713,400
Mashonaland Central	154,600	289,800	386,400
Mashonaland East	187,000	350,600	467,500
Mashonaland West	126,300	236,800	315,700
Masvingo	252,200	472,800	630,400
Matabeleland North	127,500	239,100	318,900
Matabeleland South	148,500	278,400	371,200
Midlands	243,800	457,200	609,500
Urban and peri-urban localities	515,000	966,600	1,288,800
Total	2,040,800	3,826,400	5,101,800

Source: FAO/WFP crop and food supply assessment mission to Zimbabwe, 18 June 2008

Diversifying responses from food aid

A powerful illustration of donor-driven decision-making is the provision of food aid as the first line of defence and response to most food crises. Food aid continues to dominate the response, in terms of both what is appealed for and the resources supplied by donors. A comparative analysis of the 2001–2003 and 2005–2006 crises in southern Africa (Maunder and Wiggins, 2007) found that the emergency responses remained largely unchanged – that is, dominated by large-scale food aid. In effect, many EWS have been designed to answer an operational question of “when, where and how much food aid to deliver?”

In-kind food aid undoubtedly continues to be a key tool in famine prevention. However, the scale of its use clearly owes much to the ready availability of this resource for emergency response, largely because of the agricultural surpluses resulting from domestic agricultural policies in the donor nations. The emphasis given to food aid as the main response runs counter to the growing consensus on the limitations of in-kind food aid. The time lags are significant; these may average in excess of six months for the delivery of internationally sourced food, thus compromising the timeliness of the response (Barrett and Maxwell, 2005).

Furthermore, there are significant doubts about the appropriateness of food aid in addressing the real causes of malnutrition – which may be far more varied than a shortfall in food consumption. As Gro Harlem Brundtland, former director general of the World Health Organization and prime minister of Norway, has said:

“The dual scourge of hunger and malnutrition will be truly vanquished not only when granaries are full, but also when people’s basic health needs are met and women are given their rightful role in societies.”
(FAO, 2002)

Critically, food aid may protect lives, but it is a highly inefficient and ineffective means of protecting livelihoods. Effective early action in support of livelihoods requires the more balanced use of a range of instruments that deal with the genuine causes of vulnerability, as opposed to merely what donors are willing to give.

A greater role for cash transfers?

Over the last decade there has been a rapid growth in experimentation with the use of cash transfers and vouchers in meeting food needs in emergencies. Critical potential benefits of cash transfers include greater timeliness, greater flexibility and individual choice for beneficiaries in the use of the resource, cost savings and positive secondary impacts on the local markets and economy. Examples of large-scale *emergency* cash transfer programmes remain limited, although a growing number of pilot

programmes are yielding important quantitative evidence of their beneficial impact. For example, the evaluation of Save the Children-UK's emergency drought response in Swaziland in 2007–2008 revealed that not only were cash transfers used to ensure access to food for drought-affected families, but that they also enabled the purchase of other essential non-food items and were in part invested in assets and livelihoods (Devereux and Jere, 2008). The World Food Programme has recently made a positive policy commitment to consider cash and voucher schemes as an alternative to food aid.

Clearly, the use of cash is not a panacea. The appropriateness of cash or voucher transfers varies enormously depending on the context. Cash will only be appropriate if the necessary goods or services are available on local markets. Depending on the situation, cash, vouchers or the in-kind provision of commodities or services may be the preferred or the only feasible option. A range of resources, commodities and services is needed to save lives and livelihoods and to prevent and mitigate acute food insecurity.

Early action to protect livelihoods

There is a broad consensus on the need to react to early indications of a pending crisis and implement relief action designed to strengthen livelihoods. When a slow-onset event begins to emerge, there are various possible interventions which can be used to support traditional coping mechanisms. These options can help avoid, or at least mitigate, the impending crisis. But why has it been so problematic to translate these ideas into action, and can more early action be taken?

At the most basic level, there is often a lack of understanding over what interventions are appropriate and cost-effective in a given employment context. Relief workers often lack the detailed knowledge of people's livelihoods necessary to facilitate the planning of more sophisticated emergency responses. Such detailed knowledge is typically held by development workers, acquired through their sustained work with communities at risk.

Poor coordination between organizations and their staff in the field, as well as between emergency and development agencies, is an important issue. All sides bring key skills and capacities to the response task. Development specialists have strengths in grass-roots participation, detailed analysis of the socio-cultural context and capacity-building, which are vital to understanding and implementing early livelihood actions.

Conversely, emergency specialists bring skills in vulnerability analysis and logistics as well as the ability rapidly to implement interventions at scale. These diverse skills need to be brought together, through the establishment of appropriate coordination and consultation mechanisms.

Another aspect of an improved strategy to protect livelihoods must be the dissemination of knowledge on emergency response options. The Livestock Emergency Guidelines (LEGS) is a useful and valuable model for what might be achieved (see Box 5.4) and it is now being replicated in the fisheries sector.

Box 5.4 Livelihoods-based interventions, pastoralism and drought

Two underlying principles of livelihoods-based programming in disasters are to protect people's key assets and to support the local markets and services which are needed for recovery after a disaster.

In pastoralist areas of Africa, these principles can be applied to drought as a slow-onset hazard which is, to a large extent, an expected, although not precisely predictable, event.

Approaches to dealing with drought are not new and include drought cycle management as a means to identify appropriate livelihoods-based responses relative to the progression of drought. In these areas, livestock are the key livelihoods asset; the responses, therefore, centre on converting these assets into cash, protecting a 'core herd' needed for recovery after the drought and, as a last resort, rebuilding herds through restocking.

Following the drought cycle management model above, early warning requires timely detection of the alert/alarm phase of a drought and early response requires timely action. Furthermore, experience from the Horn of Africa shows that it makes strong economic sense to intervene early. As a general rule, well-designed interventions implemented during the alert/alarm phase of a drought carry a far higher benefit-cost ratio than interventions used later on.

The benefits of early response: commercial destocking in Ethiopia

In 2006, the USAID-funded Pastoralist Livelihoods Initiative programme in Ethiopia responded to drought by linking livestock traders to

hitherto unaccessed pastoralist communities. Facilitated by Save the Children US, the Ethiopian government and Tufts University, the process led to traders using their own resources to buy approximately 20,000 cattle, valued at US\$ 1.01 million. Pastoralists did not opt to sell all of their cattle, but selected specific types of animals for sale while retaining a core herd for breeding (Abebe et al., 2008). On average, destocked pastoral households in the programme received US\$ 186 from the sale of cattle. Approximately 5,405 households were involved. In terms of aid investment, the approximate benefit-cost ratio was 41:1 for the intervention.

During the drought, income from destocking accounted for 54.2 per cent of household income (n=114 households), and this income was used to buy food, care for livestock, meet various domestic expenses, support relatives, and either pay off debts or add to savings. In terms of supporting local markets and services, 79 per cent of the income derived from destocking was used to buy local commodities or services. Expenditure on livestock care amounted to 36.5 per cent of the local expenditure, and included the private trucking of livestock to better grazing areas (Abebe et al., 2008).

Constraints to early response

Despite the obvious benefits of livelihoods-based interventions such as commercial destocking, this kind of early response has yet to be institutionalized in Horn of Africa countries. For humanitarian actors and systems, key remaining challenges include:

- Early warning systems do not present information against a drought cycle management framework or use specific indicators for each stage of the cycle.
- Humanitarian actors wait for an official declaration of a disaster which, for drought, means waiting until substantial livestock assets have already been lost.
- Even when an alert/alarm phase is accurately identified, the decision-making processes and administrative rules in UN agencies and large non-governmental organizations (NGOs) prevent appropriate and timely response.
- In some emergencies, donors have limited capacity to assess proposals using livelihoods-based approaches.

It follows that strong livelihoods-based interventions during drought in pastoralist areas tend not to be implemented by typical emergency actors, but more by agencies with a long-term presence on the ground through development programmes.

Some of these players have built-in contingency funds and triggers which enable them to react quickly during the alert/alarm phase of a drought, and to respond on the basis of a relatively in-depth understanding of local livelihoods and of the capacities of government and private sector.

The livelihoods and programming logic of this kind of predictive flexibility indicates that all 'pastoral development' programmes should view drought as normal and include drought contingency funds supported by pre-agreed triggers, rapid decision-making and streamlined procurement and contracting arrangements. None of these ideas are new, but tend to contradict the trend within the UN and larger NGOs towards greater financial accountability and risk-averse management. Yet it makes little

sense to account for every cent if the response was late and had no impact.

Livestock Emergency Guidelines and Standards

The Livestock Emergency Guidelines and Standards (LEGS) are being developed as a set of international guidelines and standards for the design, implementation and assessment of livestock interventions to assist people affected by humanitarian crises.

The LEGS process:

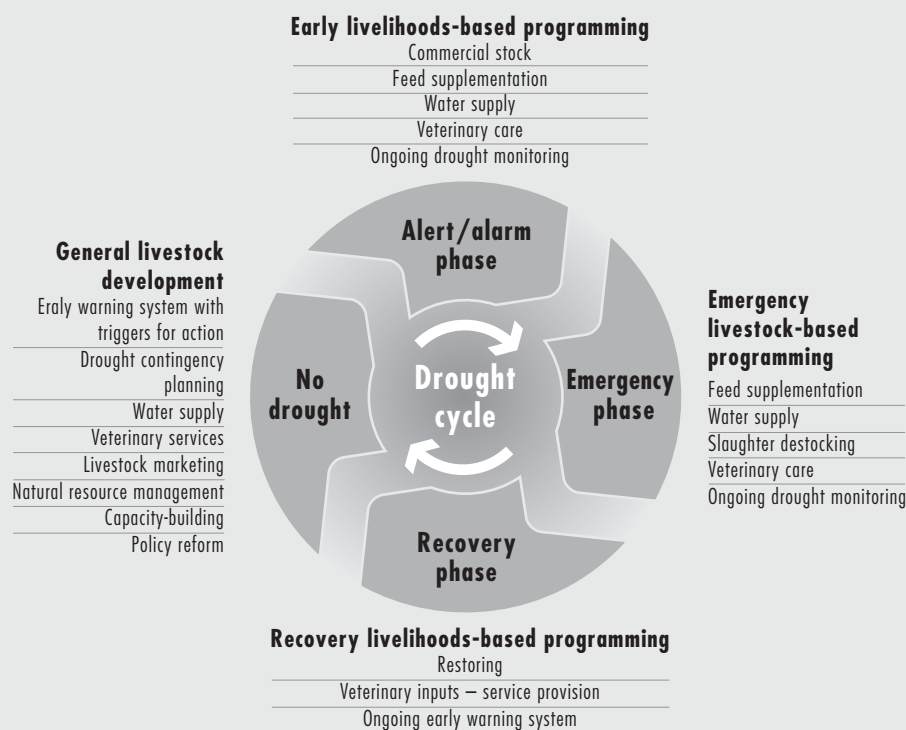
- grew out of a recognition that livestock are a crucial livelihoods asset for people throughout the world and that livestock interventions are often a feature of relief responses. Yet to date, there are no widely available guidelines to assist donors, programme managers or technical experts in the design or implementation of livestock interventions in disasters
- mirrors the process for developing the *Humanitarian Charter and Minimum Standards in Disaster Response* – the Sphere Project. The process is based on multi-agency contributions and broad reviews and collation of practitioner experience. LEGS liaises closely with the Sphere Project and intends to become one of the first Sphere 'companion modules'
- recognizes the value of livelihoods thinking and the need to harmonize 'relief' and 'development' approaches. This means promoting more long-term thinking and response in emergencies. This approach is particularly important as climatic trends are causing more frequent and varied humanitarian crises, particularly affecting communities such as pastoralists who rely heavily on livestock
- is led by a steering group comprising the Feinstein International Center (Tufts University), the International Committee of the Red Cross, the FAO, the African Union and Vétérinaires sans frontières, Belgium

- will result in an independent publication available as hard copy and CD-ROM in early 2009. Soft copies will also be available on the LEGS web site (www.livestock-emergency.net). LEGS will also run a series of awareness-raising and training events to promote the use and future revision of the standards and guidelines

In terms of timely responses to drought in pastoralist areas, LEGS advocates early, livelihoods-based interventions. As a set of international guidelines, LEGS should act as a point of reference for donors, NGOs and government agencies involved in drought response. LEGS also covers rapid-onset hazards, such as floods and earthquakes, and complex emergencies. ■

Figure 1

Livelihoods-based livestock interventions in the drought cycle



Source: Adapted from Aklilu et al., 2006

A critical observation is that a relatively narrow window of opportunity exists for implementing specific livelihood interventions. Many are subject to a tight timeline, in many cases only a month or two, beyond which they are ineffective.

For example, working in the Horn of Africa, a region of serious food insecurity, the Pastoral Areas Coordination Analysis and Policy Support (PACAPS) project (part of the USAID-funded Regional Enhanced Livelihoods in Pastoral Areas programme) is

advocating the phased use of a range of early actions to support pastoral livelihoods. In this region, given that a crisis normally spans two rainy seasons (see Figure 5.3), the timeline for some possible interventions would include:

- appropriate livestock feeding from around August, when pasture is scarce and animal condition is deteriorating, until the following March, when the rains may bring new pasture
- support to livestock marketing from around August, when poor body condition pushes prices down, until December once the condition of the animals is so poor that they have little market value
- mass destocking by early October, since it can be anticipated that animals will be dying in large numbers by January; destocking would be supported by selective livestock deworming and feeding to keep them in a marketable condition and to maintain a core breeding herd until the next rains (PACAPS, October 2008)

To support decision-making about when to implement livelihood interventions, a range of sensitive trigger points, or thresholds, should be defined. To reduce response delays, each of these thresholds should automatically trigger associated action. Achieving this aim demands redesigning early warning systems so that there is no longer a primary and single-purpose trigger of deterioration in welfare.

Furthermore, many of these triggers may only be visible in local-level systems, rather than at regional and national levels. The point is, therefore, not just to give an early warning of an impending crisis, but also to provide the information about the detailed scenario likely to unfold over the crisis period.

Figure 5.3
The evolution of a pastoral food crisis in the Horn of Africa

	March April	May June	July August	September October	November December	January February
	poor rains	no rain		poor rains	poor rains	
<i>pasture</i>		declining	very scarce	none		none
<i>livestock condition</i>		declining		very poor – old and weak starting to die	mortality increasing	high mortality
<i>livestock market</i>	high		low demand and price	very low demand and price	no demand, exploitation price	

Source: PACAPS, October 2008

Action-oriented contingency planning

Many of these alternative livelihood interventions require more time to design and plan than do general food distribution schemes. The problem is that given current start-up times, it may be necessary to decide upon and initiate action *before* the trigger points have been reached. Therefore, it may be vital to compress the timeline for implementing the response.

Response-oriented contingency planning has been advocated to increase the effectiveness of such time-critical livelihood interventions. Contingency planning should focus on the most probable scenarios and a limited number of feasible, tested response options. In these situations the goal is to reduce the associated timelines for implementation. Activities can be analysed to see which could be carried out well before a crisis matures, as the following quotation explains:

“For example, preparing draft job descriptions and having these approved ‘in principle’ could save two or three days. Pre-qualifying suppliers could save another two or three days by checking up on trading licences. A short list of pre-qualified suppliers would also shorten the time for advertising a tender by over a week. Having draft project proposals written and discussed both within the organisation and with potential donors could save much more time. Ensuring that customs staff recognise and can accept the goods which will need to be imported could save long delays. Working as a team, staff will quickly see that individual ‘savings’ of one or two days quickly add up to improving response times by weeks or months. None of the steps should involve much expenditure of resources, so there should be little waste if crises don’t occur.”

(PACAPS, September 2008)

Overall, early livelihood interventions have the potential of providing more timely, appropriate and cost-effective interventions. Nevertheless, it is difficult to find examples where humanitarian aid has prevented a large-scale crisis specifically by protecting household assets.

Even the advocates of these new strategies are pragmatic about the extent to which they constitute a comprehensive solution. The conservatism of response agencies and donors still needs to be overcome. Even then, the sophistication of the strategies – in contrast to the uniformity of traditional food-aid approaches – calls for strong technical and organizational capacities at the local level. In consequence, they must be thought of as offering a partial, albeit important, element of the overall effort to improve early action and prevent serious food crises in the wake of an emergency.

The role of risk reduction and safety nets

The practical constraints on our ability to react to the first signs of an acute crisis and mount a timely response are daunting. Hence, there is increased awareness of the need to concentrate on preventing and mitigating disasters *before* the shock occurs. In the broadest sense, the above can be thought of as part of an early warning *system*. Early warning starts with a process of risk assessment. This involves identifying hazards, high-risk areas, vulnerabilities, capacities and the probabilities of disasters occurring. Logically, the next stage consists of prevention and mitigation activities to protect against the identified risks.

There is growing attention to disaster risk reduction (DRR), which identifies opportunities for the prevention and mitigation of risks. DRR aims to decrease the likelihood that shocks will occur or, if they do occur, that they will cause damage. DRR can, in theory, reduce the need for emergency response to food crises. Examples of actions that reduce risk range from establishing early warning systems, to improving agricultural resilience (through distributing drought-tolerant seeds) and protecting the environment (such as implementing water conservation measures).

