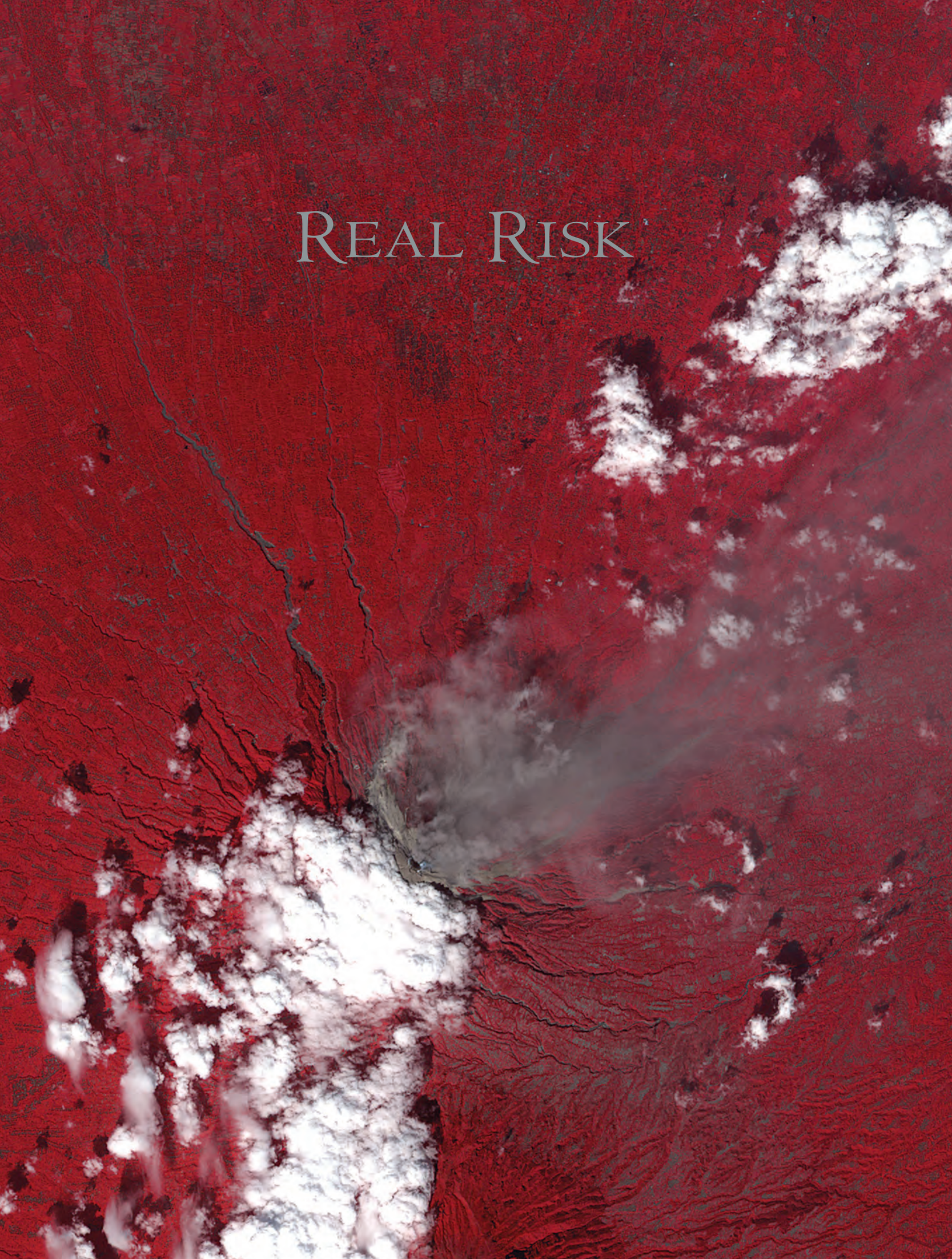
Real Risk



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Foreword

When *Know Risk* was published in January 2005, to coincide with the World Conference on Disaster Reduction in Kobe, public and private sector organizations around the world acknowledged that disaster risk reduction is the responsibility of everyone. Among other measures, the summit would result in the *Hyogo Framework for Action 2005-2015*, a plan for developing the disaster-resilience of nations, communities and individuals.

Even as *Know Risk* was produced, a massive tsunami in the Indian Ocean devastated many communities, causing hundreds of thousands of deaths. Among the succession of major disasters across the world since then, the devastation of New Orleans by Hurricane Katrina brought home the fact that communities of any size, in any nation, rich or poor, are vulnerable to natural disasters.

They can be vulnerable, but they do not have to be. For this reason, it is time to revisit the findings of *Know Risk*, to see how its messages are being understood and implemented, and what can be learnt from recent disaster experiences.

One point that has become abundantly clear is that any discussion of natural disasters must also take into account human nature — there can be no hard-and-fast division between acts of nature and man-made risks. Human phenomena like urbanization, deforestation, the use of land and of water, and building practices all contribute to increasing or decreasing risk and vulnerability. In acknowledging this, we recognize that everybody, at every level, owns disaster risk, and that everybody plays a part in reducing that risk.

Clearly, discussion and recommendation are not enough — sustained action is needed to reduce vulnerability and risk in the knowledge that another disaster can and will strike at any time. In Indonesia alone, the past two months have seen a major earthquake followed by the eruption of Mount Merapi, and at the time of writing, an undersea earthquake of magnitude 7.7 has caused a tsunami to hit the island of Java, leaving over 650 people dead and 52,700 displaced. As we know from experience, those figures could be even higher if the mechanisms for recovery are not in place.

As the articles in this volume illustrate, it is possible to reduce disaster risk and to mitigate the effects of disasters through a wealth of techniques including education, shared experiences, microfinance and planning. Where action is being taken and knowledge shared, vulnerability is being reduced.

Real Risk represents the ongoing work of a broad spectrum of private and public organizations, united in the view that disaster risk and mitigation are shared by everyone, the world over.

Our thanks go to all of the organizations that have contributed their time, thought and resources to this volume. We trust that *Real Risk* will be a useful addition to the knowledge sharing that lies at the heart of disaster risk reduction and mitigation.