So far there is little quantitative evidence that investments in risk reduction are effective in maintaining food security in the face of shocks. The absence of this evidence does not imply that risk reduction investment is ineffective; rather it points to the need for improved impact evaluations.

Scaling up established safety nets to mitigate the impact of an unfolding disaster is an important area, but so far one which is under-explored. Capitalizing on the existence of an ongoing and well-funded poverty alleviation programme would greatly reduce the response lag-time.

Tangible, albeit modest, progress has been made in rolling out social protection and safety nets in a number of low-income countries. Several donors and international NGOs have taken a keen interest in safety nets and social protection. National governments are more ambivalent, concerned as they are about the fiscal implications of investing in safety nets and the difficulties of targeting the needy. Despite this, the number of social protection programmes is increasing. These programmes encompass a wide range of instruments, from poverty alleviation transfers targeted at the chronically poor, to transfers which support desirable agricultural, health or educational outcomes.

One of the most ambitious programmes has been the establishment of a safety net programme in Ethiopia (see Box 5.5). In 2006 the Productive Safety Net Programme (PSNP) was used, on a pilot basis, to distribute additional resources to farmers affected by drought. The outcome of this pilot project could have significant ramifications for transforming the future delivery of humanitarian aid.

Box 5.5 Ethiopia Productive Safety Net Programme: improving the efficiency and effectiveness of emergency response

The Ethiopia PSNP is an innovative attempt to meet predictable food needs in more appropriate ways and thus limit the extent of household impoverishment in the event of a natural hazard.

Over the last two decades, emergency appeals for Ethiopia have become an annual event. Between 1994 and 2004, the number of food aid beneficiaries in Ethiopia fluctuated between 5 and 14 million. It has become increasingly clear that a large proportion of the households targeted for emergency food aid were, in fact, vulnerable not as a result of exceptional circumstances – such as drought – but rather due to predictable seasonal food shortages caused largely by structural agricultural production constraints and poverty.

People living with chronic food insecurity are, clearly, also vulnerable to other shocks to their livelihoods. In an emergency, families may be forced to take children out of school or sell productive assets and household goods in order to survive. The consequences are inevitably long term and with each shock, families and communities become less able to cope and fall further into food insecurity.

Decades of large-scale food aid did little to prevent this deterioration of livelihoods. As Food for the Hungry's country director in Ethiopia reported: "Food aid appeals were made based on annual crop assessments. The timing of these assessments and appeals made it difficult to receive the food aid on time and many people had to sell assets to survive until the food arrived. The food-for-work activities associated with these annual appeals were hastily planned and the quality of the activities was in many cases less than desired. Truly, a new approach to programming food aid was needed for the

lives of these food insecure households and communities to improve" (Alliance for Food Aid, 2008).

To better address long-term vulnerability to food insecurity in response to this situation, the government of Ethiopia, jointly with WFP and the World Bank, initiated a PSNP. This programme provides for a multi-year response to those affected by chronic hunger instead of the relatively unreliable annual emergency appeals. The PSNP has received widespread donor support, including the Canadian International Development Agency, Development Cooperation Ireland, European Commission, the United Kingdom's Department for International Development, USAID and the World Bank.

Under the PSNP, resource transfers (a mix of cash and food-for-work) are planned in advance and made available during the annual hunger period. The PSNP offers food-for-work and cash-for-work opportunities to households with productive members, while households without labour qualify for unconditional food or cash transfers. The programme is designed to provide timely resources that help households to bridge periods of hunger without having to sell scarce assets to survive.

The ultimate goal of the PSNP is to produce long-term improvements in livelihoods so that households can 'graduate' from the need for external food assistance. The logic is that not only are household assets protected, but household and community assets will be built up over time, since most of the food-for-work activities reinforce the communities' protective environment (e.g., erosion control, drainage and reservoirs) and leave households more food secure.

The PSNP is designed to meet structural food deficits in the absence of an emergency.

In a typical year, no emergency appeal is needed beyond the programmed PSNP resources.

Over the first four years of the programme's operations, good rains prevailed. Unfortunately in 2008, weather conditions led to an exceptional food crisis, and needs were well in excess of the planned capacity of the PSNP. However, the framework of the PSNP was used to expand deliveries efficiently, without the long start-up time and delays of stand-alone emergency programmes. Whereas in a normal year the chronically food insecure households may need food support for five or six months, in 2008 they required an additional three months of rations. By the same token, the PSNP has some flexibility to provide support to population groups not normally affected by structural food insecurity (i.e., only in times of crisis).

A pilot scheme is developing a model for financing unforeseen additional distributions under the PSNP as a result of drought shocks. The project, whereby farmers would receive cash payments in the event of a severe drought, was piloted by the WFP and its reinsurance partner Axa Re in 2006. Weather-indexed payments are triggered early in the season, mostly by comparing levels of rainfall with historical levels and crop requirements. The goal is to provide a national-level programme, where the insurance cover generates a contingency fund for up to 6.7 million people in the case of a severe drought.

"This is the first ever attempt of the humanitarian community to approach risk in a social protection fashion, determining in advance of a

crisis which segments of a population are at risk from what sources, and intervening with mechanisms that are able to avert or mitigate a crisis before it occurs" (Maxwell et al., 2008).

The early studies of the impact of the PSNP are generally positive. The main operational concern is that distributions have not proved to be as predictable as intended – in either timing or quantity. This has obviously limited the food security impacts (Gilligan et al., 2008). It is also argued that a safety net programme alone is unlikely to enable graduation on any scale: "A combination of a safety net programme and other programmes will enable some (but not all) households to also build assets, but whether they thereby graduate into food security will depend to a large extent on whether critical enabling elements in the wider environment are in place" (RHVP, August 2007).

However, there is little doubt that this model offers a considerable improvement over sole reliance on annual emergency appeals. Most significantly, emergency needs may be met in a more timely way that helps to preserve basic household assets and livelihoods. In addition, redirecting the responsibility for responding to chronic needs has important repercussions for reducing operational pressures on scarce humanitarian capacities and budgets. This strategy deserves further consideration in other regions or countries (western and southern Africa and Bangladesh have been mentioned) where chronic hunger persists alongside the capacity and political will to establish and manage such schemes. ■

Political and financial support for early action

Even when the technical elements of an effective early warning and response system are in place, the effectiveness of the response is highly dependent on the overall governance context. Amartya Sen's provocative observation (Sen, 1999) that "famines don't occur in democracies" raised the all-important question of governance and accountability.



The primary responsibility in any country for ensuring the right to food rests with the leaders and administrators of that country. Despite the widely endorsed political commitments to the reduction and eventual elimination of hunger, many of the most serious food crises are clearly associated with a failure of states to protect, respect and fulfil the right to food. Indeed, it can be argued that poor governance may be viewed as the major underlying cause of food crises.

Failures of governance that contribute to the escalation of food crises occur at many levels. Long-term efforts to reduce vulnerability depend on the success of governments in tackling poverty and delivering the range of basic services in health, sanitation, education – which are strongly correlated with food security. At a basic level, emergency response cannot compensate for failures of development.

At a cruder level, there may be political interference in the monitoring process and the distribution of humanitarian aid. While a common concern is the artificial inflation of needs, in fact the reverse may be the case, even more insidious in its consequences. Recently it has been claimed that, for diverse reasons, several governments have been unwilling to acknowledge and respond to the food crises; examples cited include Senegal (McNabb, 2008) and Ethiopia (Righter, 2008).

A farmer works in a field of maize near Siara village in Ethiopia.

© José Cendón/
International Federation

That good governance is necessary to prevent acute food insecurity goes without saying. More generally, though, responsibility for preventing hunger and malnutrition must be shared by nations globally. The donor nations persistently fall far short of delivering on existing aid commitments.

It is unclear whether, even if these commitments were met, this would suffice to meet established needs and prevent a continuing downward spiral of destitution in the most vulnerable regions. Uncomfortable comparisons deserve to be drawn between the willingness to mobilize huge sums to respond to the global financial crisis of 2008, with the parsimonious response to appeals to meet the survival needs of the world's poorest and most destitute.

Clearly, it is not just the quantity of funding that is important, but also the quality. Flexible emergency funding needs to be made available to support early action, ideally well in advance through the establishment of national safety net programmes. Although progress has been made in improving the availability and flexibility of funding, this is still the exception rather than the norm. As CARE reports:

“Donors are still failing to fund preventative action adequately. In April 2008, three donors either refused or ignored CARE’s requests for funds to protect the health and assets of vulnerable populations faced with crop failure and rising prices in the Horn of Africa. But later some of these same donors funded expensive emergency responses instead. Heartening exceptions have been the US Agency for International Development’s new flexible multi-year development funding in southern Ethiopia, and the European Community Humanitarian Office’s regional drought funding in the Horn of Africa.”

(CARE, 2008)

The establishment of various ‘pooled’ donor funds for emergency response funds has been part of wider UN reform programme. These have included the establishment of the Common Emergency Response Fund (CERF) and other country-specific pooled donor funds. The recent CERF evaluation found some evidence that its fund had contributed to the timeliness of response, but had mainly been used by UN agencies to respond in traditional ways – for example, via food aid (Barber et al., 2008).

A specific criticism of the CERF has been that it is not directly accessible to NGOs, the very agencies best placed to implement livelihood interventions. Therefore, further adapted, or additional, funding instruments are still needed to support the flexible funding of livelihood interventions that can respond dynamically to changing circumstances (see, for example, Simpkin, 2005).

An agenda for action

It is hard to justify or accept a continuance of the status quo, where natural hazards trigger a descent into nutritional emergencies. The knowledge and resources exist to prevent this cycle of suffering. Improving early warning and early action presents one important opportunity to address this problem. While significant progress in this area is evident, what has been achieved still falls far short of what is needed, given the paramount importance of protecting lives and livelihoods from natural hazards, wherever possible.

Given the complexity of livelihoods, and the numerous and evolving sources of risk and variable governance capacities, there is no simple or uniform solution for improving the early warning and early action systems. The challenges and opportunities are highly context-specific and action on multiple fronts is needed. Overall, a number of general conclusions and common themes for action emerge.

First, considerable progress has been made in monitoring, analysing and disseminating early warning of risks to food security. The operation of early warning is still far from perfect and deserves continued development and support. Placing greater emphasis on early livelihood action demands new thinking on what to monitor, how to analyse it and how to report it. But only infrequently is an absence of early warning cited as a critical constraint on action. At the same time, a major remaining challenge occurs when conflict precludes humanitarian access. Second, there is a growing consensus around, and knowledge of, what early actions are necessary and appropriate to prevent hunger and destitution. The capacity to deliver a diversified menu of tailored response recommendations is increasing, but more needs to be done to put in place the ability to react in a timely and appropriate way to early warnings.

There are a number of promising avenues of action, which can be scaled up and built upon. Much needs to be done to strengthen implementation capacity for early livelihood actions. Capitalizing on the roll-out of social safety nets as a means of mitigating risk is an emerging and promising opportunity that deserves greater support.

Nevertheless, what emerges as the single most critical constraint on more effective action is the uneven level of demonstrated political commitment for early action. Rarely are national governments or donors held accountable in this respect. As noted, the primary responsibility for ensuring the right to food in any country rests with the national government.

Creative solutions to strengthening the responsibility and accountability of governments to their own citizens must be a priority. At a donor level, financial aid commitments must be better met, both with respect to humanitarian response and to address the underlying structural causes through increased development funding.

CHAPTER 5

Chapter 5 and three boxes were written by Nick Maunder who works in the field of food security, social protection and vulnerability analysis. He is currently the European Commission Directorate General for Humanitarian Aid (DG-ECHO) sector expert for food assistance and disaster risk reduction. The opinions expressed are solely those of the author. Box 5.3 was written by Jean-Luc Martinage and Matthew Cochrane of the International Federation's secretariat. Andy Catley, research director at the Feinstein International Center, Tufts University, based in Addis Ababa, Ethiopia, and a member of the LEGS steering group, contributed Box 5.4.

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Disclaimer

The data and opinions expressed in these annexes do not necessarily represent the official policy of the International Federation of Red Cross and Red Crescent Societies or of individual National Red Cross or Red Crescent Societies. For further information regarding the figures, data and analysis provided in Annexes 1 and 2, please contact the Centre for Research on the Epidemiology of Disasters (CRED), the UN International Strategy for Disaster Reduction (UNISDR) and the US Committee for Refugees and Immigrants (USCRI).

ANNEXES

Red Cross and Red Crescent Societies have long trained their staff and volunteers in disaster response, so that they can respond rapidly to disaster events in their communities. However, they also need to learn about early warning and early action to help improve local resilience to disaster.

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Disaster data

According to the Centre for Research on the Epidemiology of Disasters (CRED), 326 natural disasters and 259 technological disasters were reported worldwide in 2008 – the lowest figures for the decade in both cases.

However, the number of people reported killed by natural disasters (235,736) was the second highest of the decade, close to the peak of 2004 (241,635, mostly attributable to the Indian Ocean tsunami). In 2008, Cyclone Nargis left 138,366 people dead or missing in Myanmar and the Sichuan earthquake killed 87,476 people in China. These two disasters account for 93 per cent of all people considered dead or missing.

The number of people killed in technological disasters (6,926) is, by contrast, the lowest of the decade and is, for 75 per cent, attributable to transport accidents.

The number of people reported affected by natural disasters (213 million) remained stable compared to the previous year and below the decade's average of 270 million. The extreme winter conditions that affected several Chinese provinces left 77 million people in difficulty, which represents more than one-third of all people affected by natural disasters. The Sichuan earthquake affected around 46 million people, a major flood in the United States affected 11 million people, while in Thailand, drought affected 10 million people. Another 19 other major natural disasters affected 1 to 8 million people each. Eleven of these disasters occurred in Asia, five in Africa and three in the Americas.

By comparison, technological disasters affected far fewer people – some 39,000, which is also the lowest of the decade. More than 50 per cent were affected by miscellaneous accidents.

Natural disaster costs (US\$ 181 billion) were the second highest of the decade and represent three-quarters of the record of 2005, when Hurricane Katrina caused damage amounting to almost US\$ 140 billion (2008 prices). The Sichuan earthquake (US\$ 85 billion) accounts for almost half of 2008 costs. Damages from Hurricane Ike cost US\$ 31.5 billion (USA: US\$ 30 billion; Cuba: US\$ 1.5 billion), the cost of extreme winter conditions in China amounted to US\$ 21 billion and a major flood in the United States cost US\$ 10 billion. The cost of damage in 11 other disasters amounted to between US\$ 1 and 9 billion: eight windstorms cost a total of US\$ 20 billion, two floods cost US\$ 3 billion and one wildfire, US\$ 2 billion. Nine of the 15 natural disasters with damages equal or superior to US\$ 1 billion occurred in North America and two in Europe; of the four that occurred in Asia, three hit China.

Photo opposite page:
Village health
volunteers in Tibang
village, Banda Aceh,
Indonesia create
a calendar to map
seasonal health risks,
such as malaria.
Activities such as this
are part of the people-
centred approach to
early warning.

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American Red Cross

EM-DAT: a specialized disaster database

Tables 1–13 on natural and technological disasters and their human impact over the last decade were drawn and documented from CRED's EM-DAT. Established in 1973 as a non-profit institution, CRED is based at the School of Public Health of the Catholic University of Louvain in Belgium and became a World Health Organization (WHO) collaborating centre in 1980. Although CRED's main focus is on public health, the centre also studies the socio-economic and long-term effects of large-scale disasters.

Since 1988, with the sponsorship of the United States Agency for International Development's Office of Foreign Disaster Assistance (OFDA), CRED has maintained EM-DAT, a worldwide database on disasters. It contains essential core data on the occurrence and effects of more than 17,000 disasters in the world from 1900 to the present. The database is compiled from various sources, including United Nations (UN) agencies, non-governmental organizations, insurance companies, research institutes and press agencies.

Priority is given to data from UN agencies, followed by OFDA, governments and the International Federation. This prioritization is not a reflection of the quality or value of the data but the recognition that most reporting sources do not cover all disasters or may have political limitations that could affect the figures. The entries are constantly reviewed for redundancies, inconsistencies and the completion of missing data. CRED consolidates and updates data on a daily basis. A further check is made at monthly intervals. Revisions are made annually at the end of the calendar year.

The database's main objectives are to assist humanitarian action at both national and international levels; to rationalize decision-making for disaster preparedness; and to provide an objective basis for vulnerability assessment and priority setting.

Data definitions and methodology

CRED defines a disaster as “a situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance (definition considered in EM-DAT); an unforeseen and often sudden event that causes great damage, destruction and human suffering”.

For a disaster to be entered into the database, at least one of the following criteria must be fulfilled:

- Ten or more people reported killed
- 100 people or more reported affected
- Declaration of a state of emergency
- Call for international assistance

The number of people killed includes people confirmed as dead and people missing and presumed dead. People affected are those requiring immediate assistance during a period of emergency (i.e., requiring basic survival needs such as food, water, shelter, sanitation and immediate medical assistance). People reported injured or homeless are aggregated with those reported affected to produce a 'total number of people affected'.