Sean Nicklin
Tudor Rose
August 2006

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www.adpc.net

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www.southasiadisasters.net

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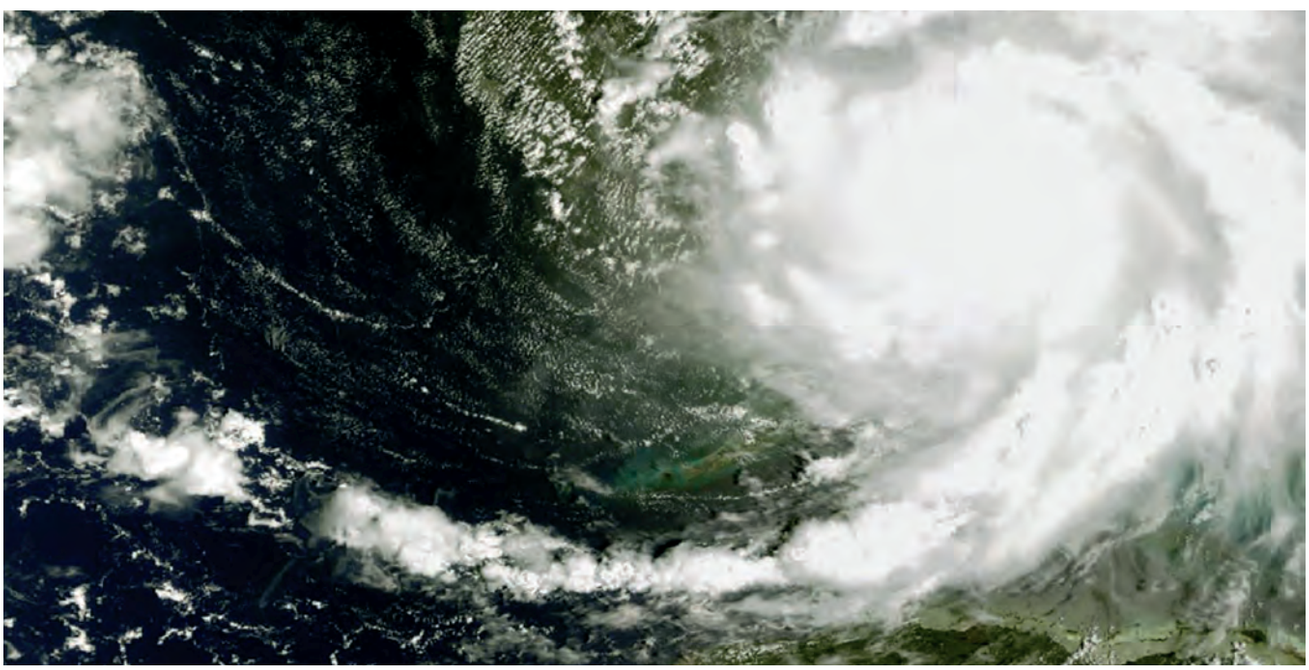


Photo: ESA

Introduction

Sálvano Briceño, Director, Secretariat of the International Strategy for Disaster Reduction

"Vision without action is but a daydream, but action without vision is a nightmare" — A global framework for reducing risk of disasters[1]

Over the past two years, there has been no shortage of reminders that reducing risk and improving the management of natural hazards must be given the highest priority. The need for a global disaster reduction strategy has been underscored by a string of disasters ranging from the Indian Ocean tsunami, to droughts in Africa; from hurricanes roaring onto American and Caribbean shores to typhoons triggering landslides in Southeast Asia; from fires and floods in Europe to earthquakes in Pakistan and Indonesia. Last year alone, 92,000 people lost their lives in disasters and close to 160,000 were affected overall.[2]

At the heart of the United Nations' efforts to reduce the serious and growing impact of natural hazards on communities and countries lies the International Strategy for Disaster Reduction (ISDR). It was launched in 2000 following an International Decade dedicated to the subject of Natural Disaster Reduction (IDNDR, 1990-1999) with an ISDR secretariat and an inter-agency task force. Today, this effort has advanced into a much wider system of commitments and platforms on specific subjects, in many regions and involving many nations.

What is being done to prevent more death and destitution?
A significant step towards more action and commitment was taken just a few weeks after the tsunami claimed over 250,000 lives. In January 2005, 168 governments gathered in Japan at the second UN World Conference on Disaster Reduction and adopted the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters. The Framework lays out a detailed ten-year plan to make risk reduction an essential component of development policies and programmes.

The Hyogo Framework commits governments as well as regional, international, and non-governmental organizations (NGOs) to:

1. Ensure that disaster risk reduction is a national and local priority
2. Identify, assess and monitor disaster risks and enhance early warning
3. Use knowledge, innovation and education to build a culture of safety and resilience at all levels
4. Reduce the underlying risk factors
5. Strengthen disaster preparedness for effective response at all levels.

The challenge is to turn these priorities into practical measures and produce measurable results in disaster reduction. The overall goal is to substantially reduce loss of life and damage to the social, economic and environmental assets of communities.

All too often, disasters are perceived and responded to as singular 'events' rather than manifestations of complex natural and human systems at work. Yet, a disaster is more than just the inevitable consequence of some natural event. It is the result of human exposure and vulnerability. When a tropical cyclone hits a deserted beach, it does not create disaster. But when it strikes an area populated with fishing communities living in thatched roof homes, the number of fatalities and economic losses surge.

Although the most vulnerable communities are found in developing countries, no country, poor or rich, is immune from disasters — as was demonstrated by Hurricane Katrina and the 2005 floods in Europe. In less developed countries, however, disasters are stunting (and often reversing) social and economic progress, thus inevitably widening the gap between the 'haves' and 'have-nots.' The World Bank calculated that in the 1990s, the average economic cost of any large-scale disaster in low-

income countries has ranged between two and fifteen per cent of gross domestic product.

However, it does not stop there. In an age of close trade links and economic interdependence, the damage done in one country is bound to have significant ramifications elsewhere. If nothing is done to reduce vulnerability, everybody, including the richer countries and those not immediately at risk from natural hazards, will pay the price.

Why are human and economic losses growing?

A number of factors contribute to the increased levels of devastation observed in recent disasters. Rising urban populations are increasing vulnerability very rapidly. The world's current population of 6.5 billion could reach the 9 billion mark within the next 50 years. The majority of people will live in urban areas. Particularly in developing countries, poorer segments of the population are pouring into cities in search of employment. They move into ramshackle houses in spontaneous settlements without building codes, often located in high-risk areas like hillsides and riverbeds.

At the same time, intensified economic activity is leaving its mark on the environment the world over. Deforestation, for instance, is a major factor in magnifying the scale and impact of landslides and storms, while wasteful water-use practices are responsible for aggravating the effects of droughts.

Increasingly, there is also a discussion about the effect of global warming on natural hazards. Research is showing that the number and intensity of some extreme, weather-related events such as floods, windstorms and droughts are related to the warming of the atmosphere as well as the oceans. And this trend could be reinforced by further human-induced climate change.

What is to be done?

These challenges are not likely to go away, but may be expected to become magnified. Reducing vulnerability and risk begins by considering how and where people live and work, and to which hazards they are exposed. It is important to do this even 'when the sun is still shining,' i.e. when people are not worried about potential hazards or imminent threats.

The good news is that, across the developing and developed world, the knowledge, expertise and resources already exist to protect communities against natural hazards. Even the poorest countries should have the means to raise awareness, build hazard-resistant houses, install early warning systems and respond to crises.

As an example, there are lessons to be learned from Bangladesh. There, the repeated loss of life through tropical cyclones in coastal areas prompted national and local administrators as well as NGOs and the scientific community to monitor and forecast weather. This has produced cyclone forecasts that are relayed to communities in clear and intelligible warnings through local authorities and networks of more than 5,000 community and Red Cross/Red Crescent volunteers. As a result, death rates have dropped significantly. In Mexico, Romania, Cuba, Vietnam and elsewhere, schools have been required by law to teach disaster-related subjects, so as to instil risk awareness at an early age.