The economic impact of a disaster usually consists of direct consequences on the local economy (e.g., damage to infrastructure, crops, housing) and indirect consequences (e.g., loss of revenues, unemployment, market destabilization). In EM-DAT, the registered figure corresponds to the damage value at the moment of the event and usually only to the direct damage, expressed in US dollars.

In 2007, a new natural disaster category classification was introduced in EM-DAT. This new classification was initiated by CRED and Munich Re and brought together CRED, Munich Re, Swiss Re, the Asian Disaster Reduction Center and the United Nations Development Programme (UNDP). The goals were to create and agree on a common hierarchy and terminology for all global and regional databases on natural disasters and to establish a common and agreed definition of sub-events that is simple and self-explanatory.

This classification is a first step in the development of a standardized international classification of disasters. It distinguishes two generic categories for disasters (natural and technological). The natural disasters category is divided into five sub-groups, which in turn cover 12 disaster types and more than 32 sub-types. The five sub-groups and 12 types are as follows:

- **biological disasters:** insect infestations, epidemics and animal attacks (the last two categories are not considered in the *World Disasters Report*)
- **geophysical disasters:** earthquakes and tsunamis, volcanic eruptions, dry mass movements (avalanches, landslides, rockfalls and subsidence of geophysical origin)
- **climatological disasters:** droughts (with associated food insecurities), extreme temperatures and wildfires
- **hydrological disasters:** floods (including waves and surges), wet mass movements (avalanches, mud/landslides, rockfalls and subsidence of hydrological origin)
- **meteorological disasters:** storms (divided into nine sub-categories)

The technological disasters remain unchanged and comprise three groups:

- **industrial accidents:** chemical spills, collapse of industrial infrastructure, explosions, fires, gas leaks, poisoning, radiation
- **transport accidents:** transport by air, rail, road or water
- **miscellaneous accidents:** collapse of domestic/non-industrial structures, explosions, fires

In Tables 1–13, 'disasters' refer to disasters with a natural and technological trigger only, and do not include wars, conflict-related famines, diseases or epidemics.

ANNEX

The classification of countries as ‘high’, ‘medium’ or ‘low human development’ is based on UNDP’s 2009 Human Development Index (HDI). For a small number of countries not appearing in the HDI, the World Bank’s classification of economies by the countries’ level of income is used (‘high’, ‘middle’ and ‘low’).

In both EM-DAT and the tables in this annex, data are considered at country level for many reasons, including the fact that it is at this level that they are reported most of the time and also due to issues regarding possible aggregation and disaggregation of data. For droughts or food insecurities, which are often multi-years disasters, their impact over time is taken into account.

Bearing in mind that data on deaths and economic damage from drought are infrequently reported, CRED has adopted the following rules as regards data for droughts:

- The total number of deaths reported for a drought is divided by the number of years for which the drought persists. The resulting number is registered for each year of the drought’s duration.
- The same calculation is made for the reported economic damages.
- For the total number of people reported to be affected, CRED considers that the same number is affected each year that the disaster persists.

Some disasters begin at the end of a year and may last some weeks or months into the following year. In such cases, CRED has adopted the following rules:

- As regards the number of people reported affected, the total number is recorded for both the start year and the end year.
- For the number of people reported killed, CRED distinguishes between disasters which are of sudden onset (earthquakes, flash floods, landslides, etc.) and of slow onset (wildfires, some floods, extreme temperatures, etc.) as follows:
 - Sudden-onset disasters: all those killed are registered according to the start year of the disaster
 - Slow-onset disasters: the total of all those killed is divided by two and a half and is attributed to each year of persistence
- Reported economic damages are always attributed to the end year of the disaster. This is because damage is related to both the strength of a disaster and its duration.

By using these rules, some data bias correction is attempted. However, they are far from perfect and CRED will try to improve them, as well as the database as a whole in the future.

Caveats

Key problems with disaster data include the lack of standardized collection methodologies and definitions. The original information, collected from a variety of public sources, is not specifically gathered for statistical purposes. So, even when the

compilation applies strict definitions for disaster events and parameters, the original suppliers of information may not. Moreover, data are not always complete for each disaster. The quality of completion may vary according to the type of disaster (for example, the number of people affected by transport accidents is rarely reported) or its country of occurrence.

Data on deaths are usually available because they are an immediate proxy for the severity of the disaster. However, the numbers put forward immediately after a disaster may sometimes be seriously revised, occasionally several months later.

Data on the numbers of people affected by a disaster can provide some of the most potentially useful figures, for planning both disaster preparedness and response, but they are sometimes poorly reported. Moreover, the definition of people affected remains open to interpretation, political or otherwise. Even in the absence of manipulation, data may be extrapolated from old census information, with assumptions being made about percentages of an area's population affected.

Data can also be skewed because of the rationale behind data gathering. Reinsurance companies, for instance, systematically gather data on disaster occurrence in order to assess insurance risk, but with a priority in areas of the world where disaster insurance is widespread. Their data may, therefore, miss out poor, disaster-affected regions where insurance is unaffordable or unavailable.

For natural disasters over the last decade, data on deaths are missing for around one-tenth of reported disasters, data on people affected are missing for around one-fifth of disasters, and data on economic damages are missing for 67 per cent of disasters. The figures should, therefore, be regarded as indicative. Relative changes and trends are more useful to look at than absolute, isolated figures.

Dates can be a source of ambiguity. For example, a declared date for a famine is both necessary and meaningless – a famine does not occur on a single day. In such cases, the date the appropriate body declares an official emergency has been used. Changes in national boundaries cause ambiguities in the data and may make long-term trend analysis more complicated.

However, in some cases, available data may differ greatly according to sources, be more or less documented estimations and/or subject to controversies. In these cases, CRED always compiles all available data or analysis to try to make its own documented estimation, which can be revised when more accurate data are provided.

Information systems have improved vastly in the last 25 years and statistical data are now more easily available, intensified by an increasing sensitivity to disaster occurrence and consequences. Nevertheless there are still discrepancies. An analysis of

quality and accuracy of disaster data, performed by CRED in 2002, showed that occasionally, for the same disaster, differences of more than 20 per cent may exist between the quantitative data reported by the three major databases – EM-DAT (CRED), NatCat (Munich Re) and Sigma (Swiss Re).

Despite efforts to verify and review data, the quality of disaster databases can only be as good as the reporting system. This, combined with the different aims of the three major disaster databases (risk and economic risk analysis for reinsurance companies, development agenda for CRED), may explain differences between data provided for some disasters. However, in spite of these differences, the overall trends indicated by the three databases remain similar.

The lack of systematization and standardization of data collection is a major weakness when it comes to long-term planning. Fortunately, due to increased pressures for accountability from various sources, many donors and development agencies have started paying attention to data collection and its methodologies.

Part of the solution to this data problem lies in retrospective analysis. Data are most often publicly quoted and reported during a disaster event, but it is only long after the event, once the relief operation is over, that estimates of damage and death can be verified. Some data gatherers, like CRED, revisit the data; this accounts for retrospective annual disaster figures changing one, two and sometimes even three years after the event.

US Committee for Refugees and Immigrants

The US Committee for Refugees and Immigrants (USCRI) is the successor to the merged non-governmental organizations (NGOs) Immigration and Refugee Services of America and US Committee for Refugees. USCRI resettles refugees, reports on the situation of refugees and asylum seekers abroad, and encourages the public, policy-makers and the international community to respond effectively to their needs and to honour their rights under the 1951 Convention relating to the Status of Refugees.

USCRI travels to the scene of refugee situations to gather testimony from uprooted people, to assess their legal rights and to gauge governmental, civil and international responses. The committee also works with more than 40 NGO research partners in refugee-hosting countries to gather information and to conduct advocacy. USCRI conducts public briefings to present its findings and recommendations, testifies before the US Congress, communicates concerns directly to governments and provides first-hand assessments to the media. USCRI publishes the annual *World Refugee Survey*, the monthly e-mail 'Bulletin of the Campaign to End Refugee Warehousing' and various issue papers.

USCRI provided the data in Tables 14–16. The quality of the data in these tables is affected by the less-than-ideal conditions often associated with the flight of the affected people. Unsettled conditions, the biases of governments and opposition groups and the need to use humanitarian aid planning estimates can each contribute to inaccuracies. The estimates reproduced in these tables were preliminary as at March 2009.

Table 14 lists refugees and asylum seekers by country/territory of origin, while Table 15 lists them by host country/territory. Refugees are people who are outside their home country and who are unable or unwilling to return to that country because they fear persecution or armed conflict. But most refugees never receive formal status determinations. Asylum seekers are people who claim and, *prima facie*, appear to be refugees. While not all asylum seekers are refugees, they are in need of international protection at least until it is clear that they are not refugees. USCRI also includes people granted various subsidiary forms of protection if based on factors related to the refugee definition, as distinct from, for example, protection granted because of natural disaster.

Table 16 concerns internally displaced people (IDPs). Like refugees and asylum seekers, IDPs have fled their homes, but remain in their home country. No universally accepted definition of IDPs exists, nor is it clear when their situation ceases to be of concern. USCRI generally considers people who are uprooted within their country because of armed conflict or persecution – and who would thus be refugees if they were to cross an international border – to be internally displaced. Others employ broader definitions, however, sometimes including people uprooted by hazards (natural or otherwise) or other causes not directly related to human rights. IDPs often live in war-torn areas and are neither registered nor counted in any systematic way. Estimates of the size of IDP populations are frequently prone to great margins of error.

Philippe Hoyois, senior research fellow with CRED, Regina Below, manager of CRED's EM-DAT disaster database and Debarati Guha-Sapir, director of CRED, prepared the sections on natural and technological disasters. For further information, please contact: Centre for Research on the Epidemiology of Disasters (CRED), School of Public Health, Catholic University of Louvain, 30.94, Clos Chapelle-aux-Champs, 1200 Brussels, Belgium. Tel. +32 2 764 3327. Fax: +32 2 764 3441. E-mail: cred@esp.ucl.ac.be. Web: www.emdat.be.

The section on refugees, asylum seekers and IDPs was prepared by the US Committee for Refugees and Immigrants, 1717 Massachusetts Avenue NW, Suite 200, Washington DC 20036, USA (www.refugees.org).

Table 1 Total number of reported disasters,¹ by continent and by year (1999 to 2008)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Africa	144	202	183	197	169	164	170	198	178	159	1,764
Americas	140	150	134	156	126	135	139	103	133	138	1,354
Asia	256	303	295	310	292	314	359	299	255	226	2,909
Europe	92	130	96	115	96	98	127	92	103	52	1,001
Oceania	16	13	18	19	20	22	16	18	11	10	163
High human development ²	194	248	200	230	197	207	215	170	187	138	1,986
Medium human development	381	425	402	459	414	435	477	417	387	363	4,160
Low human development	73	125	124	108	92	91	119	123	106	84	1,045
Total	648	798	726	797	703	733	811	710	680	585	7,191

Source: EM-DAT, CRED, University of Louvain, Belgium

¹ In Tables 1–13, ‘disasters’ refer to those with a natural and/or technological trigger only, and do not include wars, conflict-related famines, diseases or epidemics.

² See note on UNDP’s Human Development Index country status in the section on disaster definitions in the introduction to this annex.

With 585 disasters, 2008 is the year with the lowest number of disasters of the decade, far below the peaks of 2000, 2002 and 2005

In 2008, disaster numbers were the lowest of the decade in Asia, Europe and Oceania as well as in high and medium human development countries.

With, respectively, 27 per cent and 24 per cent of all disasters, Africa and the Americas are above their decade’s averages of 25 per cent and 19 per cent.

Table 2 Total number of people reported killed, by continent and by year (1999 to 2008)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Africa	2,690	5,392	4,520	7,639	6,160	4,246	3,192	5,780	3,464	2,943	46,026
Americas	33,998	2,066	3,077	2,108	2,196	8,321	5,437	1,558	2,884	2,672	64,317
Asia	98,944	88,056	105,960	89,777	38,977	238,103	90,936	20,478	15,548	236,302	1,023,081
Europe	19,535	1,622	2,338	1,808	73,373	1,259	1,130	5,699	1,684	722	109,170
Oceania	116	205	9	91	64	35	46	24	273	23	886
High human development ¹	6,164	3,306	3,404	3,370	74,736	2,664	4,036	6,065	2,861	1,820	108,426
Medium human development	71,295	13,872	33,207	14,930	43,718	247,188	93,645	23,726	17,889	238,235	797,705
Low human development	77,824	80,163	79,293	83,123	2,316	2,112	3,060	3,748	3,103	2,607	337,349
Total	155,283	97,341	115,904	101,423	120,770	251,964	100,741	33,539	23,853	242,662	1,243,480

Source: EM-DAT, CRED, University of Louvain, Belgium

¹ See note on UNDP's Human Development Index country status in the section on disaster definitions in the introduction to this annex.

In 2008, the number of people reported killed was the second highest of the decade, with Cyclone Nargis in Myanmar killing 138,366 people (or 57 per cent of all deaths) and the earthquake in Sichuan, China with 87,476 people dead or missing (36 per cent of all deaths).

Other major disasters during the decade include the famine in the Democratic People's Republic of Korea* (more than 600,000 deaths from 1995 to 2002); the Indian Ocean tsunami in December 2004 (226,408 deaths); the South Asia earthquake in 2005 (74,647 deaths); the 2003 heatwave in Europe (more than 70,000 deaths); floods in Venezuela in 1999 (30,000 deaths); and the major earthquakes in Iran in 2003 (Bam: 26,796 deaths), India in 2001 (Gujarat: 20,005 deaths) and Turkey in 1999 (Izmit: 17,127 deaths).

* The estimates provided are disputed. See the caveats in the introductory pages of the statistical data for further information.

Table 3 Total number of people reported affected, by continent and by year (1999 to 2008), in thousands

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total ²
Africa	37,634	46,000	45,445	44,601	29,213	36,902	22,856	22,892	12,526	18,220	316,289
Americas	17,277	975	10,913	2,517	3,995	9,478	8,308	1,450	8,940	19,684	83,537
Asia	241,095	206,644	186,203	663,070	234,974	132,289	129,716	118,356	190,886	175,732	2,278,965
Europe	6,311	2,929	787	1,493	1,546	538	527	260	1,646	268	16,304
Oceania	151	7	31	41	38	119	28	38	172	92	718
High human development ¹	19,357	1,550	8,942	2,914	2,849	6,568	7,364	828	5,980	16,816	73,163
Medium human development	262,389	225,821	212,343	687,582	248,008	155,809	136,039	122,275	199,723	184,070	2,434,060
Low human development	20,727	29,184	22,095	21,226	18,909	16,948	18,033	19,893	8,467	13,110	188,590
Total	302,467	256,556	243,380	711,722	269,765	179,325	161,436	142,995	214,170	213,996	2,695,813

Source: EM-DAT, CRED, University of Louvain, Belgium

¹ See note on UNDP's Human Development Index country status in the section on disaster definitions in the introduction to this annex.

² Since slow-onset disasters can affect the same people for a number of years, it is best to use figures on total numbers affected to calculate annual averages over a decade rather than as absolute totals.

On the basis of available data, an average of around 270 million people were affected annually by disasters from 1999 to 2008, 85 per cent of them in Asia.

In the Americas, the number of people affected was the highest of the decade. In the United States, a major flood affected 11 million people; in the Caribbean and the United States, Hurricane Gustav affected 2.1 million people; and in Brazil and Colombia, two floods affected a total of 2.5 million people.

In 2008, the number of people affected by disaster living in Africa and Europe was the second lowest of the decade.

Table 4 Total amount of disaster estimated damage, by continent and by year (1999 to 2008) in millions of US\$ (2008 prices)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Africa	802	1,248	808	438	6,480	1,915	38	244	784	341	13,097
Americas	28,602	6,672	16,006	15,446	25,357	74,301	190,499	7,251	18,293	61,983	444,411
Asia	44,427	27,204	15,743	15,914	27,734	75,600	30,603	24,961	35,874	115,935	413,995
Europe	65,714	22,254	2,403	40,431	21,496	2,079	17,323	2,594	22,393	2,803	199,489
Oceania	2,899	670	698	2,610	694	630	241	1,373	1,493	90	11,399
High human development ¹	89,092	41,473	19,768	63,700	54,088	127,943	207,866	13,281	57,069	64,128	738,409
Medium human development	53,325	8,523	15,822	11,078	27,670	25,980	30,825	23,139	21,280	117,023	334,666
Low human development	25	8,052	68	60	3	602	13	3	489	n.a.	9,316
Total	142,443	58,048	35,658	74,838	81,761	154,525	238,704	36,424	78,838	181,152	1,082,391

Source: EM-DAT, CRED, University of Louvain, Belgium

¹ See note on UNDP's Human Development Index country status in the section on disaster definitions in the introduction to this annex. Note: n.a. signifies no data available. For more information, see section on caveats in introductory text.

As mentioned in the introduction, damage assessment is frequently unreliable. Even for existing data, the methodologies are not standardized and the financial coverage can vary significantly. Depending on where the disaster occurred and who reports it, estimations may vary from zero to billions of US dollars.