Disaster risk reduction must be based on solid institutional and legal frameworks to be effective and to ensure that all segments of society are involved. Governments must assume primary responsibility for the welfare of their communities by providing the legal and institutional framework for disaster risk management. First and foremost, they need to define clear responsibilities and ensure that the various agencies at national, provincial and local levels understand their roles and coordinate their efforts.

The second task of governments is to allocate sustained funding to disaster risk reduction activities. The Government of India, for instance, decided to channel 10 per cent of all development spending into risk reduction measures. These funds have helped to build dams, roads and disaster-resilient schools, as well as having contributed to income generation and microfinance programmes aimed at reducing vulnerability amongst the poorest segments of society.

The third element is to establish effective cooperation. An increasing number of countries are setting up national platforms for disaster risk reduction to bring together all relevant actors, generate wider public visibility, encourage expanded professional engagement and establish concentrated official authority across disciplines and sectors.

What else constitutes an effective disaster risk reduction strategy?

All risk reduction starts with hazard and vulnerability assessments and with the mapping of the risks faced by different communities. This data is vital and allows for critical analysis and informed decisions about where to invest, how to develop settlements and how to reduce human suffering and physical destruction in the future.

Once hazards have been identified, early warning systems need to be put in place to enable individuals and communities to react swiftly and appropriately. The most effective warning systems are 'people-centred' ones, meaning that communities at risk are actively involved in their development and implementation. In Guatemala, for example, communities located along the Coyolate River organized committees, carried out participatory risk assessment, established community-based early warning systems to monitor the water levels in the rivers upstream and downstream, and organized evacuation plans and shelters. With these measures in place, the impact of the devastating Hurricane Mitch in 1998 was minimized and no lives were lost in these communities.

Awareness-raising and education also form crucial components of effective early warning, which should begin in primary and secondary education so as to build generational knowledge of local hazards and risks. Incorporating risk-related topics in school curricula can enable children to protect themselves and others in times of crisis.

When the Indian Ocean tsunami struck, British schoolgirl Tilly Smith urged people to flee the shores of Phuket Island in Thailand, saving hundreds of lives as a result. Her geography class in Britain had taught her to recognize the first signs of a tsunami. Similarly, on the Indonesian island of Simileue, grandparents have traditionally conveyed their knowledge of earthquakes and tsunamis to their grandchildren, with the result that only seven people out of the more than 80,000 inhabitants perished in the tsunami. Hence, training teachers in disaster risk reduction, staging regular evacuation drills, and involving NGOs, community organizations and the media in a variety of public awareness activities, can go a long way in making communities more alert — and therefore more resilient to natural hazards.

Other measures that can drastically reduce fatalities include compliance with building codes, application of safer construction techniques, land-use planning and zoning. Among the 92,000 people who lost their lives in disasters in 2005, 18,000 were pupils, crushed to death as their schools crumbled during the Pakistan earthquake. With stronger, more resilient school buildings in place, this number could have been considerably lower. Turkey, Cuba and Nepal are three countries that already make focused efforts to retrofit schools, hospitals and other public facilities with a view to saving lives and ensuring the continued functioning of critical services in times of crisis.

So-called 'natural disasters' are not really 'natural' but a combination of a natural hazard and vulnerability, influenced by human decisions and behaviour. It is, therefore, vital to address environmental degradation as one human-made condition, and to implement environmental policies, which strengthen the capacity of ecosystems to withstand and mitigate the impact of natural hazards. This includes preserving wetlands, preventing or reversing land degradation and deforestation, preventing the destruction of mangroves, coral reefs and other natural defences. At the same time, societies need to mitigate and adapt to climate change, for instance by switching to renewable energy sources. Sensible environmental management encourages sustained economic productivity without increasing vulnerability.

In addition to making the physical environment more resilient, the capacity of affected populations to withstand and recover from disasters must be boosted, too. Microcredit and microfinance programmes play a central role in building and protecting people's livelihoods. A single earthquake or flood can wipe out entire local economies and erase the work of generations. Low income communities with significant dependence on subsistence farming are usually particularly hard-hit. Yet, in the absence of effective insurance and development assistance, people are often reluctant to respond to warnings and to leave their livestock and property behind, thus placing themselves in danger in the event of a natural hazard. Microfinance tools such as microcredit and microinsurance should be widely available to help households transfer and share risks and recover more quickly.

The role of the private sector

According to United Kingdom Department for International Development (DFID), the private commercial sector provides nine out of ten jobs in developing countries. It therefore plays a critical role in making societies in general more physically and economically resilient. Effective disaster risk reduction strategies must take this into account and promote strong partnerships between the public and private domains.

Naturally, private companies primarily invest in risk reduction for their own good, namely to minimize their potential losses and to improve the company's public image. However, public-private partnerships in disaster risk reduction can also offer much needed material and political support to necessary but, at times, unpopular government policies. The removal of slums and spontaneous settlements from hazardous flood or mudslide zones, for instance, may prove difficult for national and local authorities to carry out, as they are under pressure to fulfil popular expectations and safeguard votes in the affected areas. Pooling public and private expertise and resources can help to overcome some of these difficulties and make the process more effective and credible.

In India, central government, in collaboration with private and technical bodies like space application and land use planning centres, created a national vulnerability atlas and land-use zone plans. These served as the basis for the provision of incentives to local authorities to make hazardous settlements resilient through redevelopment. Another way for the private sector to contribute would be to offer building loans and construction services at affordable rates to the affected communities so as to facilitate their relocation or the upgrading of their settlements. In return, governments may offer tax breaks for private investment in seismically safe construction, and allocate land for companies to relocate to safer zones — measures that will ultimately also benefit the wider community.

These are just some examples of ways for governments and the private sector to collaborate in disaster risk reduction. As it is an important aspect of ISDR's work to serve as an information clearinghouse, many existing resources and examples of good practice are currently being compiled for wider availability on the ISDR website (www.unisdr.org).

Disaster risk reduction as a regional effort

Notwithstanding the primary responsibility of national authorities for disaster risk reduction, natural hazards do not respect national borders. It is therefore important to address transboundary issues early, before emergency conditions arise, to ensure complementary and mutually reinforcing efforts in the affected countries. The key actors must cooperate closely before, during and after a disaster occurs through such institutional arrangements as regional mechanisms for common natural resource management. Regional initiatives can motivate a joint approach to issues involving geography, political alignment, or cultural/historical affinity amongst neighbouring or nearby countries. The Indus Valley agreements between India and Pakistan, for example, brokered by the World Bank and borne out of a common incentive, motivate both countries to conserve watershed and share water flow information for mutual benefit. Similar agreements exist for other major rivers such as the Mekong and the Nile.

A regional approach can also act as a 'flywheel' to maintain a collective momentum, when a country changes government or suffers a disaster. Information sharing, education, training and analysis are all facilitated by a common approach. Furthermore, regional initiatives prepare the ground for a truly global early warning system, which the UN Secretary-General called for in the wake of the Indian Ocean tsunami. The main steps towards such a system of systems have already been outlined and work is underway on its realization.