The total amount of damage (US\$ 181 billion) reported in 2008 is the second highest of the decade and is largely above the decade's average (US\$ 108 billion), but still below the peak of 2005 (US\$ 239 billion).

In 2008, in Asia, reported disaster damages were the highest of the decade, accounting for 64 per cent of all damages reported in the world. The Sichuan earthquake alone accounts for 45 per cent of all reported damages.

For the second time in the decade, in 2008 damage in medium human development countries was greater than that reported for high human development countries.

Table 5 Total number of reported disasters, by type of phenomenon and by year (1999 to 2008)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Droughts/food insecurity	31	42	42	40	23	19	28	19	13	15	272
Earthquakes/tsunamis	33	31	25	37	40	42	25	24	20	21	298
Extreme temperatures	8	31	23	15	25	16	29	24	25	8	204
Floods ¹	122	158	157	171	159	129	195	227	219	158	1,695
Forest/scrub fires	22	30	14	22	14	8	13	9	18	4	154
Insect infestation	ndr	2	2	ndr	ndr	12	ndr	ndr	ndr	ndr	16
Mass movement: dry ²	ndr	1	ndr	1	ndr	1	ndr	1	ndr	3	7
Mass movement: wet ³	18	28	24	20	21	15	12	20	10	12	180
Volcanic eruptions	5	5	6	7	2	5	8	12	6	6	62
Windstorms	106	102	108	124	85	127	130	76	105	99	1,062
Subtotal climato-, hydro-meteorological disasters	307	393	370	392	327	326	407	375	390	296	3,583
Subtotal geophysical disasters	38	37	31	45	42	48	33	37	26	30	367
Total natural disasters	345	430	401	437	369	374	440	412	416	326	3,950
Industrial accidents	37	51	54	48	52	81	76	61	52	38	550
Miscellaneous accidents	52	58	50	52	45	62	66	32	42	30	489
Transport accidents	214	259	221	260	237	216	229	205	170	191	2,202
Total technological disasters	303	368	325	360	334	359	371	298	264	259	3,241
Total	648	798	726	797	703	733	811	710	680	585	7,191

Source: EM+DAT, CRED, University of Louvain, Belgium

¹ Includes waves and surges. ² Landslides, rockfalls, subsidence of geophysical origin. ³ Mud/landslides, avalanches, subsidence of hydrological origin.

Note: ndr signifies no disaster reported. For more information, see section on caveats in introductory text.

In 2008, the numbers of both natural and technological disasters were the lowest of the decade, as were the numbers of forest/scrub fires and of miscellaneous accidents. In 2008, the most frequent disasters were transport accidents (33 per cent), floods (27 per cent) and windstorms (17 per cent), near their average for the decade.

Table 6 Total number of people reported killed, by type of phenomenon and by year (1999 to 2008)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Droughts/food insecurity	76,344	76,379	76,476	76,903	38	80	88	208	0	4	306,520
Earthquakes/tsunamis	21,869	216	21,348	1,634	29,617	227,290	76,241	6,692	706	87,885	473,498
Extreme temperatures	771	941	1,787	3,369	74,698	255	1,040	4,826	1,086	1,559	90,332
Floods ¹	34,807	6,025	5,014	4,236	3,886	6,984	5,772	5,854	8,602	4,757	85,937
Forest/scrub fires	70	47	33	6	47	14	49	13	150	52	481
Insect infestation	ndr	n.a.	n.a.	ndr	ndr	n.a.	ndr	ndr	ndr	ndr	n.a.
Mass movement: dry ²	ndr	11	ndr	60	ndr	44	ndr	11	ndr	120	246
Mass movement: wet ³	445	1,012	786	1,089	706	313	646	1,638	271	504	7,410
Volcanic eruptions	n.a.	n.a.	n.a.	200	n.a.	2	3	5	11	9	230
Windstorms	12,274	1,354	1,914	1,475	1,028	6,653	5,250	4,329	6,035	140,846	181,158
Subtotal climato-, hydro- meteorological disasters	124,711	85,758	86,010	87,078	80,403	14,299	12,845	16,868	16,144	147,722	671,838
Subtotal geophysical disasters	21,869	227	21,348	1,894	29,617	227,336	76,244	6,708	717	88,014	473,974
Total natural disasters	146,580	85,985	107,358	88,972	110,020	241,635	89,089	23,576	16,861	235,736	1,145,812
Industrial accidents	740	1,807	1,279	1,112	1,444	1,797	2,281	1,822	1,656	776	14,714
Miscellaneous accidents	1,323	1,341	1,341	2,013	1,438	2,115	2,669	1,120	909	895	15,164
Transport accidents	6,640	8,208	5,926	9,326	7,868	6,417	6,702	7,021	4,427	5,255	67,790
Total technological disasters	8,703	11,356	8,546	12,451	10,750	10,329	11,652	9,963	6,992	6,926	97,668
Total	155,283	97,341	115,904	101,423	120,770	251,964	100,741	33,539	23,853	242,662	1,243,480

Source: EM-DAT, CRED, University of Louvain, Belgium

¹ Includes waves and surges. ² Landslides, rockfalls, subsidence of geophysical origin. ³ Mud/landslides, avalanches, subsidence of hydrological origin.

Note: n.a. signifies no data available and ndr signifies no disaster reported. For more information, see section on caveats in introductory text.

In 2008, deaths caused by natural disasters were at their second highest level of the decade, while those caused by technological disasters were at their lowest level. The number of deaths from windstorms is the highest of the decade, with Cyclone Nargis accounting for 98 per cent of these deaths. Deaths from earthquakes/tsunamis were the second highest of the decade, with the Sichuan tremor accounting for 99.5 per cent of all earthquake fatalities. Most reported deaths caused by droughts and food insecurity during the decade were attributable to the famine in the Democratic People's Republic of Korea, although the estimates provided are disputed (see caveats in introductory text).

Table 7 Total number of people reported affected, by type of phenomenon and by year (1999 to 2008), in thousands

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total ⁴
Droughts/food insecurity	120,289	164,579	166,672	428,879	81,842	35,272	30,643	40,671	8,278	28,731	1,105,856
Earthquakes/tsunamis	6,857	2,479	9,711	851	4,194	3,147	6,187	3,859	1,200	47,223	85,708
Extreme temperatures	725	28	213	104	1,840	2,140	2	62	988	79,171	85,273
Floods ¹	149,086	73,905	34,552	167,769	169,462	116,991	75,028	30,309	177,837	43,014	1,037,953
Forest/scrub fires	19	39	6	26	184	21	7	2	1,785	59	2,147
Insect infestation	ndr	n.a.	n.a.	ndr	ndr	n.a.	ndr	ndr	ndr	ndr	n.a.
Mass movement: dry ²	ndr	n.a.	ndr	n.a.	ndr	n.a.	ndr	n.a.	ndr	1	1
Mass movement: wet ³	15	215	71	305	459	12	10	432	9	5	1,533
Volcanic eruptions	34	127	110	278	25	53	341	379	51	127	1,524
Windstorms	25,102	15,137	31,991	113,441	11,093	21,383	49,117	67,109	23,974	15,627	373,974
Subtotal climato-, hydro-meteorological disasters	295,236	253,902	233,505	710,524	264,879	175,818	154,808	138,586	212,871	166,606	2,606,736
Subtotal geophysical disasters	6,890	2,605	9,822	1,130	4,219	3,200	6,528	4,237	1,250	47,351	87,233
Total natural disasters	302,126	256,508	243,326	711,654	269,099	179,018	161,336	142,823	214,122	213,957	2,693,969
Industrial accidents	324	17	19	2	646	157	16	137	3	14	1,335
Miscellaneous accidents	12	24	31	61	15	102	77	32	41	21	416
Transport accidents	5	7	3	6	5	48	6	4	4	4	92
Total technological disasters	341	48	53	68	667	307	100	172	48	39	1,843
Total	302,467	256,556	243,380	711,722	269,765	179,325	161,436	142,995	214,170	213,996	2,695,813

¹ Includes waves and surges. ² Landslides, rockfalls, subsidence of geophysical origin. ³ Mud/landslides, avalanches, subsidence of hydrological origin. ⁴ Since slow-onset disasters can affect the same people over a number of years, it is best to use figures on total numbers affected to calculate annual averages over a decade rather than as absolute totals.

Note: n.a. signifies no data available and ndr signifies no disaster reported. For more information, see section on caveats in introductory text. Disasters affecting the most people in 2008 were extreme temperatures (79 million people affected; 37 per cent of those affected by disasters). Earthquakes (47 million people affected) and floods (43 million people affected) accounted for, respectively, 22 and 20 per cent of those affected by disasters. The number of people affected by extreme temperatures and earthquakes was the highest of the decade. Extreme winter conditions in China (77 million people affected) and Tajikistan (2 million people affected) and the Sichuan earthquake (46 million people affected) explain these high numbers. The number of people reported affected by technological disasters was the lowest of the decade, and the number affected by drought was the second lowest of the decade.

Table 8 Total amount of disaster estimated damage, by type of phenomenon and by year (1999 to 2008) in millions of US\$ (2008 prices)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Droughts/food insecurity	8,228	4,972	2,800	9,923	867	1,236	2,611	3,349	n.a.	n.a.	33,987
Earthquakes/tsunamis	53,906	516	8,951	2,475	9,659	44,000	7,392	3,665	16,938	85,000	232,502
Extreme temperatures	1,292	463	243	0	14,653	0	441	1,068	0	21,350	39,510
Floods ¹	20,176	32,262	5,778	32,108	24,420	11,834	19,777	8,336	25,530	14,742	194,963
Forest/scrub fires	634	3,199	109	433	7,133	3	4,241	896	4,774	2,000	23,424
Insect infestation	ndr	150	n.a.	ndr	ndr	n.a.	ndr	ndr	ndr	ndr	150
Mass movement: dry ²	ndr	n.a.	ndr	n.a.	ndr	n.a.	ndr	n.a.	ndr	n.a.	n.a.
Mass movement: wet ³	968	578	86	230	61	4	61	43	n.a.	n.a.	2,030
Volcanic eruptions	n.a.	3	20	11	n.a.	n.a.	n.a.	160	n.a.	n.a.	194
Windstorms	57,232	15,578	17,652	17,662	24,968	95,956	203,718	18,906	30,693	58,060	540,426
Subtotal climato-, hydro-meteorological disasters	88,531	57,202	26,668	60,357	72,102	109,034	230,849	32,598	60,997	96,152	834,490
Subtotal geophysical disasters	53,906	519	8,972	2,486	9,659	44,000	7,392	3,825	16,938	85,000	232,696
Total natural disasters	142,436	57,721	35,640	62,843	81,761	153,034	238,241	36,423	77,936	181,152	1,067,186
Industrial accidents	4	n.a.	12	11,922	n.a.	1,026	452	n.a.	902	n.a.	14,318
Miscellaneous accidents	3	327	6	74	n.a.	n.a.	11	1	n.a.	n.a.	423
Transport accidents	n.a.	n.a.	n.a.	n.a.	n.a.	465	n.a.	n.a.	n.a.	n.a.	465
Total technological disasters	7	327	18	11,996	n.a.	1,491	463	1	902	n.a.	15,206
Total	142,443	58,048	35,658	74,838	81,761	154,525	238,704	36,424	78,838	181,152	1,082,391

Source: EM-DAT, CRED, University of Louvain, Belgium

¹ Includes waves and surges. ² Landslides, rockfalls, subsidence of geophysical origin. ³ Mud/landslides, avalanches, subsidence of hydrological origin.

Note: n.a. signifies no data available and ndr signifies no disaster reported. For more information, see section on caveats in introductory text.

Estimates of disaster damage must be treated with caution, as the financial value attached to infrastructure in developed countries is much higher than in developing countries. While reporting is better for large disasters, the low reporting rates of direct damage make analysis difficult. The costliest disasters in 2008 were earthquakes (47 per cent of all reported damages), windstorms (32 per cent), extreme temperatures (12 per cent) and floods (8 per cent). In 2008, damages reported for earthquakes and extreme temperatures were the highest of the decade.

Table 9 Total number of reported disasters, by type of phenomenon, by continent and by level of human development¹ (1999 to 2008)

	Africa	Americas	Asia	Europe	Oceania	HHD	MHD	LHD	Total
Droughts/food insecurity	127	51	75	16	3	43	153	76	272
Earthquakes/tsunamis	23	47	173	46	9	65	210	23	298
Extreme temperatures	5	40	50	108	1	130	69	5	204
Floods ²	402	342	649	259	43	498	911	286	1,695
Forest/scrub fires	12	61	20	51	10	113	36	5	154
Insect infestation	11	1	1	1	2	3	7	6	16
Mass movement: dry ³	1	2	3	0	1	0	7	0	7
Mass movement: wet ⁴	12	34	111	18	5	30	140	10	180
Volcanic eruptions	8	27	18	1	8	9	49	4	62
Windstorms	88	344	401	160	69	529	498	35	1,062
Subtotal climato-, hydro-meteorological disasters	657	873	1,307	613	133	1,346	1,814	423	3,583
Subtotal geophysical disasters	32	76	194	47	18	74	266	27	367
Total natural disasters	689	949	1,501	660	151	1,420	2,080	450	3,950
Industrial accidents	63	24	411	52	0	58	443	49	550
Miscellaneous accidents	117	68	225	77	2	136	293	60	489
Transport accidents	895	313	772	212	10	372	1,344	486	2,202
Total technological disasters	1,075	405	1,408	341	12	566	2,080	595	3,241
Total	1,764	1,354	2,909	1,001	163	1,986	4,160	1,045	7,191

Source: EM-DAT, CRED, University of Louvain, Belgium

¹ See note on UNDP's Human Development Index country status in the section on disaster definitions in the introduction to this annex.² Includes waves and surges. ³ Landslides, rockfalls, subsidence of geophysical origin. ⁴ Mud/landslides, avalanches, subsidence of hydrological origin.

Note: ndr signifies no disaster reported. For more information, see section on caveats in introductory text.

During the decade, Asia accounted for 40 per cent of the total number of disasters but for 74 per cent of industrial accidents; 61 per cent of mass movement of hydrological origin and 58 per cent of earthquakes/tsunamis. Africa accounted for 25 per cent of the total number of disasters but for 47 per cent of droughts/food insecurity and 40 per cent of transport accidents. The Americas accounted for 19 per cent of the total number of disasters but for 43 per cent of volcanic eruptions and 32 per cent of windstorms. Europe accounted for 14 per cent of the total number of disasters but for 52 per cent of extreme temperatures and 33 per cent of forest/scrub fires. Oceania accounted for 2.3 per cent of the total number of disasters but for 13 per cent of volcanic eruptions, 6.5 per cent of forest/scrub fires and 6.5 per cent of windstorms.

Table 10 Total number of people reported killed, by type of phenomenon, by continent and by level of human development¹ (1999 to 2008)

	Africa	Americas	Asia	Europe	Oceania	HHD	MHD	LHD	Total
Droughts/food insecurity	1,130	53	305,335	2	0	0	758	305,762	306,520
Earthquakes/tsunamis	3,349	3,159	448,489	18,430	71	2,734	469,072	1,692	473,498
Extreme temperatures	125	1,346	8,734	80,127	0	80,129	8,478	1,725	90,332
Floods ²	7,623	38,281	38,735	1,245	53	4,037	75,152	6,748	85,937
Forest/scrub fires	124	74	64	192	27	282	149	50	481
Insect infestation	0	0	0	0	0	0	0	0	0
Mass movement: dry ³	98	72	66		10	246	0	0	246
Mass movement: wet ⁴	175	959	5,901	311	64	562	6,717	131	7,410
Volcanic eruptions	206	16	8	0	0	0	25	205	230
Windstorms	1,551	9,899	168,652	708	348	6,130	174,196	832	181,158
Subtotal climate, hydro-meteorological disasters	10,728	50,612	527,421	82,585	492	91,140	265,450	315,248	671,838
Subtotal geophysical disasters	3,653	3,247	448,563	18,430	81	2,734	469,343	1,897	473,974
Total natural disasters	14,381	53,859	975,984	101,015	573	93,874	734,793	317,145	1,145,812
Industrial accidents	2,443	430	10,895	946	ndr	790	11,765	2,159	14,714
Miscellaneous accidents	3,273	2,319	7,948	1,588	36	3,786	9,135	2,243	15,164
Transport accidents	25,929	7,709	28,254	5,621	277	9,976	42,012	15,802	67,790
Total technological disasters	31,645	10,458	47,097	8,155	313	14,552	62,912	20,204	97,668
Total	46,026	64,317	1,023,081	109,170	886	108,426	797,705	337,349	1,243,480

Source: EM-DAT, CRED, University of Louvain, Belgium

¹ See note on UNDP's Human Development Index country status in the section on disaster definitions in the introduction to this chapter annex.

² Includes waves and surges. ³ Landslides, rockfalls, subsidence of geophysical origin. ⁴ Mud/Landslides, avalanches, subsidence of hydrological origin.

Note: ndr signifies no disaster reported. For more information, see section on caveats in introductory text.

During the decade, medium human development countries accounted for 64 per cent of the total number reported deaths but for almost all reported deaths related to earthquakes and windstorms, 90 per cent of those caused by mass movements of hydrological origin, 87 per cent of floods and 80 per cent of industrial accidents. Low human development countries accounted for 27 per cent of the total number reported deaths but for more than 99 per cent of those caused by droughts/food insecurity and 89 per cent of deaths from volcanic eruptions. High human development countries accounted for 9 per cent of the total number reported deaths but for 88 per cent of those related to extreme temperatures, 59 per cent of wildfire deaths and 25 per cent of those caused by miscellaneous accidents.

Table 11 Total number of people reported affected, by type of phenomenon, by continent and by level of human development¹ (1999 to 2008), in thousands

	Africa	Americas	Asia	Europe	Oceania	HHH	MHD	LHD	Total
Droughts/food insecurity	288,550	14,315	801,634	1,273	84	13,196	924,099	168,562	1,105,856
Earthquakes/tsunamis	377	4,085	78,837	2,381	28	874	84,508	327	85,708
Extreme temperatures	0	4,920	79,531	822	0	796	84,107	371	85,273
Floods ²	22,173	28,542	983,214	3,851	173	22,461	998,118	17,373	1,037,953
Forest/scrub fires	13	951	10	1,162	10	1,978	165	5	2,147
Insect infestation	0	0	0	0	0	0	0	0	0
Mass movement: dry ³	1	0	0	0	0	ndr	1	ndr	1
Mass movement: wet ⁴	6	169	1,333	14	11	165	1,066	303	1,533
Volcanic eruptions	408	722	343	0	50	66	1,336	121	1,524
Windstorms	4,445	29,245	333,173	6,750	361	32,665	339,981	1,327	373,974
Subtotal climato-, hydro-meteorological disasters	315,187	78,142	2,198,895	13,872	640	71,261	2,347,535	187,941	2,606,736
Subtotal geophysical disasters	786	4,807	79,181	2,381	79	940	85,845	448	87,234
Total natural disasters	315,973	82,949	2,278,076	16,253	718	72,201	2,433,380	188,389	2,693,970
Industrial accidents	104	566	643	23	ndr	923	315	97	1,335
Miscellaneous accidents	196	12	185	24	0	27	336	54	416
Transport accidents	16	10	62	4	0	12	29	50	92
Total technological disasters	315	588	889	51	0	962	680	201	1,843
Total	316,289	83,537	2,278,965	16,304	718	73,163	2,434,060	188,590	2,695,813

Source: EM-DAT, CRED, University of Louvain, Belgium

¹ See note on UNDP's Human Development Index country status in the section on disaster definitions in the introduction to this chapter annex.

² Includes waves and surges. ³ Landslides, rockfalls, subsidence of geophysical origin. ⁴ Mud/landslides, avalanches, subsidence of hydrological origin.

Note: ndr signifies no disaster reported. For more information, see section on caveats in introductory text.

During the decade, medium human development countries accounted for almost 90 per cent of the total number of people reported affected by disasters but 98 per cent of those affected by earthquakes/tsunamis and extreme temperatures, and 96 per cent of those affected by floods. Low human development countries accounted for 7 per cent of the total number of people reported affected by disasters but 54 per cent of those affected by transport accidents, 19 per cent of those affected by mass movements of hydrological origin, 15 per cent of those affected by droughts/food insecurities and 13 per cent of those affected by miscellaneous accidents. High human development countries accounted for 3 per cent of the total number of people reported affected but for 92 per cent of those affected by forest/scrub fires, 69 per cent of those affected by industrial accidents, 13 per cent of those affected by transport accidents, 11 per cent of those affected by mass movements of hydrological origin and for 8 per cent of those affected by windstorms.

Table 12 Total amount of disaster estimated damage, by type of phenomenon, by continent and by level of human development¹ (1999 to 2008) in millions of US dollars (2008 prices)

	Africa	Americas	Asia	Europe	Oceania	HHD	MHD	LHD	Total
Droughts/food insecurity	1,355	9,544	13,328	7,366	2,394	19,575	14,411	0	33,987
Earthquakes/isunamis	6,671	10,729	179,450	35,653	0	78,541	153,847	114	232,502
Extreme temperatures	1	1,305	21,818	16,143	243	17,584	21,927	0	39,510
Floods ²	3,400	30,045	93,387	65,353	2,777	104,433	89,319	1,211	194,963
Forest/scrub fires	13	13,849	22	8,873	668	23,359	65	0	23,424
Insect infestation	0	0	0	0	150	150	0	0	150
Mass movement: dry ³	0	0	0	ndr	0	ndr	0	ndr	0
Mass movement: wet ⁴	0	107	327	1,596	0	1,703	327	0	2,030
Volcanic eruptions	11	174	6	4	0	4	179	11	194
Windstorms	717	378,582	104,715	51,245	5,166	480,689	52,227	7,509	540,426
Subtotal climate, hydro-meteorological disasters	5,486	433,432	233,597	150,577	11,399	647,492	178,277	8,720	834,490
Subtotal geophysical disasters	6,681	10,902	179,455	35,657	0	78,544	154,027	125	232,696
Total natural disasters	12,167	444,334	413,052	186,233	11,399	726,037	332,304	8,845	1,067,186
Industrial accidents	924	0	458	12,936	ndr	12,036	2,282	0	14,318
Miscellaneous accidents	6	77	20	320	0	337	80	6	423
Transport accidents	0	0	465	0	0	0	0	465	465
Total technological disasters	930	77	943	13,256	0	12,373	2,362	471	15,206
Total	13,097	444,411	413,995	199,489	11,399	738,409	334,666	9,316	1,082,391

Source: EM-DAT, CRED, University of Louvain, Belgium

¹ See note on UNDP's Human Development Index country status in the section on disaster definitions in the introduction to this chapter annex.

² Includes waves and surges. ³ Landslides, rockfalls, subsidence of geophysical origin. ⁴ Mud/landslides, avalanches, subsidence of hydrological origin. Note: ndr signifies no disaster reported. For more information, see section on caveats in introductory text.

Estimates of disaster damage must be treated with caution, as the financial value attached to infrastructure in developed countries is much higher than in developing countries. While reporting is better for large disasters, the low reporting rates of direct damage make analysis difficult. During the decade, the Americas accounted for 41 per cent of the reported damages but 89 per cent of costs related to volcanic eruptions, 70 per cent of those related to windstorms and 59 per cent of those related to forest/scrub fires. Asia accounted for 38 per cent of the reported damages but 100 per cent of those caused by transport accidents, 77 per cent of those caused by earthquakes/isunamis and 48 per cent of those caused by floods. Europe accounted for 18 per cent of the reported damages but 90 per cent of those caused by industrial accidents, 75 per cent of those related to miscellaneous accidents and 34 per cent of those caused by floods. Africa accounted for 1.2 per cent of the reported damages but 6 per cent of those caused by industrial accidents and by volcanic eruptions and 5 per cent of those caused by droughts/food insecurity. Oceania accounted for 1 per cent of the reported damages but 7 per cent of those caused by droughts and 3 per cent of those caused by forest/scrub fires.

Table 13 Total number of people reported killed and affected by disasters by country or by territory (1989 to 1998; 1999 to 2008; and 2008)

	Total number of people reported killed (1989–1998)	Total number of people reported affected (1989–1998)	Total number of people reported killed (1999–2008)	Total number of people reported affected (1999–2008)	Total number of people reported killed (2008)	Total number of people reported affected (2008)
Africa	27,370	194,756,608	46,026	316,288,517	2,943	18,220,289
Algeria	472	64,640	4,139	425,208	120	59,111
Angola	836	7,910,197	1,047	641,599	8	81,400
Benin	34	776,727	328	227,794	20	159,263
Botswana	20	105,500	3	143,736	ndr	ndr
Burkina Faso	22	2,762,790	326	165,547	108	4,900
Burundi	112	3,600	438	8,365,342	9	3,275
Cameroon	502	374,154	667	41,621	76	25,022
Cape Verde	n.a.	16,306	18	30,000	ndr	ndr
Central African Republic	7	30,699	290	95,226	31	815
Chad	41	737,700	254	1,336,929	n.a.	14,450
Comoros	240	200	158	284,343	ndr	ndr
Congo, Rep. of	663	36,500	140	128,668	ndr	ndr
Congo, DR of the	1,094	64,015	3,067	338,765	487	13,930
Côte d'Ivoire	173	7,267	383	97,698	6	450
Djibouti	155	391,075	184	883,149	n.a.	340,000
Egypt	2,349	261,592	3,396	7,312	350	922
Equatorial Guinea	ndr	ndr	105	5,050	23	n.a.
Eritrea ¹	133	1,615,725	56	13,207,043	n.a.	1,700,000
Ethiopia ¹	855	40,740,884	1,776	47,981,414	45	6,516,440
Gabon	102	0	94	11	32	n.a.
Gambia	100	5,000	110	47,427	10	706
Ghana	331	2,702,809	801	861,841	25	58,040
Guinea	485	6,066	483	247,107	27	4,220
Guinea-Bissau	217	7,847	44	134,161	n.a.	750
Kenya	1,620	11,911,651	1,850	103,903,468	84	1,462,482
Lesotho	22	994,750	41	1,481,561	n.a.	4,500
Liberia	10	1,007,000	61	20,840	n.a.	340
Libyan AJ	330	121	271	79	140	n.a.
Madagascar	707	5,365,402	1,089	5,775,000	105	533,166
Malawi	528	31,516,643	827	14,758,763	24	26
Mali	83	323,101	277	2,162,716	n.a.	2,500
Mauritania	146	490,217	131	3,147,740	ndr	ndr
Mauritius	6	14,307	5	2,050	ndr	ndr
Mayotte (F)	ndr	ndr	21	12	21	12
Morocco	1,254	98,203	1,681	887,758	148	20,096

	Total number of people reported killed (1989–1998)	Total number of people reported affected (1989–1998)	Total number of people reported killed (1999–2008)	Total number of people reported affected (1999–2008)	Total number of people reported killed (2008)	Total number of people reported affected (2008)
Mozambique	723	9,754,711	1,576	11,340,592	58	723,036
Namibia	20	851,400	51	804,309	18	30,000
Niger	273	3,358,992	162	13,386,017	39	33,057
Nigeria	3,525	692,233	8,937	564,521	226	13
Reunion (F)	69	6,261	4	3,790	ndr	ndr
Rwanda	329	142,000	348	6,839,488	48	11,998
Saint Helena (UK)	ndr	ndr	n.a.	300	ndr	ndr
Sao Tome and Principe	ndr	ndr	33	34	20	31
Senegal	169	322,954	1,739	634,034	34	10,027
Seychelles	5	1,237	3	11,630	ndr	ndr
Sierra Leone	582	200,022	638	19,572	ndr	ndr
Somalia	2,708	1,290,600	1,057	6,950,100	n.a.	3,352,000
South Africa	1,580	342,484	1,722	15,259,713	145	7,663
Sudan	1,044	21,796,481	1,130	5,798,298	143	92,976
Swaziland	n.a.	1,500,000	55	4,573,744	n.a.	2,500
Tanzania, UR of	1,771	11,152,164	1,345	10,110,346	104	9,502
Togo	3	676,905	77	253,167	6	44,814
Tunisia	78	152,089	436	33,634	20	n.a.
Uganda	388	344,737	1,300	5,725,666	98	780,056
Zambia	145	6,773,432	363	3,610,745	21	15,800
Zimbabwe	309	25,055,218	489	22,531,839	14	2,100,000
Americas	46,706	35,969,741	64,317	83,536,786	2,672	19,684,199
Anguilla (UK)	ndr	ndr	n.a.	150	ndr	ndr
Antigua and Barbuda	6	78,757	2	31,757	n.a.	25,800
Argentina	358	571,767	646	708,951	31	85,048
Aruba (NL)	ndr	ndr	ndr	ndr	ndr	ndr
Bahamas	4	1,700	69	20,578	n.a.	3,000
Barbados	n.a.	n.a.	1	2,881	ndr	ndr
Belize	31	62,600	55	150,570	8	48,000
Bermuda	n.a.	n.a.	22	n.a.	ndr	ndr
Bolivia	468	746,959	958	1,564,154	94	6,659
Brazil	2,296	11,502,394	2,384	15,323,951	294	1,792,148
Canada	555	101,940	77	40,422	2	14,918
Cayman Islands (UK)	ndr	ndr	2	300	n.a.	n.a.
Chile	468	334,550	223	766,068	19	152,760
Colombia	1,833	569,798	3,181	5,821,018	161	1,168,479
Costa Rica	154	1,013,858	117	350,711	11	209,498
Cuba	995	2,281,790	205	10,094,489	7	519,445
Dominica	13	5,711	5	8,520	ndr	ndr

	Total number of people reported killed (1989–1998)	Total number of people reported affected (1989–1998)	Total number of people reported killed (1999–2008)	Total number of people reported affected (1999–2008)	Total number of people reported killed (2008)	Total number of people reported affected (2008)
Dominican Republic	893	1,024,465	1,230	285,902	31	17,023
Ecuador	1,064	434,524	556	944,168	55	289,162
El Salvador	631	96,000	1,532	2,098,287	43	3,040
Falkland Islands (UK)	ndr	ndr	ndr	ndr	ndr	ndr
French Guiana (F)	n.a.	70,000	ndr	ndr	ndr	ndr
Grenada	n.a.	1,000	40	61,860	ndr	ndr
Guadeloupe (F)	5	11,084	25	1,052	ndr	ndr
Guatemala	818	144,126	2,311	897,526	129	180,029
Guyana	n.a.	1,252,600	44	409,774	n.a.	100,000
Haiti	4,086	2,632,580	6,874	1,179,221	843	246,476
Honduras	15,393	2,357,969	461	2,052,678	90	313,375
Jamaica	28	556,512	55	429,410	13	4,000
Martinique (F)	10	4,510	2	706	ndr	ndr
Mexico	3,404	1,593,605	2,456	7,367,765	151	520,080
Montserrat (UK)	43	25,040	n.a.	200	ndr	ndr
Netherlands Antilles (NL)	13	40,000	15	4	ndr	ndr
Nicaragua	3,635	1,806,940	390	632,215	30	15,578
Panama	146	48,207	122	97,308	39	23,837
Paraguay	111	430,654	455	433,720	n.a.	80,155
Peru	3,152	4,496,958	3,068	7,020,066	143	495,124
Puerto Rico (US)	113	158,005	114	15,499	ndr	ndr
St Kitts and Nevis	6	13,100	n.a.	1,180	ndr	ndr
St Lucia	4	925	1	200	ndr	ndr
St Pierre et Miquelon (F)	ndr	ndr	ndr	ndr	ndr	ndr
St Vincent and the Grenadines	3	200	4	1,634	ndr	ndr
Suriname	169	13	35	31,548	22	6,548
Trinidad and Tobago	5	1,627	3	1,760	ndr	ndr
Turks and Caicos Islands (UK)	43	n.a.	4	1,700	4	1,500
United States	5,042	1,377,015	5,829	23,869,247	373	13,360,996
Uruguay	96	18,040	43	137,759	ndr	ndr
Venezuela	605	82,215	30,698	679,877	79	1,521
Virgin Islands (UK)	n.a.	3	ndr	ndr	ndr	ndr
Virgin Islands (US)	7	20,000	3	n.a.	ndr	ndr
Asia	671,024	1,805,458,332	1,023,081	2,278,965,214	236,302	175,731,752
Afghanistan	10,787	443,717	4,973	10,908,888	1,331	451,904
Armenia ²	106	3,522,954	1	297,000	ndr	ndr
Azerbaijan ²	560	2,434,142	143	43,989	ndr	ndr
Bahrain	10	n.a.	212	60	ndr	ndr
Bangladesh	150,589	86,571,641	13,736	68,390,673	94	746,338