In conclusion, only some key examples of effective disaster risk reduction could be introduced here. Disaster risk reduction in hazard-prone countries is a complex task, requiring comprehensive, cross-sectoral and trans-boundary efforts to alert communities, strengthen institutions and operational capacities, and to make disaster risk reduction central to local, national and regional development planning. The Hyogo Framework for Action clearly spells out the responsibilities of governments, regional and international organizations, including the UN system, with the ISDR serving as an overall facilitator. Now it is time to move from concept to action; to foster a wide 'disaster risk reduction movement', with grassroots organizations, local and national authorities, regional and international actors, as well as the private sector and other segments of society. This will be the new ISDR system.

Capacity building and education for disaster reduction: UNESCO approaches

Badaoui Rouhban, Chief, Section for Disaster Reduction, Natural Sciences Sector, United Nations Educational, Scientific and Cultural Organization

In contrast with many environment and development problems, the causes of natural disasters are understood and measures for limiting their impacts are widely available. Over the past three decades, scientific knowledge about natural hazards and the technological means of confronting them has expanded greatly. Yet despite the ample availability of knowledge and expertise, society continues to be increasingly vulnerable to catastrophes that are more destructive than ever. While a number of barriers prevent the widespread adoption of disaster reduction techniques, these can be overcome through better use of science and technology as well as more effective education, capacity building and public awareness programmes where several disciplines and sectors come into play. It is not only a question of investing in major technological infrastructure solutions. Disaster mitigation depends fundamentally on strengthening local communities through a culture of pre-emptive resilience.

Advancement, transfer, sharing and application of knowledge are key foundations for disaster risk management. It is now widely agreed that achieving disaster resilience is essentially a process of using knowledge and learning at all levels. When it comes to living with risk, we must embrace education in all its forms, from drills involving disaster simulations in primary and secondary schools to advanced university and postgraduate studies. We must also capitalise on traditional local knowledge about hazards and coping with their occurrence.

The emerging approach to disaster risk reduction, which is advocated by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and other relevant organizations, stresses the merit of forging close cooperation across disciplines and sectors, and between sectoral organizations and departments within countries and institutions. In order to integrate mitigating and preventive measures in a development context, different disciplines from the natural and social sciences need to join forces with the educational, cultural and communication fields through interdisciplinary work to bring solutions to the complex problem of vulnerability assessment and reduction. UNESCO has been engaged in promoting interdisciplinary work and transdisciplinary activities through and among its intergovernmental programmes. This approach also depends on encouraging effective communication of information, involving local communities, making disaster prevention part of education, and raising the awareness of the public.

Scientific and educational programmes, which are promoted by institutions like UNESCO and implemented at various levels (local, national and international) help provide the means for communities, countries and groups of nations to learn and acquire knowledge, and to enhance the application of this knowledge in coping with the threats to their built and physical environment. This is achieved by launching international initiatives supporting worldwide research, training and teaching; establishing international, regional and national centres, networks and early warning systems; identifying hazardous zones; and quantitative assessment of hazards in those zones.

Promotion of resistant building design is encouraged. Practical advice is given on how to build schools that will be relatively safe if a natural disaster occurs. Recommendations are made for enabling post-disaster efforts to minimize discontinuity in educational programmes. Recent pilot studies have been carried out in Asian countries, introducing disaster preparedness into the curricula covering social and behavioral aspects. Campaigns and information materials are developed to safeguard cultural heritage, monuments, sites and property against hazards, including international standard setting activities and conventions regarding the protection of physical cultural heritage against extreme events. UNESCO post-disaster reconnaissance missions operating in areas stricken by earthquakes, volcanic eruptions, landslides, floods and cyclones make recommendations on reconstruction, future risk mitigation, and the rehabilitation or reconstruction of educational and cultural buildings.

Reduced vulnerability to disasters cannot be attained if individuals are not empowered to learn, understand and act accordingly. The development of human resources and continued learning plays the key role in effecting the necessary shift in emphasis from post-disaster response and reaction to pre-disaster prevention and action. Science and education contribute to building the knowledge and skills of men and women and to achieving the capacity that will enable them to better cope with natural and environmental threats. The Hyogo Framework for Action 2005-2015, which was adopted at the World Conference on Disaster Reduction, places knowledge and education among the top five priority themes.

Educating all sectors of society on disaster reduction actions that are based on the application of sound scientific, engineering, and cultural principles to create sustainable systems is a goal which is pursued in certain countries. In the context of the United Nations Decade of Education for Sustainable Development, the United Nations Inter-Agency Secretariat of the International Strategy for Disaster Reduction and UNESCO, jointly with other stakeholders, are promoting and facilitating a global campaign on education for disaster reduction. The purpose of this inter-

national drive is to ensure that educational programmes and public information integrate the notion of natural hazards and disaster risk attenuation measures. It will aim at advocating that the education and information about natural hazards and disaster reduction reach as wide an audience as possible. Schools, industry, the mass media and non governmental organizations (NGOs) can play an important role. At the same time, programmes for the general public can serve to stimulate political support for long-term mitigation and preparedness measures.

Scientific and technological solutions to the complex problems of disasters must be rooted in social realities, in the fullest sense of the term. Science needs to be seen only as part of a continuum of action extending from the design of interdisciplinary research to the communication of results to diverse non-specialist user groups and to formal and informal education. Beyond the advancement of science and technology, UNESCO advocates their blending with other disciplines, notably with traditional knowledge, for every society harbours its own distinct way of determining how to act and react in relation to disasters. In Thailand, the 196 members of the Mokens of the Surin Islands, known as 'people of the sea,' who were living in a tsunami-thrashed village, all survived the devastation of the 26 December 2004 disaster. As they noticed that the seawater had quickly receded, they knew they had to flee from it and go to higher places immediately.

A number of steps can be taken to integrate disaster reduction and development planning. Perhaps the most important among these steps is for governments to build capacities among managers and disaster-specialists to enable them to pursue strategic planning for disaster risk reduction and implement it in development projects. Capacity-building and education for disaster reduction and human security should not be a one-off affair, but rather a continuing process, offering individuals lessons in coping with hazards not just once but several times throughout their lives. Furthermore education and raising awareness of disaster risks must respond to society's changing needs and focus on empowering individuals throughout their lives.

The promotion of global and regional initiatives targeting capacity building on specific hazards and themes is providing useful platforms for cooperation. Over the past three years, UNESCO has been associated with the launch of the International Consortium on Landslides (ICL), the International Flood Initiative (IFI) and with regional efforts. The objectives of the ICL are to promote landslide research and capacity building, notably in developing countries; to integrate geosciences and technology within the appropriate cultural and social contexts in order to evaluate landslide risk in urban, rural and developing areas; to combine and coordinate international expertise in landslide risk assessment and mitigation; and to promote a global, multidisciplinary programme on landslides. The secretariat for ICL is hosted at Kyoto University. The purposes of the IFI are to promote an integrated approach to flood management, in order to maximize the long-term benefits of floods and minimize the loss of life, goods and other assets that result from floods. The operational arm of this initiative is the International Centre for Water Hazard and Risk Management (ICHARM) in Tsukuba, Japan, which has been established under the auspices of UNESCO. At the regional level, projects are carried out in the Mediterranean and in South Asia.