	Total number of people reported killed (1989–1998)	Total number of people reported affected (1989–1998)	Total number of people reported killed (1999–2008)	Total number of people reported affected (1999–2008)	Total number of people reported killed (2008)	Total number of people reported affected (2008)
Bhutan	39	65,600	200	1,000	ndr	ndr
Brunei Darussalam	n.a.	n.a.	ndr	ndr	ndr	ndr
Cambodia	809	18,129,000	497	8,874,614	ndr	ndr
China, People's Rep. of ³	37,462	1,265,536,451	113,434	1,180,968,100	89,232	132,925,587
Georgia ²	340	4,665	128	1,415,246	ndr	ndr
Hong Kong (China) ³	357	11,603	65	4,820	35	263
India	50,092	276,853,467	75,722	689,798,148	3,259	12,389,350
Indonesia	8,202	7,132,065	181,962	8,810,871	182	472,533
Iran, Islamic Republic of	44,876	2,060,011	31,469	113,391,938	230	22,486
Iraq	868	500	1,495	69,542	20	629
Israel	156	1,343	49	885	24	28
Japan	6,581	1,069,024	1,130	1,993,960	51	50,843
Jordan	59	18,340	145	330,322	21	33
Kazakhstan ²	244	638,036	149	81,134	31	13,161
Korea, DPR of ⁴	305,573	41,512,068	306,605	34,445,037	ndr	ndr
Korea, Rep. of	2,446	490,548	1,483	552,623	50	23
Kuwait	2	200	ndr	ndr	ndr	ndr
Kyrgyzstan ²	255	205,464	323	29,570	139	4,222
Lao Dem. People's Rep.	180	2,840,862	51	1,277,195	6	204,190
Lebanon	70	104,075	49	17,605	ndr	ndr
Macau (China) ³	n.a.	3,986	n.a.	133	n.a.	133
Malaysia	937	47,574	288	445,407	n.a.	2,000
Maldives	n.a.	23,849	143	28,963	ndr	ndr
Mongolia	280	105,061	133	3,266,658	52	n.a.
Myanmar	840	666,151	138,960	2,801,323	138,404	2,420,044
Nepal	3,295	843,398	3,002	2,421,231	191	250,038
Oman	ndr	ndr	192	20,115	ndr	ndr
Pakistan	8,921	17,919,044	79,236	28,982,418	301	366,131
Palestine (West Bank/Gaza) ⁵	ndr	ndr	19	785	n.a.	n.a.
Philippines	16,248	37,774,132	10,750	40,369,761	1,873	8,465,070
Qatar	ndr	ndr	ndr	ndr	ndr	ndr
Saudi Arabia	2,489	1,798	1,269	14,668	28	285
Singapore	3	1,437	ndr	ndr	ndr	ndr
Sri Lanka	1,006	4,257,964	35,895	7,236,738	42	788,043
Syrian Arab Republic	83	12	403	1,668,748	n.a.	1,000,000
Taiwan (China)	1,042	422,303	3,147	782,653	47	88
Tajikistan ²	1,841	368,692	207	9,294,535	n.a.	2,800,000
Thailand	3,240	15,994,934	9,874	34,271,110	71	11,540,600

	Total number of people reported killed (1989–1998)	Total number of people reported affected (1989–1998)	Total number of people reported killed (1999–2008)	Total number of people reported affected (1999–2008)	Total number of people reported killed (2008)	Total number of people reported affected (2008)
Timor-Leste ⁶	ndr	ndr	5	13,235	ndr	ndr
Turkmenistan ²	40	420	11	n.a.	ndr	ndr
United Arab Emirates	85	101	109	46	11	6
Uzbekistan ²	105	71,700	96	1,207,718	8	3,530
Viet Nam	8,891	16,481,911	4,498	24,384,422	436	789,171
Yemen ⁷	1,015	828,089	823	51,327	133	25,023
Europe	18,220	55,664,542	109,170	16,303,910	722	267,596
Albania	75	9,648,600	68	605,434	38	10,300
Austria	52	130	633	71,815	16	5
Azores (P)	183	1,215	35	n.a.	ndr	ndr
Belarus ²	5	61,390	92	3,929	ndr	ndr
Belgium	109	2,137	2,162	3,684	n.a.	n.a.
Bosnia and Herzegovina ⁸	12	n.a.	65	354,179	11	n.a.
Bulgaria	46	5,842	101	14,893	10	n.a.
Canary Islands (SP)	ndr	ndr	146	1,274	ndr	ndr
Croatia ⁸	96	2,025	873	2,306	14	30
Cyprus	54	2,657	40	448	ndr	ndr
Czech Republic ⁹	54	102,171	495	204,453	12	100
Czechoslovakia ⁹	41	n.a.	–	–	–	–
Denmark	56	100	13	2,072	ndr	ndr
Estonia ²	912	140	25	130	ndr	ndr
Finland	11	33	24	415	ndr	ndr
France	613	25,971	21,555	3,584,256	3	2,706
Germany ¹⁰	383	137,574	9,661	433,212	5	208
Gibraltar (UK)	ndr	ndr	ndr	ndr	ndr	ndr
Greece	307	37,056	696	138,504	2	3,708
Greenland (DK)	ndr	ndr	ndr	ndr	ndr	ndr
Hungary	58	279	757	180,155	17	500
Iceland	34	83	n.a.	199	ndr	ndr
Ireland	38	3,500	9	1,200	ndr	ndr
Isle of Man (UK)	ndr	ndr	ndr	ndr	ndr	ndr
Italy	814	74,290	20,713	68,240	9	300
Latvia ²	ndr	ndr	82	n.a.	ndr	ndr
Lithuania ²	16	780,000	79	n.a.	ndr	ndr
Luxembourg	n.a.	n.a.	190	n.a.	ndr	ndr
Macedonia FYR ⁸	198	11,515	44	1,110,111	ndr	ndr
Malta	295	n.a.	112	31	10	8
Moldova ²	59	52,824	19	2,823,107	3	4,000

	Total number of people reported killed (1989–1998)	Total number of people reported affected (1989–1998)	Total number of people reported killed (1999–2008)	Total number of people reported affected (1999–2008)	Total number of people reported killed (2008)	Total number of people reported affected (2008)
Montenegro ⁸	–	–	n.a.	1,086	ndr	ndr
Netherlands	204	265,170	2,021	3,196	n.a.	n.a.
Norway	437	4,000	53	2,242	n.a.	100
Poland	305	226,006	1,074	20,971	22	1,060
Portugal	136	3,377	2,891	150,897	2	110
Romania	628	168,438	563	226,122	5	10,610
Russian Federation ²	4,977	1,352,249	4,422	2,712,273	121	5,256
Serbia ⁸	–	–	n.a.	12,370	ndr	ndr
Serbia-Montenegro ⁸	80	6,095	112	120,190	–	–
Slovakia ⁹	65	11,867	37	46,915	ndr	ndr
Slovenia ⁸	n.a.	700	309	1,655	13	n.a.
Soviet Union ²	2,013	369,806	–	–	–	–
Spain	551	36,068,581	15,811	9,710	183	41
Sweden	92	184	11	n.a.	ndr	ndr
Switzerland	53	5,205	1,191	7,406	ndr	ndr
Turkey	2,966	3,701,854	19,804	2,323,077	88	474
Ukraine ²	315	2,060,748	1,717	660,713	130	224,780
United Kingdom	596	470,590	465	401,040	8	3,300
Yugoslavia ⁸	281	140	–	–	–	–
Oceania	3,626	38,924,497	886	718,462	23	92,185
American Samoa (US)	n.a.	n.a.	6	23,063	ndr	ndr
Australia	398	36,639,299	289	70,197	6	16,200
Cook Islands (NZ)	20	900	n.a.	1,352	ndr	ndr
Fiji	57	434,958	85	38,733	7	n.a.
French Polynesia (F)	13	511	20	n.a.	ndr	ndr
Guam (US)	229	12,033	5	15,644	ndr	ndr
Kiribati	ndr	ndr	n.a.	84,085	n.a.	85
Marshall Islands	n.a.	6,000	n.a.	600	n.a.	600
Micronesia, Fed. States of	n.a.	28,800	48	8,631	n.a.	n.a.
Nauru	ndr	ndr	ndr	ndr	ndr	ndr
New Caledonia (F)	2	n.a.	2	1,100	ndr	ndr
New Zealand	14	3,169	24	8,000	ndr	ndr
Niue (NZ)	n.a.	200	1	702	ndr	ndr
Northern Mariana Islands (US)	ndr	ndr	n.a.	300	ndr	ndr
Palau	1	12,004	278	363,198	10	75,300
Papua New Guinea	2,722	1,388,506	10	n.a.	ndr	ndr
Samoa	21	283,000	52	3,919	n.a.	n.a.

	Total number of people reported killed (1989–1998)	Total number of people reported affected (1989–1998)	Total number of people reported killed (1999–2008)	Total number of people reported affected (1999–2008)	Total number of people reported killed (2008)	Total number of people reported affected (2008)
Solomon Islands	37	88,904	n.a.	26	ndr	ndr
Tokelau (NZ)	n.a.	102	n.a.	16,500	ndr	ndr
Tonga	1	9,674	18	n.a.	ndr	ndr
Tuvalu	n.a.	850	48	82,412	ndr	ndr
Vanuatu	106	15,567	ndr	ndr	ndr	ndr
Wallis and Futuna (F)	5	20	ndr	ndr	ndr	ndr
World	766,946	2,130,773,720	1,243,480	2,695,812,889	242,662	213,996,021

Source: EM-DAT, CRED, University of Louvain, Belgium

Note: n.a. signifies no data available; ndr signifies no disaster reported. For more information, see section on caveats in introductory text.

¹ Prior to 1993, Ethiopia was considered one country, after this date separate countries: Eritrea and Ethiopia.

² Prior to 1991 Soviet Union was considered one country, after this date separate countries. The western former republics of the USSR (Belarus, Estonia, Latvia, Lithuania, Moldova, Russian Federation, Ukraine) are included in Europe; the southern former republics (Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan) are included in Asia.

³ Hong Kong became part of China in July 1997; Macau became part of China in December 1999.

⁴ The estimates provided are disputed. See the caveats in the introductory pages of the statistical data for further information.

⁵ Since September 1993 and the Israel–Palestine Liberation Organization (PLO) Declaration of Principles, the Gaza Strip and the West Bank have a Palestinian self-government. Direct negotiations to determine the permanent status of these territories began in September 1999 but are far from a permanent agreement.

⁶ Since May 2002, Timor-Leste (formerly East Timor) has been an independent country.

⁷ Prior to May 1990, Yemen was divided into Arab and People's Democratic Republics; after this date it is considered one country.

⁸ Prior to 1992 Yugoslavia was considered one country, after this date separate countries: Bosnia and Herzegovina, Croatia, Serbia-Montenegro, Slovenia and the Former Yugoslav Republic of Macedonia. Serbia-Montenegro became two separate countries – Serbia and Montenegro – in 2006.

⁹ Prior to 1993, Czechoslovakia was considered one country, after this date separate countries: Czech Republic and Slovakia.

¹⁰ Prior to October 1990, Germany was divided into Federal and Democratic Republics, after this date it is considered as one country.

Over the last decade, the highest numbers of deaths by continent were reported in Nigeria (Africa), Venezuela (Americas), Democratic People's Republic of Korea (Asia) (see note 4 above), France (Europe) and Australia (Oceania).

The highest numbers of people affected by disaster by continent were reported in Kenya (Africa), United States of America (Americas), People's Republic of China (Asia), France (Europe) and Palau (Oceania).

Compared to 1989–1998, the past decade has seen disaster deaths rise by 62 per cent and the numbers affected by disasters rise by 26 per cent. The number of deaths has risen by 68 per cent in Africa, 38 per cent in Americas, 52 per cent in Asia and 499 per cent in Europe. It has decreased by 76 per cent in Oceania. The number of people affected by disasters has risen by 62 per cent in Africa, 132 per cent in Americas and 26 per cent in Asia. It has decreased by 71 per cent in Europe and 98 per cent in Oceania.

Table 14 Refugees and asylum seekers by country/territory of origin (2002 to 2008)

	2002	2003	2004	2005	2006	2007	2008
Africa	2,907,700	3,110,100	3,209,600	3,197,000	3,149,900	3,093,800	3,017,600
Algeria	–	–	–	900	2,400	2,200	1,700
Angola	402,000	312,000	219,700	213,500	195,000	142,300	156,300
Benin	–	–	–	100	100	100	–
Burkina Faso	–	–	–	100	100	100	300
Burundi	395,000	349,000	472,700	438,500	393,700	364,900	252,900
Cameroon	–	–	2,300	3,900	4,900	4,000	3,900
Central African Rep.	14,000	41,000	29,700	43,700	73,000	95,500	121,500
Chad	–	3,000	53,000	49,900	84,800	87,900	116,600
Comoros	–	–	–	500	–	–	100
Congo, DR of	393,000	422,000	456,100	450,800	413,300	388,400	360,400
Congo, Rep. of	15,000	14,000	22,700	24,300	18,500	18,600	17,800
Côte d'Ivoire	22,000	51,000	44,900	25,300	27,200	28,800	29,400
Djibouti	–	–	–	100	200	–	–
Egypt	–	–	–	2,200	3,000	3,000	2,200
Equatorial Guinea	–	–	–	200	–	–	–
Eritrea	285,000	277,000	199,700	215,300	255,400	270,800	295,600
Ethiopia	15,500	14,500	46,800	63,900	77,800	78,900	80,800
Gambia	–	–	–	700	900	700	900
Ghana	10,000	10,000	10,000	10,000	7,900	7,800	6,700
Guinea	–	–	–	2,600	2,700	2,300	3,500
Guinea-Bissau	–	–	–	100	100	100	100
Kenya	–	–	10,100	11,400	3,500	3,100	14,000
Liberia	255,300	381,800	323,100	219,800	141,100	104,000	86,300
Libyan AJ	–	–	300	100	–	100	500
Madagascar	–	–	–	100	–	–	–
Malawi	–	–	2,900	3,800	9,100	9,300	10,300
Mali	–	–	4,000	3,300	4,100	4,200	4,500
Mauritania	40,000	20,000	28,600	29,300	28,000	28,300	22,500
Morocco	–	–	124,000	117,400	116,800	119,900	116,800
Mozambique	–	–	–	400	900	900	900
Namibia	–	–	–	1,200	1,100	1,100	1,100
Niger	–	–	–	100	300	100	300
Nigeria	15,000	17,000	25,700	22,800	11,300	9,000	12,800
Rwanda	36,000	40,000	45,900	102,500	92,100	81,100	79,300
Sao Tome and Principe	–	–	–	–	600	600	–
Senegal	11,000	13,000	11,600	9,600	16,300	16,700	16,700
Seychelles	–	–	–	–	1,400	1,400	–
Sierra Leone	115,000	61,000	20,800	26,500	25,000	24,300	22,600
Somalia	282,900	263,300	311,600	328,000	410,300	495,000	548,700
South Africa	–	–	–	100	100	100	100
Sudan	471,000	595,000	697,500	670,900	648,000	607,100	517,600
Swaziland	–	–	–	–	200	200	100
Tanzania	–	–	4,100	5,400	4,300	4,100	4,200

	2002	2003	2004	2005	2006	2007	2008
Togo	–	4,000	4,200	44,100	24,200	16,300	11,700
Tunisia	–	–	–	100	100	200	100
Uganda	25,000	28,000	29,100	35,100	28,500	27,300	18,300
Western Sahara ¹	105,000	191,000	–	–	–	–	–
Zambia	–	–	–	500	600	600	1,100
Zimbabwe	–	2,500	8,500	17,900	21,000	42,400	76,400
East Asia and Pacific	1,172,100	1,236,100	1,366,000	1,385,900	1,329,000	1,374,200	1,352,400
Cambodia	16,000	16,000	15,000	16,400	13,800	23,300	10,300
China	160,900	139,900	155,300	156,300	158,700	160,700	154,700
Fiji	–	–	–	300	200	300	300
Indonesia	5,100	23,400	23,500	44,300	39,300	35,500	31,000
Japan	–	–	–	100	–	–	–
Korea, DPR of ²	100,000	101,700	100,000	51,400	32,400	32,700	13,700
Korea, Rep. of	–	–	–	300	300	300	–
Lao PDR	–	15,000	12,700	15,700	9,300	10,200	9,000
Malaysia	–	–	–	200	100	–	–
Mongolia	–	–	–	400	1,800	1,100	1,100
Myanmar	509,100	584,800	688,500	727,100	693,300	720,200	734,100
Philippines	57,000	57,200	65,000	67,700	69,400	71,400	73,200
Taiwan (CN)	–	–	–	–	100	100	–
Thailand	–	–	–	200	2,300	2,100	500
Timor-Leste	28,000	–	–	–	–	–	–
Viet Nam	296,000	298,100	306,000	305,500	308,000	316,300	324,500
South and Central Asia	3,878,600	2,839,500	2,461,700	2,725,700	3,673,600	3,281,900	3,113,700
Afghanistan	3,532,900	2,533,200	2,070,500	2,192,100	3,260,300	2,907,100	2,723,900
Bangladesh	–	–	6,800	45,300	47,000	47,200	76,700
Bhutan	127,000	128,700	120,400	122,300	119,100	124,300	125,200
India	18,000	17,000	11,900	11,700	15,300	14,000	7,600
Kazakhstan	–	–	–	500	700	600	500
Kyrgyzstan	–	–	–	200	400	300	400
Nepal	–	–	100,000	201,800	102,500	52,200	27,000
Pakistan	–	6,700	14,700	16,500	16,500	17,500	21,000
Sri Lanka	148,100	106,400	82,600	79,100	108,900	115,800	128,900
Tajikistan	52,600	47,500	54,800	54,200	–	–	–
Turkmenistan	–	–	–	100	100	100	100
Uzbekistan	–	–	–	1,900	2,800	2,800	2,400
Middle East	3,244,500	3,220,200	3,366,300	3,898,700	4,533,200	5,237,600	5,246,000
Iran, Isl. Rep. of	24,800	21,000	27,000	31,900	29,100	27,300	27,700
Iraq	237,400	268,200	349,400	888,700	1,457,800	2,076,200	1,930,700
Israel	–	–	–	500	700	900	1,000
Jordan	–	–	–	500	700	700	800
Lebanon	1,200	–	3,900	700	2,100	2,100	1,500
Palestinian Territory, Occupied	2,981,100	2,927,000	2,986,000	2,971,600	3,036,400	3,125,500	3,276,700