Photo: UNESCO/H. Hakeem

School buildings in the Maldives destroyed by the tsunami of 26 December 2004

Jointly with the US Geological Survey, UNESCO is implementing projects on capacity building regarding earthquake risk in the extended Mediterranean region and in South Asia. The purpose is to assess, evaluate and help reduce expected earthquake losses in those regions. The projects facilitate the exchange of data, software and expertise through the provision of workshops, and enable the development of joint activities. Several regional organizations have been involved in programme workshops. Similarly, in the framework of the Tehran-based International Institute of Earthquake Engineering and Seismology, an alliance for cooperation on earthquake risk reduction in central Asian cities is being promoted.

The need for capacity building in effective information and appropriate action was demonstrated with dramatic clarity by the Indian Ocean tsunami. Scientists were aware that one of the mightiest earthquakes known had occurred deep beneath the sea on 26 December 2004, but had no way of alerting people in the path of the ensuing tsunami. A timely warning could have saved tens of thousands of lives. The tsunami early warning system established by UNESCO in the Pacific in the 1960s has been a quiet success for nearly four decades. Sadly, it took a loud disaster to wake up the world to the need for similar systems for other oceans and seas. It is to be recalled that the tsunami programme of UNESCO's Intergovernmental Oceanographic Commission (IOC) had recommended the creation of early warning systems in the Indian Ocean and in the Caribbean long before December 2004, but this advice had not been heeded. No single country can adequately protect itself from tsunamis without an international network composed of hundreds of observation stations.

Following, and immediately after the Indian Ocean calamity, the IOC has been coordinating the efforts of two-dozen countries in the Ocean region in order to build a regional early warning system. This truly cooperative tsunami warning system is now in place and is operating as of July 2006. The architecture of the system consists of the simultaneous operation of two distinct components:

- Internationally coordinated detection networks of instruments
- A network of 28 national tsunami warning centres.

The third essential component is an effective education and preparedness programme. The IOC is also assisting the countries to carry out needs assessments in respect of material and capacity building requirements, and in relation to public awareness and risk reduction needs. Recommendations have been delivered

directly to, and discussed with, national authorities, and will be used to guide technical plans and support national and regional strategies for disaster preparedness. But since such risks exist in all ocean basins to varying degrees, UNESCO is promoting the establishment of tsunami early warning systems not only in the Indian Ocean but also in the Caribbean, the Mediterranean and the North East Atlantic, and for their reinforcement in the South West Pacific and the South China Sea.

Flood mitigation in Lagos, Nigeria: the case of Ikoyi and Victoria islands

Victoria and Ikoyi islands constitute the two main barrier island complexes in Lagos State. The islands are made up of residential, commercial and tourist facilities and are surrounded by the Lagos Lagoon and the Atlantic Ocean. The islands usually experience annual flooding during the rainy months, May to October. Even though the islands have a network of drainage channels consisting of both ancillary and main channels with outfalls to the Lagos Lagoon, flooding hazards are worsened when heavy rains or storm surges coincide with high tides. When this happens, large areas of the islands are flooded, causing a disruption of socio-economic activities on the islands with concomitant adverse effects on the economy of Lagos State and the entire nation of Nigeria.

As a contribution to the UNESCO Disaster Reduction Programme, the Coastal Regions and Small Islands (CSI) platform of UNESCO supported a project to study the drainage channels in Victoria and Ikoyi islands, Lagos, Nigeria. This was followed by a public enlightenment programme.

Aim of the study — The study examined the causes of flooding in Victoria and Ikoyi islands and the implications of tidal and sea level changes, and anthropogenic activities. The study also focused on the effectiveness of the main drainage channels built to discharge runoff into the Lagos Lagoon.

Activities — The study, which was carried out by the Nigerian Institute for Oceanography and Marine Research (NIOMR) between July 1998 and September 2000, examined the efficiency of the main drainage channels in the face of tidal and sea level rise and other anthropogenic activities by:

- Surveying eight main drainage channels to estimate their capacity to discharge storm waters to the lagoon
- Analysing historical tide gauge data to determine sea level rise variations
- Conducting a bathymetric survey of the outfalls of the drainage channels
- Collecting and analysing meteorological data and storm surge data
- Determining the efficiency of the present channels and giving recommendations to government
- Organizing a public enlightenment campaign through the media and a public forum.

Data collection and analysis — Data used in this study comprised primary water level, wind parameters and barometric pressure records from the Next Generation Water Level Measuring System (NGWLMS) acoustic tide gauge between 1992 and 1996; daily rainfall data for Lagos from 1980 to 1998; and public opinion sampling through the use of a questionnaire.

Statistical analysis of rainfall data, primary water level, wind parameters and barometric pressure records from the NGWLMS was carried out. Topographic levelling of the eight selected main drainage channels was done to determine their gradient from the head to their outfalls. During this levelling, particular attention was paid to the state of the channels, namely deposits of solid waste, sediment and other physical obstructions.

A questionnaire was used to collect information about flooding, refuse disposal, and drainage channel patterns from local residents in flood-prone areas. The answers were statistically analysed and used to determine residents' opinions on the problem of flooding. In addition, an awareness campaign was conducted using a public forum and the media to inform the public about the results of the study.

Results — A report on the case study detailed several problems that had been identified through analysis of levelling records for the eight major drainage channels:

- Clogging of the drainage channels by domestic waste and blocking of some channels by buildings
- Low gradient of the channels and variable channel width from head to outfall
- Collapsed drainage channel walls
- Reverse gradients in most channels such that, when heavy rains coincide with high tides, tidal waters flow back into the channels through the outlets causing excessive flooding.

Analysis of the questionnaire showed that few people were well prepared to tackle the problems; that the drainage channels were ineffective because they were either blocked by sand or refuse; and that refuse containers are inadequate, leading to dumping of refuse in the drainage canals by residents.

A successful media and public forum was conducted on 6 June 2000. More than 200 participants attended, representing several government agencies, print media, radio and television stations.

The report, which was submitted to the Lagos State Ministry of Environment and Physical Planning, made several recommendations, including the rerouting, repairing, fencing and screening of several channels; construction of new channels; increasing beach height; and a public awareness campaign to discourage the dumping of solid refuse in drainage channels.

Flood mitigation: wise practices

Working with CSI, flood mitigation measures were categorized into two groups: engineering and social. The engineering solution may require rerouting, fencing and screening of several channels; construction of new channels; increasing beach height; and removing solid waste and structures erected on the channels. These may not represent all available engineering options, as there is a need for further studies.

The social solution requires a determined effort towards awareness creation, environmental education and behavioural modification to encourage good waste disposal practices. The 'wise practices' social solution was implemented by NIOMR, UNESCO and the Clean-up Nigeria NGO. This consisted of public enlightenment campaigns to educate local residents on the adverse effects of dumping their waste in drainage channels in the belief that storm waters will transport it to the lagoon. Residents, government officials, print and electronic media took part in the public enlightenment effort, which targeted at least 50 per cent of the population of Lagos. Posters, handbills, brochures, street theatres and meetings with relevant stakeholders were organized. Market women, the taxicab operators' association, residents and all groups of citizens whose activities impact flooding in Lagos were also involved. This was reinforced with electronic media jingles and media chats. The activities are still ongoing, and constitute a part of the wise coastal practices.

Environmental factors in building risk-resilient communities

Glenn Dolcemascolo, PhD, Technical Adviser, United Nations Environment Programme, Division of Environmental Policy Implementation/Disaster Management Branch

The earthquake that struck off the coast of Indonesia on the 26 December 2004 unleashed a wave of unprecedented proportions. The scale of international response to the disastrous impacts of this tsunami was also unprecedented. In the days, weeks and months that followed, the international community endeavoured to meet the unique challenges posed by the catastrophe with new and innovative approaches.

The Indian Ocean tsunami prompted new mechanisms for coordination among UN agencies, international financial institutions and non-governmental organizations. Development agencies were involved earlier in the recovery process — perhaps earlier than ever before. New protocols for facilitating early recovery are rapidly maturing. In drawing the linkages between disaster risk and development, the recovery process included concerted efforts to 'build back better' and created opportunities to advance sustainable development and even to help achieve the Millennium Development Goals. In addition, the coincidence of the post-tsunami phase with the World Conference on Disaster Reduction and agreement on the Hyogo Framework for Action in January 2005, assured that disaster risk reduction was a part of the recovery agenda. This new approach to recovery and commitment to build back better was also marked by unprecedented attention to environmental issues.

Awareness of the environmental dimensions of disasters is by no means new. The physical environment is the source of all natural hazards. While some hazards are the unavoidable consequences of bio-geophysical processes, others are directly or indirectly affected by human-induced environmental change. The evidence that climate change is associated with changing patterns of hydro-meteorological hazards is no longer seriously disputed. Similarly, it is well established that land use and land cover change play significant roles in floods, landslides and droughts. Intact coastal ecosystems provide valuable, if not total protection from many coastal hazards. These are among the many crucial services provided by healthy ecosystems. In addition, the correlation between degraded ecosystems, poverty and vulnerability to natural disasters is well documented and the prevention dividends of environmental management include strengthened community resilience and reduced vulnerability to disasters.

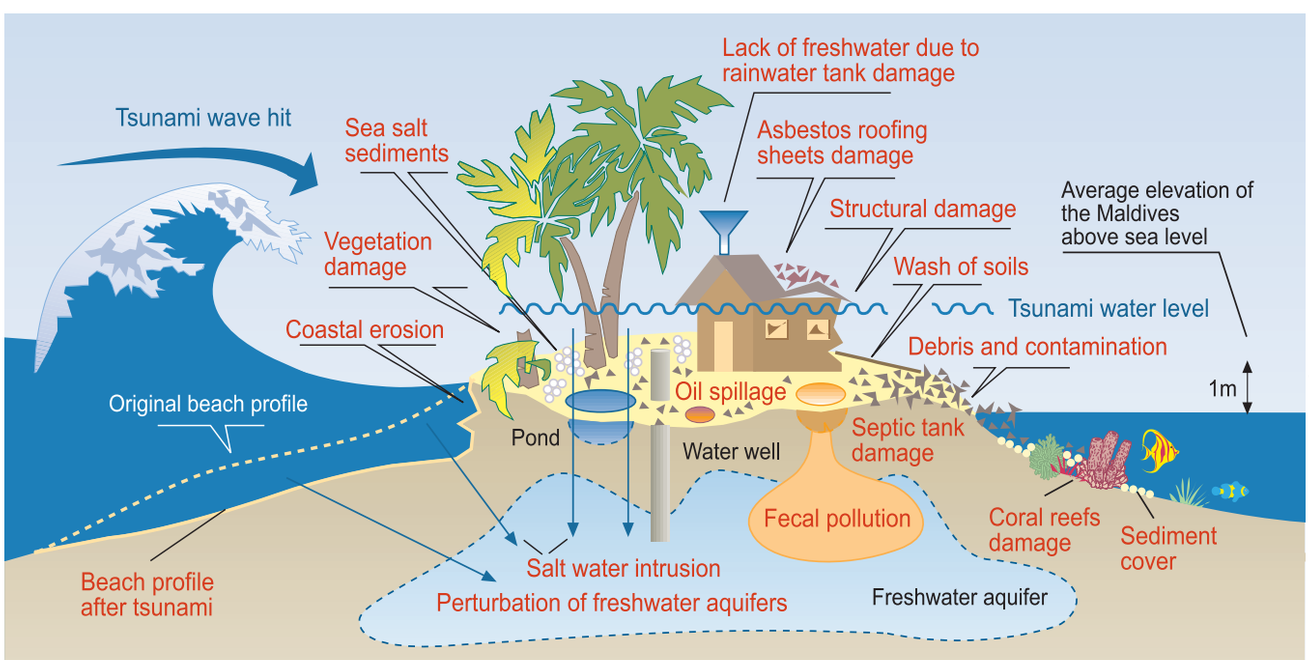


Image: UNEP Asian Tsunami Disaster Task Force

Environmental impacts of the Asian tsunami in the Maldives

While the tsunami drew the role of the environment in post-disaster recovery into sharper focus, the introduction of environmental concerns at this delicate time was not unproblematic. Nevertheless, with newfound awareness that environmental concerns can only be ignored at great peril, the UN Environment Programme (UNEP) has been receiving a growing number of requests for guidance and technical assistance. From the very outset, environmental managers were confronted with a number of significant challenges. There follows an account of UNEP's responses to meeting some of these challenges.

Assessing environmental impacts

In the immediate aftermath of the disaster, the joint UNEP/OCHA Environment Unit provided the expertise to assess the immediate environmental implications of the emergency. Based on the unit's findings, it became apparent that sustained engagement of environmental experts was sorely needed. Even in the best of situations, access to baseline information on environmental conditions is challenging. In Aceh, the situation was even more dire. Many public servants, including environmental managers, tragically lost their lives, while much laboratory equipment was irreparably damaged. UNEP initiated a long process of strengthening the capacity of local environmental authorities, providing equipment and supporting the collection and management of baseline data. While much work remains to be done, important contributions were made. The significant role of environmental managers and environmental information in the earliest stages of disaster and recovery has become more widely recognized and the importance of preparing environmental managers, establishing good environmental governance before a disaster strikes and maintaining baseline environmental data were all reinforced.

Clearing debris

The tsunami generated a daunting volume of waste, compounded in Aceh by the severe damage caused by the earthquake. Early efforts to move debris had unintended consequences. Often, opportunities to sort the waste were lost and contaminated materials were irretrievably mixed with otherwise recyclable material. In addition, waste was often removed to unsuitable locations resulting in expensive remedial actions to remove waste from valuable agricultural fields and sensitive ecosystems — some of these may never be cleared.

The situation was exacerbated by pre-existing waste management problems in many of the affected areas, including inadequate landfills, insufficient waste collection services and lack of coherent waste management plans. UNEP worked closely with governments in Indonesia, the Maldives, Sri Lanka and later in Pakistan to provide training in the development of disaster waste management plans. UNEP also supported successful clean-up operations in the Maldives where 89 islands were cleared of asbestos waste, thereby reducing significant health risks to local populations and disaster managers. In addition, UNEP developed a programme to sort and remove pharmaceutical waste. In several countries, successful implementation of clean-up projects, particularly for hazardous waste, relies heavily on the availability of technically skilled implementation partners. Greater effort is needed to build capacities in this regard, in both governmental and non-governmental organizations.