	2002	2003	2004	2005	2006	2007	2008
Syrian Arab Rep.	–	4,000	–	4,400	5,900	4,300	6,900
Yemen	–	–	–	400	500	600	700
Europe	517,500	438,600	226,500	230,100	274,500	239,300	223,400
Albania	–	–	3,300	2,900	2,800	2,500	3,100
Armenia	–	–	2,500	4,200	7,300	5,200	4,400
Azerbaijan	–	–	11,000	13,000	12,500	5,100	5,200
Belarus	–	–	–	1,300	2,000	1,700	1,600
Bosnia and Herzegovina	156,100	121,200	30,300	29,700	33,300	31,200	21,800
Bulgaria	–	–	–	1,100	1,000	900	700
Croatia	250,000	208,900	69,800	59,600	57,300	57,700	53,300
Czech Republic	–	–	–	100	–	100	800
Estonia	–	–	–	100	100	100	100
Georgia	11,400	6,600	20,000	23,100	54,600	47,400	51,500
Germany	–	–	–	–	–	100	100
Hungary	–	–	–	200	200	200	400
Latvia	–	–	–	100	100	100	100
Lithuania	–	–	–	200	100	100	100
Macedonia	3,000	–	–	1,400	1,600	600	600
Moldova	–	–	–	1,500	1,800	1,200	1,300
Poland	–	–	–	500	400	400	400
Portugal	–	–	–	100	–	–	–
Romania	–	–	–	900	1,400	1,100	900
Russian Federation	27,900	25,600	39,400	34,000	35,400	29,900	31,900
Serbia and Montenegro ³	52,200	52,800	19,300	24,700	26,100	25,100	19,100
Slovakia	–	–	–	–	200	200	–
Slovenia	–	–	–	100	–	–	–
Turkey	16,900	17,600	26,600	25,700	28,600	21,800	21,600
Ukraine	–	5,900	4,300	5,500	7,700	6,600	4,400
United Kingdom	–	–	–	100	–	–	–
Americas and Caribbean	454,200	319,000	339,800	324,000	515,700	652,500	600,800
Argentina	–	–	–	300	100	100	100
Bolivia	–	–	–	100	300	300	–
Brazil	–	–	–	600	500	500	600
Chile	–	–	–	–	–	100	100
Colombia	42,900	230,700	261,000	257,900	453,300	581,600	523,900
Costa Rica	–	–	–	100	100	–	–
Cuba	31,500	26,500	25,100	16,700	13,600	13,900	13,800
Dominican Republic	–	–	–	–	100	100	100
Ecuador	–	–	–	200	200	300	300
El Salvador	203,000	4,500	4,500	5,000	4,700	4,900	5,300
Grenada	–	–	–	100	100	100	100
Guatemala	129,000	10,200	12,600	5,900	4,800	4,900	5,100
Guyana	–	–	–	500	400	300	400
Haiti	30,800	23,800	19,900	17,200	18,100	22,000	23,600

	2002	2003	2004	2005	2006	2007	2008
Honduras	-	-	-	1,300	1,500	1,600	1,900
Jamaica	-	-	-	300	300	300	600
Mexico	-	20,700	4,100	4,900	6,800	9,600	12,300
Nicaragua	15,800	2,600	8,200	5,600	3,400	3,600	3,600
Peru	1,200	-	-	2,900	2,900	2,800	2,200
St Lucia	-	-	-	200	200	200	400
St Vincent and the Grenadines	-	-	-	400	500	500	800
Trinidad and Tobago	-	-	-	200	300	300	400
United States	-	-	-	200	400	1,100	1,700
Venezuela	-	-	4,400	3,400	3,100	3,400	3,500
Total	12,174,600	11,163,500	10,969,900	11,761,400	13,475,900	14,105,202	13,553,900

Source: US Committee for Refugees and Immigrants

Notes:

- indicates zero or near zero

Preliminary figures correct as of March 2009

¹ Western Sahara: this territory is now controlled by Morocco. Hence USCRI is listing Morocco as being the source responsible

² The estimates provided are disputed. See the caveats in the introductory pages of the statistical data for further information.

³ Serbia and Montenegro: prior to 3 June 2006, Serbia and Montenegro were considered one country. Following a referendum, Montenegro declared itself an independent nation

Table 15 Refugees and asylum seekers by host country/territory (2002 to 2008)

	2002	2003	2004	2005	2006	2007	2008
Africa	3,029,000	3,245,500	3,293,500	3,176,100	3,212,900	3,194,700	3,021,400
Algeria	85,000	170,000	102,000	94,500	95,000	97,600	96,500
Angola	12,000	13,000	14,900	14,900	15,600	16,000	15,000
Benin	6,000	5,000	5,900	32,000	12,200	9,000	8,400
Botswana	4,000	4,500	3,800	3,200	3,200	3,200	3,200
Burkina Faso	–	–	–	1,300	1,300	1,300	1,300
Burundi	41,000	42,000	60,700	40,600	20,300	31,700	40,400
Cameroon	17,000	25,000	65,000	58,900	71,200	94,400	123,100
Central African Rep.	50,000	51,000	30,600	26,500	14,300	9,900	9,100
Chad	16,000	156,000	260,000	275,500	286,800	300,600	319,300
Congo, DR of	274,000	241,000	200,700	204,500	208,500	142,400	155,800
Congo, Rep. of	118,000	91,000	71,700	69,600	60,000	43,200	40,000
Côte d'Ivoire	50,000	74,000	74,200	44,100	40,800	34,100	26,300
Djibouti	23,000	36,000	18,000	10,500	9,300	8,000	8,800
Egypt	78,000	69,000	85,800	86,700	172,900	205,100	173,500
Eritrea	3,000	4,000	4,700	6,000	6,600	6,800	5,000
Ethiopia	115,000	112,000	116,000	101,100	147,300	198,100	151,400
Gabon	20,000	19,000	19,100	13,400	12,600	12,700	13,100
Gambia	10,000	10,000	11,000	8,800	14,400	14,700	14,900
Ghana	41,000	48,000	48,100	59,000	50,500	40,500	19,600
Guinea	182,000	223,000	145,200	67,300	35,400	22,100	28,100
Guinea-Bissau	7,000	10,000	7,700	7,800	8,100	8,300	8,300
Kenya	221,000	219,000	269,300	314,600	337,700	319,400	365,000
Liberia	65,000	60,000	38,600	16,100	16,200	19,300	16,600
Libyan AJ	12,000	–	12,400	12,000	10,900	16,400	18,900
Malawi	13,000	12,000	7,000	9,600	9,200	9,400	10,400
Mali	4,000	7,000	12,300	13,100	12,500	12,800	11,100
Mauritania	25,000	26,500	30,600	30,600	30,400	31,200	30,500
Morocco	2,000	–	2,300	2,300	1,900	2,000	2,000
Mozambique	7,000	8,000	5,500	6,000	6,900	7,100	12,600
Namibia	26,000	15,000	16,900	14,300	6,600	6,600	7,700
Niger	–	–	–	300	15,300	15,700	15,700
Nigeria	7,000	10,000	9,500	9,400	9,400	9,600	9,200
Rwanda	32,000	37,000	36,100	49,500	53,100	54,100	59,000
Senegal	45,000	23,000	23,200	23,400	23,200	23,800	18,100
Sierra Leone	60,000	70,000	65,700	60,100	27,600	17,200	17,200
Somalia	–	–	3,000	2,900	2,100	2,200	4,300
South Africa	65,000	104,000	142,900	169,800	171,400	216,400	208,000
Sudan	287,000	280,000	225,900	231,700	296,400	304,400	310,500
Swaziland	1,000	–	–	1,000	1,000	1,000	1,000
Tanzania	516,000	480,000	602,300	549,100	485,700	432,500	277,500
Togo	11,000	12,000	11,700	9,700	6,800	6,900	6,900
Tunisia	–	–	–	100	200	200	200
Uganda	221,000	231,500	252,300	254,400	277,800	267,500	276,100
Zambia	247,000	239,000	174,000	155,900	120,500	115,400	77,900
Zimbabwe	10,000	8,000	6,900	14,000	3,800	3,900	3,900

	2002	2003	2004	2005	2006	2007	2008
East Asia and Pacific	874,700	953,400	1,013,200	1,029,400	944,500	961,700	906,200
Australia	25,000	22,800	14,600	14,800	14,800	13,400	9,900
Cambodia	300	100	–	200	200	200	200
China	396,000	396,000	401,500	352,700	335,400	343,600	332,000
Indonesia	28,700	300	–	100	600	600	600
Japan	6,500	7,900	6,100	2,600	2,900	3,000	3,000
Korea, Rep. of	–	1,700	2,200	2,100	2,400	2,500	2,500
Malaysia	59,000	75,700	101,200	152,700	155,700	159,300	171,500
Nauru	100	200	–	–	–	–	–
New Zealand	1,700	1,200	1,800	1,000	800	800	900
Papua New Guinea	5,200	7,800	7,800	10,000	10,200	10,500	10,000
Philippines	200	2,200	2,200	300	100	100	100
Thailand	336,000	421,500	460,800	477,500	408,400	405,200	366,000
Viet Nam	16,000	16,000	15,000	15,400	13,000	22,500	9,500
South and Central Asia	2,188,600	1,872,900	1,724,600	1,953,600	2,914,200	2,618,000	2,504,000
Afghanistan	–	–	–	–	–	–	2,000
Bangladesh	122,200	119,900	150,000	150,100	178,100	177,600	193,100
Bhutan	–	–	–	–	–	–	300
India	332,300	316,900	393,300	515,100	435,900	423,400	477,200
Kazakhstan	20,600	15,300	15,800	7,300	4,500	4,500	4,500
Kyrgyzstan	8,300	8,200	4,200	3,100	900	900	900
Nepal	132,000	134,600	130,600	130,600	129,600	130,100	120,800
Pakistan	1,518,000	1,219,000	968,800	1,088,100	2,161,500	1,877,800	1,701,500
Sri Lanka	–	–	–	200	300	300	300
Tajikistan	3,500	3,200	3,700	2,600	1,200	1,200	1,200
Turkmenistan	13,700	14,100	13,300	12,000	800	800	800
Uzbekistan	38,000	41,700	44,900	44,500	1,400	1,400	1,400
Middle East	5,290,300	4,353,100	4,288,100	4,855,400	5,420,100	6,072,800	6,066,100
Gaza Strip	879,000	923,000	952,300	986,000	1,017,000	1,047,200	1,072,000
Iran	2,208,500	1,335,000	1,046,100	994,000	1,025,000	1,024,500	972,000
Iraq	134,700	131,500	96,600	63,400	46,600	41,000	44,700
Israel	2,100	1,000	4,900	1,500	1,700	1,700	1,700
Jordan	155,000	163,700	168,300	609,500	732,700	617,100	621,600
Kuwait	65,000	65,000	51,800	14,300	13,600	51,000	40,000
Lebanon	409,000	256,000	265,800	296,800	294,200	329,400	332,900
Qatar	–	–	–	100	100	100	100
Saudi Arabia	245,400	240,900	243,700	240,800	241,000	247,500	291,000
Syrian Arab Rep.	482,400	497,000	701,700	866,300	1,229,300	1,843,500	1,767,000
United Arab Emirates	–	–	–	200	200	200	200
West Bank	627,500	665,000	682,700	699,800	722,000	745,000	799,500
Yemen	81,700	75,000	74,200	82,700	96,700	124,600	123,400
Europe	859,900	884,500	610,500	530,200	569,200	527,200	502,200
Albania	100	100	–	100	100	100	100
Armenia	11,000	11,000	11,200	11,300	11,500	4,500	4,500
Austria	30,900	17,600	19,300	17,300	43,900	13,000	13,000

	2002	2003	2004	2005	2006	2007	2008
Azerbaijan	11,400	10,300	9,800	3,300	2,700	2,800	2,800
Belarus	3,600	3,400	3,400	2,700	700	700	700
Belgium	30,300	33,000	24,500	14,100	18,100	12,900	7,100
Bosnia and Herzegovina	34,200	22,500	22,700	10,800	10,400	7,400	7,400
Bulgaria	1,200	800	5,200	5,200	5,400	5,400	1,800
Croatia	8,100	4,200	3,700	2,900	2,500	2,600	2,600
Cyprus	1,800	5,300	10,600	14,300	13,400	10,000	10,000
Czech Republic	6,300	3,900	2,700	1,300	4,800	4,900	3,200
Denmark	5,200	2,800	2,000	2,000	2,700	2,800	1,400
Finland	1,200	2,300	–	2,400	2,000	2,100	4,200
France	27,600	34,900	22,900	25,500	46,400	47,700	17,000
Georgia	4,200	3,900	2,600	2,500	1,400	1,400	1,400
Germany	104,000	90,800	83,300	64,200	21,600	28,900	28,900
Greece	1,800	5,200	10,200	11,300	5,800	6,000	34,300
Hungary	1,200	1,500	8,000	8,800	1,500	1,500	1,000
Iceland	–	–	–	300	–	–	–
Ireland	6,500	5,800	10,800	2,400	4,000	4,100	1,900
Italy	5,200	5,600	5,800	5,800	5,100	5,200	5,200
Liechtenstein	–	–	–	200	100	100	100
Lithuania	200	100	–	600	600	600	600
Macedonia, FYR of	2,700	2,300	2,200	2,200	3,100	3,200	3,200
Malta	–	200	–	2,400	200	200	200
Moldova	300	100	–	200	100	100	100
Netherlands	17,200	14,600	12,800	14,400	8,700	8,700	13,500
Norway	5,900	11,000	8,900	4,300	5,900	6,100	13,300
Poland	300	1,500	8,700	6,200	2,100	2,200	5,700
Portugal	–	–	–	400	–	–	–
Romania	100	200	2,400	2,300	1,600	1,400	1,400
Russian Federation	17,400	161,300	150,000	149,200	187,400	159,500	159,500
Serbia and Montenegro	353,000	291,100	76,500	78,600	77,900	80,000	66,600
Slovak Republic	4,500	4,700	3,300	3,100	6,100	200	200
Slovenia	400	100	–	200	400	300	300
Spain	200	200	–	1,600	5,500	5,600	5,600
Sweden	24,900	25,600	19,400	19,400	23,900	41,800	23,400
Switzerland	44,200	38,300	31,200	10,500	8,200	20,700	13,700
Turkey	10,000	9,500	7,800	7,300	8,900	9,100	18,200
Ukraine	3,600	3,100	6,400	4,000	3,500	3,600	1,500
United Kingdom	79,200	55,700	22,200	14,600	21,000	19,800	26,600
Americas and the Caribbean	756,500	543,500	535,600	475,000	648,900	790,400	763,200
Argentina	2,700	2,300	3,900	3,900	4,000	4,100	700
Belize	1,000	900	–	700	500	500	500
Bolivia	400	500	–	500	600	600	600
Brazil	3,700	3,900	3,800	3,700	3,900	21,100	21,400
Canada	78,400	70,200	54,800	39,500	43,500	54,000	72,400

	2002	2003	2004	2005	2006	2007	2008
Chile	400	500	–	900	1,500	1,500	1,600
Colombia	200	200	–	200	200	200	200
Costa Rica	12,800	13,600	10,600	12,200	11,800	12,100	17,700
Cuba	1,000	800	–	700	700	700	700
Dominican Republic	300	500	–	1,000	2,000	2,100	2,100
Ecuador	9,100	16,500	45,100	47,400	207,500	272,700	250,300
El Salvador	–	200	–	–	–	–	–
Guatemala	700	800	–	400	400	400	400
Mexico	4,000	2,900	4,500	3,400	3,500	3,600	3,600
Nicaragua	–	300	–	200	200	200	200
Panama	1,700	2,000	–	2,200	11,200	11,500	17,400
Paraguay	–	–	–	–	100	100	100
Peru	900	800	–	1,200	1,400	1,400	1,400
United States	638,000	244,200	232,800	176,700	147,200	151,200	160,700
Uruguay	100	100	–	100	200	200	200
Venezuela	1,100	182,300	180,100	180,100	208,500	252,200	211,000
Total	12,999,000	11,852,900	11,465,500	12,019,700	13,709,800	14,164,800	13,763,100

Source: US Committee for Refugees and Immigrants

Notes:

– indicates zero or near zero

Preliminary figures correct as of March 2009

Table 16 Significant populations of internally displaced people (2002 to 2008)