Preventing avoidable environmental impacts in reconstruction

The urgent need to provide temporary and, later, permanent shelter placed a heavy burden on natural resources. The demand for timber alone far exceeded the amount that could sustainably be extracted from local forests. The implications for protected areas that had long been under threat from illegal logging are enormous.

Much of the impact on forest resources could have been and still can be mitigated. Innovative programmes are underway to establish guidelines and agreements with national forest agencies. At the same time, in Aceh, a group of concerned organizations has initiated a market for sustainable timber where donors and construction agencies can meet with vendors of raw materials to facilitate and streamline acquisition and, in principle, promote the use of sustainable building materials.

It was soon realized that, in addition to timber needs, vast quantities of fuel wood were being consumed for firing bricks. Opportunities to promote energy-efficient kilns remain an option to be explored. Substantial amounts of sand and gravel have also been removed for the reconstruction efforts, and all too often the excavation is uncontrolled, resulting in scarring of the landscape and perverse incentives that discourage the use of recyclable material. Among UNEP's efforts to reduce the impacts of the reconstruction on natural resources, model eco-houses are being constructed and a manual on sustainable construction practices has been prepared.

Recovering damaged ecosystems

In addition to loss of life and property, valuable coastal ecosystems were damaged by the tsunami. While there is evidence that coral reefs survived the initial wave remarkably well, debris and sedimentation pose new concerns. Dune ecosystems were also impacted — some in places eroded by the waves; others in places ravaged in the scramble to extract sand for reconstruction. Some communities have recognized the protection offered by dunes, and have prohibited extraction of sand from them.

Mangroves, which are among the most rapidly disappearing of the world's forest types, were not spared from further damage. UNEP, in cooperation with partners such as the World Conservation Union and Wetlands International, has undertaken work in Indonesia, the Maldives and Sri Lanka to remove debris and replant mangroves. Mangrove ecosystems not only provide shoreline protection from storm surge and other coastal hazards, but also serve as nurseries for many species of fish and provide important resources to sustain local livelihoods. Several early efforts at replanting were unsuccessful, and it was quickly realized that mangrove restoration requires technical knowledge, often locally available, to ensure that the appropriate sites and species are selected and communities are involved in reforestation efforts. UNEP's World Conservation Monitoring Centre also prepared a review of the role of coral reefs and mangroves in coastal protection, and organizations such as the Food and Agricultural Organization are continuing their efforts to strengthen our knowledge base on these important ecosystem services.

Promoting strategic planning and policy support

Environmental policy and legislation also play a central role in building back better. Policies put in place before a disaster strikes can help to forestall the inevitable tensions that arise when urgent decisions must be taken. Disregard for existing legislation, such as those requiring environmental impact assessments, can have long-term and adverse consequences for the environment and local communities.

Given the enormous humanitarian concerns, the need to adapt existing policies to emergency situations proved an important step. UNEP has been working with the Government of Sri Lanka to carry out rapid environmental impact assessments of over 400 housing sites. In Indonesia, UNEP has supported the development of screening mechanisms for the vast number of reconstruction projects underway. Similarly, building codes that call for disaster-resilient construction and policies that promote the use of sustainable building materials hold promise.

Spatial planning procedures and other decision-support tools also contribute strongly to the recovery process. In Sri Lanka, UNEP is working with environmental authorities to advance the use of Strategic Environmental Assessments (SEAs) for township planning; these assessments are being adapted to consider disaster risk and vulnerability in the planning process. With the support of new policies on the use of SEAs, decision makers have access to important information about the implications of alternative planning choices. In Indonesia, UNEP is working with government agencies and recovery partners to advance an environmental framework to guide local level recovery efforts. Such approaches, once institutionalized, are helpful to the recovery process while also supporting broader nationwide efforts to promote sustainable development.

From where we stand

The past 18 months have seen perhaps the best-documented disaster response in history. It is clear, however, that even with the best intentions, not all innovations have been successful. However, lessons have been learnt from all of them. From the earliest days, UNEP worked closely with national governments and other partner organizations to find viable solutions to the environmental concerns raised by the disaster and the following recovery process, and many of these are relevant to disaster risk reduction.

While more careful analysis of what worked and what did not is required, it seems that the environment will no longer be the silent victim of disasters, and that opportunities to protect the vital ecosystem services that support sustainable and disaster-resilient communities will continue to grow. As a result, it may be said with confidence that the work of post-disaster recovery will never be the same.

Damage to ecosystems, Aceh, Sumatra, Indonesia

Image: Akiko Harayama, 2005. Based on IKONOS image © CRISP 2004, National University of Singapore. Courtesy of UNEP/GRID-Europe

Bringing disaster risk into development thinking: how often do we need to be shaken before we are stirred?

Ajay Chhibber and Ronald Parker, World Bank

On the morning of 26 December 2004, a massive tsunami hit the coastal areas of Indonesia, India, Sri Lanka and Thailand. Hundreds of thousands perished. About ten months later, a huge earthquake hit Kashmir with massive force and killed tens of thousands. This followed massive earthquakes in Iran and Turkey, in an earthquake-prone arc stretching across the Near East and the Himalayas.

Could these events have been predicted? Not precisely, but just as with financial crisis, we know which countries are vulnerable and could be hit. Could the areas affected have been better prepared? Sadly, with the benefit of hindsight, probably yes. The Independent Evaluation Group report, *Hazards of Nature, Risks to Development*,[1] found that while the World Bank has often provided critical support to countries in distress, the challenge ahead lies in being less reactive and more proactive with its assistance. Natural disasters are risk factors in development rather than interruptions to it and need to be factored into the design of projects and country programmes of at-risk countries.

Disasters: growing cost, increasing frequency

The cost of natural disasters in terms of lives affected and financial impact has grown sharply — and throws into tumult the development plans of the regions and countries affected by disasters. In constant dollars, disaster costs in the 1990s were more than 15 times higher (USD652 billion in material losses) than they were in the 1950s (USD38 billion at 1998 values).[2] The reported number of disasters has also increased, growing from fewer than 100 in 1975 to more than 400 in 2005. In the 1990s alone, disasters affected some 2 billion people — almost 40 per cent of the world's population — most of them in developing countries.

These figures are rising largely due to increasing social and economic vulnerability to natural events. Economic and population pressures have forced people into harm's way — onto precarious hillsides, into poorly constructed houses, onto difficult to cultivate lands — making natural events more likely to turn into disasters.

Not surprisingly, World Bank spending on natural disasters has also risen. Since 1980, the Bank has financed about 550 disaster-related projects representing more than USD26 billion in lending for disaster response and mitigation.

We know where they happen, yet are caught by surprise

We are not totally helpless in the face of nature. The potential for disaster is foreseeable. For instance, it is clear that low-lying coastal areas on the Bay of Bengal will experience more flooding; and small island states in the Caribbean and countries along the Gulf of Mexico will be repeatedly hit by hurricanes. Considering that ten borrowers accounted for almost 40 per cent of the bank's disaster lending projects, it is necessary only to look at which countries have borrowed most for disasters in the past to know which will borrow the most in the future.