	2002	2003	2004	2005	2006	2007	2008
Africa	10,730,000	13,099,000	12,163,000	11,921,300	11,026,000	11,654,000	12,320,800
Algeria	100,000	100,000	400,000	400,000	300,000	300,000	300,000
Angola	2,000,000	1,000,000	60,000	61,700	61,700	-	-
Burundi	400,000	400,000	145,000	117,000	100,000	100,000	100,000
Central African Rep.	10,000	200,000	200,000	200,000	200,000	197,000	108,000
Chad	-	-	-	-	113,000	179,000	186,000
Congo, DR of	2,000,000	3,200,000	2,330,000	1,664,000	1,100,000	1,312,000	1,400,000
Congo, Rep. of	100,000	60,000	48,000	48,000	7,800	8,000	7,800
Côte d'Ivoire	500,000	500,000	500,000	500,000	750,000	709,000	621,000
Eritrea	75,000	75,000	59,000	50,500	40,000	32,000	32,000
Ethiopia	90,000	90,000	132,000	150,000	100,000	200,000	200,000
Guinea	20,000	20,000	82,000	82,000	19,000	-	-
Kenya	230,000	230,000	360,000	381,900	431,000	300,000	400,000
Liberia	100,000	500,000	464,000	48,000	13,000	7,000	6,000
Nigeria	50,000	57,000	200,000	200,000	200,000	200,000	100,000
Senegal	5,000	17,000	-	-	64,000	22,000	10,000
Sierra Leone	-	-	3,000	-	-	-	-
Somalia	350,000	350,000	400,000	370,000	400,000	1,000,000	1,100,000
Sudan	4,000,000	4,800,000	5,300,000	5,335,000	5,355,000	5,800,000	6,000,000
Togo	-	-	-	3,000	1,500	1,000	1,000
Uganda	600,000	1,400,000	1,330,000	1,740,500	1,200,000	717,000	869,000
Zimbabwe	100,000	100,000	150,000	569,700	570,000	570,000	880,000
East Asia and Pacific	1,349,000	1,400,000	1,160,000	992,000	1,000,000	973,000	997,000
Indonesia	600,000	600,000	500,000	342,000	250,000	250,000	150,000
Korea, DPR of ¹	100,000	50,000	50,000	50,000	30,000	-	-
Myanmar	600,000	600,000	550,000	540,000	500,000	503,000	503,000
Philippines	45,000	150,000	60,000	60,000	120,000	120,000	314,000
Solomon Islands	4,000	-	-	-	-	-	-
Timor-Leste	-	-	-	-	100,000	100,000	30,000
Europe	2,560,000	2,455,800	2,226,500	2,013,700	2,506,300	2,754,000	2,494,700
Armenia	50,000	50,000	50,000	8,000	8,400	8,000	8,000
Azerbaijan	576,000	571,000	528,000	558,400	579,000	687,000	573,000
Bosnia and Herzegovina	368,000	327,200	309,200	183,400	180,000	132,000	125,000
Croatia	17,000	12,600	12,600	4,900	4,200	7,000	2,900
Cyprus	265,000	265,000	150,000	150,000	140,000	110,000	100,000
Georgia	262,000	260,000	260,000	240,000	222,000	222,000	300,000
Macedonia, FYR of	9,000	-	2,700	800	700	-	800
Russian Federation	371,000	368,000	339,000	265,000	190,000	159,000	137,000
Serbia and Montenegro	262,000	252,000	225,000	247,400	228,000	228,000	248,000
Turkey	380,000	350,000	350,000	355,800	954,000	1,201,000	1,000,000
Americas and Caribbean	2,518,000	2,742,000	2,912,000	2,970,000	2,960,000	3,059,000	2,799,000
Colombia	2,500,000	2,730,000	2,900,000	2,900,000	2,900,000	2,959,000	2,649,000
Haiti	6,000	-	-	-	-	-	-

	2002	2003	2004	2005	2006	2007	2008
Mexico	12,000	12,000	12,000	10,000	10,000	–	–
Peru	–	–	–	60,000	50,000	100,000	150,000
Middle East	2,646,000	2,346,000	1,648,000	1,792,000	2,192,000	2,761,000	3,264,000
Palestinian Territory, Occupied	26,000	–	–	–	24,500	24,000	100,000
Iraq	1,100,000	800,000	1,000,000	1,300,000	1,700,000	2,256,000	2,842,000
Israel	250,000	276,000	10,000	9,000	8,500	8,000	7,000
Jordan	800,000	800,000	168,000	160,000	172,000	172,000	160,000
Lebanon	300,000	300,000	300,000	250,000	216,000	232,000	90,000
Syrian Arab Rep.	170,000	170,000	170,000	73,000	71,000	69,000	65,000
South and Central Asia	2,023,000	1,511,000	1,205,000	1,282,800	1,484,400	1,347,000	1,368,000
Afghanistan	700,000	200,000	167,000	153,200	132,000	132,000	200,000
Bangladesh	60,000	61,000	65,000	65,000	65,000	65,000	65,000
India	600,000	650,000	500,000	600,000	600,000	600,000	500,000
Nepal	100,000	100,000	100,000	100,000	100,000	70,000	50,000
Pakistan	–	–	17,000	20,000	84,000	17,000	50,000
Sri Lanka	563,000	500,000	353,000	341,200	500,000	460,000	500,000
Uzbekistan	–	–	3,000	3,400	3,400	3,000	3,000
Total	21,826,000	23,553,800	21,314,500	20,971,800	21,168,700	22,548,000	23,243,500

Source: US Committee for Refugees and Immigrants

Notes:

– indicates zero or near zero

Preliminary figures correct as of March 2009

¹ The estimates provided are disputed. See the caveats in the introductory pages of the statistical data for further information.

Progress on implementation of disaster risk reduction actions

Actions to reduce risk from disasters and climate change are being increasingly adopted by communities, national authorities, civil society and other responsible partners, assisted by international agencies, to build a culture of resilience. The concept of disaster risk reduction is better understood and practised than ever before. However, a lot remains to be done, better and faster.

Global commitment to monitoring and reporting on disaster risk reduction and recovery actions is also steadily gaining momentum. This signals a first comprehensive step in taking stock of results achieved so far to help us collectively prioritize risk reduction actions at the local, national, regional and international levels in the coming years.

The United Nations International Strategy for Disaster Reduction (UNISDR), in partnership with regional intergovernmental organizations, member states, UN organizations and agencies, and civil society organizations, facilitated a first biennial global review of progress in the implementation of the Hyogo Framework for Action (HFA), for the period from 2007 to 2009.

By February 2009, 99 countries were preparing national reports for the first biennial HFA review of which 62 provided completed interim reports online. It is expected that the biennial HFA reviews will strengthen the capacities of countries to monitor and assess progress in efforts for disaster risk reduction on an ongoing basis.

The Global Network of Civil Society Organizations is simultaneously leading efforts with a range of civil society actors to strengthen public accountability for HFA implementation and enhance the ability of civil society groups to measure progress, formulate policy positions from the local perspective, provide recommendations and establish baselines for discussions on progress in disaster risk reduction and recovery actions. The civil society review will complement the analysis of the biennial HFA review facilitated by UNISDR and partners at the national level.

The biennial HFA review process includes identifying benchmarks and indicators for assessing progress in efforts made across the framework's five 'priorities for action' and its cross-cutting themes. Country self-assessment was made possible by an online global tool called the *HFA Monitor*, which is available for data input, analysis and

display, and is facilitated by UNISDR. National authorities and HFA focal points use the tool to assess progress against 22 indicators associated with the five priorities for action, using five levels of progress to indicate the extent of progress made in efforts for HFA implementation. For more information on the biennial HFA review and the *HFA Monitor* tool, log on to <http://preventionweb.net>.

From interim results provided online, progress has reportedly been satisfactory for HFA priority for action 1, particularly in the development of policy and legislations and strengthening multi-sector institutional systems and platforms for disaster risk

Box 1 Monitoring and reporting progress on the implementation of the Hyogo Framework for Action

Priority for action 1: ensure that disaster risk reduction is a national and local priority with a strong institutional basis for implementation

Indicator 1. National policy and legal framework for disaster risk reduction exists with decentralized responsibilities and capacities at all levels

Indicator 2. Dedicated and adequate resources are available to implement disaster risk reduction plans and activities at all administrative levels

Indicator 3. Community participation and decentralization are ensured through the delegation of authority and resources to local levels

Indicator 4. A national multi-sectoral platform for disaster risk reduction is functioning

Priority for action 2: identify, assess and monitor disaster risks and enhance early warning

Indicator 1. National and local risk assessments based on hazard data and vulnerability information are available and include risk assessments for key sectors

Indicator 2. Systems are in place to monitor, archive and disseminate data on key hazards and vulnerabilities

Indicator 3. Early warning systems are in place for all major hazards, with outreach to communities

Indicator 4. National and local risk assessments take account of regional/transboundary risks, with a view to regional cooperation on risk reduction

Priority for action 3: use knowledge, innovation and education to build a culture of safety and resilience at all levels

Indicator 1. Relevant information on disasters is available and accessible at all levels, to all stakeholders (through networks, development of information-sharing systems, etc.)

Indicator 2. School curricula, education material and relevant training courses include disaster risk reduction and recovery concepts and practices

Indicator 3. Research methods and tools for multi-risk assessments and cost-benefit analysis are developed and strengthened

Indicator 4. Countrywide public awareness strategy exists to stimulate a culture of disaster resilience, with outreach to urban and rural communities

Priority for action 4: reduce the underlying risk factors

Indicator 1. Disaster risk reduction is an integral objective of environment-related policies and plans, including for land use, natural

resource management and adaptation to climate change

Indicator 2. Social development policies and plans are being implemented to reduce the vulnerability of populations most at risk

Indicator 3. Economic and productive sectoral policies and plans have been implemented to reduce the vulnerability of economic activities

Indicator 4. Planning and management of human settlements incorporate disaster risk reduction elements, including enforcement of building codes

Indicator 5. Disaster risk reduction measures are integrated into post-disaster recovery and rehabilitation processes

Indicator 6. Procedures are in place to assess the disaster risk impacts of major development projects, especially infrastructure

Priority for action 5: strengthen disaster preparedness for effective response at all levels

Indicator 1. Strong policy, technical and institutional capacities and mechanisms for disaster risk management, with a disaster risk reduction perspective, are in place

Indicator 2. Disaster preparedness plans and contingency plans are in place at all administrative levels, and regular training drills and rehearsals are held to test and develop disaster response programmes

Indicator 3. Financial reserves and contingency mechanisms are in place to support effective response and recovery when required

Indicator 4. Procedures are in place to exchange relevant information during hazard events and disasters, and to undertake post-event reviews

reduction. Progress has also been reported on priority for action 5, in particular in the development of technical and institutional capacities for disaster preparedness, putting disaster preparedness and contingency plans in place, and facilitating information exchange before and during disasters.

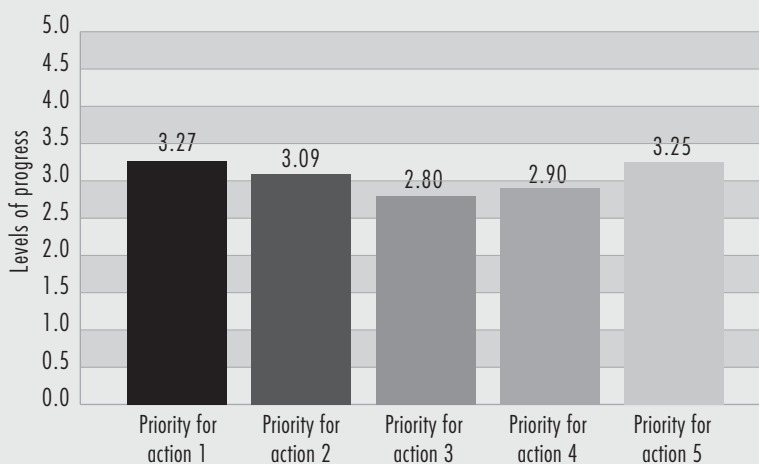
HFA priority for action 2 entails identifying, assessing and monitoring disaster risks and enhancing early warning. While consistent progress has been reported, all countries acknowledge the need for more focused and urgent efforts on this front.

In contrast, average global progress is reported to be weak across most areas of priority for action 3, which calls for the use of knowledge, innovation and education to build a culture of safety and resilience at all levels. This is the case particularly in developing and applying research methods and tools for multi-risk assessments, including disaster risk reduction and recovery concepts and practices in school curricula and education material, and developing a countrywide public awareness strategy to stimulate a culture of disaster resilience. It is important to interpret this trend as a marker of the extent of progress being made, relative to efforts in the respective areas of education, development of tools and research methods, and public awareness. In other words, a lot is being done with regard to each of these indicators, but countries report the need to do a lot more, and better.

Average global progress also appears to be weak on priority for action 4, which refers to the integration of disaster risk reduction into social, economic, environmental and

Figure 1

Global average progress on HFA implementation:
2007–2009 HFA review



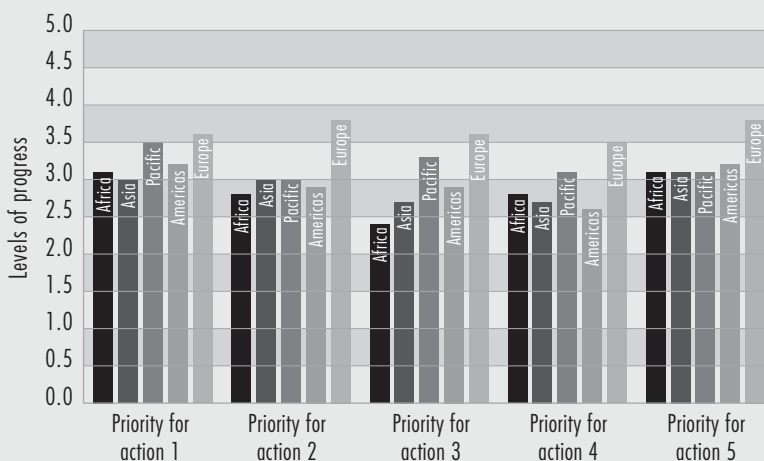
urban development and into the planning of infrastructure projects. According to a majority of national reports, much still needs to be done with regard to how underlying risk factors can be reduced in practical terms. In contrast to efforts on priority for action 3, this area remains a challenge mainly due to lack of know-how and political imperatives to address risk as a part of development processes. Increased advocacy efforts and better integration of underlying risk considerations in sector efforts, which are an urgent requirement if countries intend to avoid continually creating or recreating risks through development.

Globally, the results indicate that national efforts remain focused on strengthening policy, legislation, institutional frameworks and capacities for disaster preparedness, response, risk assessments and early warning (HFA priorities for action 1, 2 and 5). In contrast, much more effort needs to be made in using knowledge, education and innovative outreach programmes to stimulate a culture of disaster resilience and to address underlying factors that are configuring disaster risk in social, economic, urban and infrastructure development (HFA priorities for action 3 and 4).

Interestingly, results by region indicate that interpreting the global findings needs to be nuanced. Europe, which is mostly represented by high-income and some upper-middle-income countries, reports higher progress than all other regions and across all priorities. Africa, with a majority of low-income countries, has made equal or more progress than all other regions, with the exception of priorities for action 2 and 3. The Pacific, weighted by the presence of high-income countries like Australia and New Zealand, has made more progress in priorities for action 1, 3 and 4 than all other

Figure 2

Regional average progress on HFA implementation:
2007–2009 HFA review



regions except Europe. The Americas have made more progress than Asia except in priorities for action 2 and 4.

Shefali Juneja, UNISDR programme officer (2009 Global Assessment Report on Disaster Risk Reduction), contributed this text, which is taken from the 2009 Global Assessment Report on Disaster Risk Reduction. For more information on the 2007–2009 HFA review process and the key findings, please refer to the main text of the report, which is available at <http://preventionweb.net>.

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The Fundamental Principles of the International Red Cross and Red Crescent Movement

Humanity

The International Red Cross and Red Crescent Movement, born of a desire to bring assistance without discrimination to the wounded on the battlefield, endeavours, in its international and national capacity, to prevent and alleviate human suffering wherever it may be found. Its purpose is to protect life and health and to ensure respect for the human being. It promotes mutual understanding, friendship, cooperation and lasting peace among all peoples.

Impartiality

It makes no discrimination as to nationality, race, religious beliefs, class or political opinions. It endeavours to relieve the suffering of individuals, being guided solely by their needs, and to give priority to the most urgent cases of distress.

Neutrality

In order to continue to enjoy the confidence of all, the Movement may not take sides in hostilities or engage at any time in controversies of a political, racial, religious or ideological nature.

Independence

The Movement is independent. The National Societies, while auxiliaries in the humanitarian services of their governments and subject to the laws of their respective countries, must always maintain their autonomy so that they may be able at all times to act in accordance with the principles of the Movement.

Voluntary service

It is a voluntary relief movement not prompted in any manner by desire for gain.

Unity

There can be only one Red Cross or Red Crescent Society in any one country. It must be open to all. It must carry on its humanitarian work throughout its territory.

Universality

The International Red Cross and Red Crescent Movement, in which all societies have equal status and share equal responsibilities and duties in helping each other, is worldwide.

“Timely, preventive response to disaster risk requires effective early warning systems that are technically sound, politically viable and communally acceptable. To curb increasing disaster risks and climate change impacts, as highlighted in this year’s *World Disasters Report*, it is high time to unite and to take concrete concerted actions, for securing human life and livelihoods and protecting socio-economic gains and opportunities.”

Loren B. Legarda

Senator of the Republic of the Philippines

UNISDR Regional Champion for Disaster Risk Reduction and Climate Change Adaptation for Asia Pacific and UNEP Laureate

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The International Federation of Red Cross and Red Crescent Societies promotes the humanitarian activities of National Societies among vulnerable people.

By coordinating international disaster relief and encouraging development support it seeks to prevent and alleviate human suffering.

The International Federation, the National Societies and the International Committee of the Red Cross together constitute the International Red Cross and Red Crescent Movement.

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