Similarly, countries have been ranked according to the risks they face. One such ranking, elaborated in the World Bank Hotspots Study, has identified 75 countries with high economic risk from multiple hazards, with 30-97 per cent of GDP in areas at risk. The same study identifies 96 countries at high mortality risk, with 10-98 per cent of the population in areas at risk to two or more hazards.[3] A disaster in any of these countries could wipe out development gains for decades and affect an entire generation.

Given the concentration of funding and risks, it is surprising that the strategies of the World Bank and much of the development community do not more seriously consider the frequency of disasters, in order to give special attention to planning ahead and reducing long-term vulnerability in those countries at highest risk. In fact, of current assistance strategies for countries that have received World Bank support in natural disasters, 44 per cent did not mention natural disasters. Even in countries that have had more than eight World Bank funded disaster projects, one-third of the strategies did

Permanent solutions take longer to implement and require sufficient political will

In Tajikistan floods and landslides occur with regularity. After severe flooding and landslides in 1998, the World Bank provided support to repair roads and bridges. Quick reopening of transport links was indeed important in the short term. However, the same damage will occur when it floods again. Repairing hillsides and redirecting roads away from flood-prone areas would have provided a more permanent fix. In many high-risk areas of the world where the same disasters strike repeatedly, permanent solutions, not quick fixes, are needed.

not mention disaster. Similarly, of the 59 Poverty Reduction Strategy Papers prepared to date, only nine have incorporated aspects of hazard risk management. At the project level, economic analyses rarely consider the risk of disaster, even though 176 bank projects have been interupted by disaster during implementation.

Because most natural disasters are foreseeable to the extent that it is possible to predict generally where an event is likely to occur at some time in the near future, human and financial risks should be calculated in advance, and donor policy and practices need to provide a supportive framework for such an approach. In terms of strategic thinking and policy formulation, the World Bank and others can therefore go beyond acknowledging the general existence of natural disasters and identify with relative precision the geographic 'hotspots' — countries most vulnerable to natural disasters — anticipate foreseeable risks, and encourage borrowing targeted at reducing risks, in line with these calculations ahead of the disaster event.

Careful long-term planning

Although the destructive impacts of disasters are tightly connected with development, disasters are typically treated as an interruption in development rather than risks that should be a calculated part of development plans. Some countries are even in a near-permanent state of recovery. Donors are often funding post-disaster relief and recovery, rather than lending for long-term development that takes into account disaster risks. The Danish International Development Agency notes that European long-term development assistance in Africa fell by 20 per cent from 1994 to 1999, while emergency assistance increased sharply. European humanitarian aid in the second half of the 1990s was ten times that provided in the second half of the 1980s.

But the incentives to engage in disaster response far outweigh those of prevention — major political gains come from the visibility of crisis response, while successful prevention is invisible. Likewise, other pressing development priorities often take precedence over mitigation, prevention, and disaster risk management.

This thinking is costly. Studies show that USD1 spent on prevention can save at least USD5 to USD8 on damage, and sometimes up to USD40 on damage. Many countries have seen risk mitigation as a cost rather than a benefit. Following floods and landslides in 1998, Tajikistan found it too costly in the short term to take the extra time needed to rebuild in a way that would prevent the same disaster occurring again. But if in the case of financial systems we are ready to spend more funds on establishing mechanisms to avoid financial crisis, then we need to do the same with disasters. Leaving choices only to people's preference or to the market is sometimes insufficient, and a combination of cost-benefit analysis of mitigation measures, financing incentives for mitigation, and regulation is needed to ensure that risk mitigation is not neglected.

Reconstruction requires careful planning to ensure that a similar disaster in the future would not result in a similar level of suffering. Cleaning up damage and rebuilding structures without addressing the human actions that repeatedly turn recurring natural phenomena into disasters only ensures that the inevitable next event will be as disastrous as the last.

For example, where environmental degradation turns seasonal events into disaster, environmental restoration needs to be part of the solution and part of ongoing development plans. In other places, increased attention to infrastructure and settlement design would increase disaster resilience. Effective activities that address root causes of vulnerability and mitigate the potential for future damage are key to reducing the erosion of development gains that natural disasters represent.

Poor construction quality is a major reason for high mortality rates in developing countries stricken by disaster. Small changes in building materials and design can save thousands of lives[4] or put them at greater risk. Among the things that would contribute to an improvement are: development of building codes, enforcement of construction standards, improved procurement practices, and strengthened land use planning.

Quick response comes from emergency management preparedness

Once a disaster strikes, a swift and effective response is vital for both immediate relief and long-term recovery. Even developed countries that are ill-prepared can find themselves floundering after a disaster. The Gulf Coast of the United States suffered greatly after Hurricane Katrina because the response capacity of the US Federal Emergency Management Agency had been eroded by poor leadership and funding cuts. In developing countries, where such agencies might not exist, governments are overloaded after a major natural disaster, and international response often lacks coordination.

The reconstruction process, if poorly initiated, has been shown to seriously compromise long-term recovery. Early warning systems, such as transponders in flood-prone rivers, tsunami alerts, and better cyclone tracking devices can save lives and property, but alone they are not enough. Countries preparing to respond to natural disasters — especially those in the medium- to high-risk category — need to have procedures and systems in place to deal with disasters.

The importance of such organization can be seen in the progress made in Bangladesh. Following a deadly cyclone in 1970 that took 500,000 lives, the Government created an alert system involving radio communication and a village-based volunteer system. The volunteers were trained to warn villagers, rescue and evacuate them. In 1991 when a cyclone with even higher wind speeds hit, fewer lives (140,000) were lost and 350,000 people were evacuated. After continued emergency management development, a similar cyclone hit in 1997 — only 200 people perished and 1 million were successfully evacuated.

Cash transfers have proven to be swift and effective in aiding recovery. They are quick to dispense and allow affected families to spend on items they need. In-kind support, typically unconnected to needs analysis, often goes unused or clogs up critical facilities such as ports, warehouses, and paralyses transport. It also consumes considerable management attention. Cash transfers allow self-assessment of need and help protect productive assets and land that would otherwise have to be sold off. They also permit families to stay together as the wage earners are less likely to migrate in search of work, leaving families behind. Cash transfers also regenerate the local economy as the market tries to meet local demand and allow reconstruction at costs much lower than the authorities could provide. The chief difficulty with cash transfers is in finding or designing delivery mechanisms that avoid corruption and ensure that cash goes to the intended beneficiaries.

Involving local communities for lasting recovery

Natural disasters destroy more than lives and infrastructure;

they rip apart social support networks and cohesiveness. Recovering from a disaster, then, requires more than burying the dead, caring for the injured, and rebuilding structures. It must also ensure that social structures recover. Families and communities must be kept together as they also provide the social capital that allows people to survive physically and psychologically.

Ignoring local power structures, social groups, and differences in vulnerability risks makes recovery more difficult by undercutting the very factors that helped create social cohesion in the first place. It may also leave the poor and other vulnerable groups even more disadvantaged than they were before the disaster. For instance in the case of drought recovery, women, if not given agricultural tools along with the men, are put at an earning disadvantage. It is also important to consider that disasters often increase the intensity of women's work such as care of children, the elderly, and the disabled; and the provision of water and fuel wood. Maintaining neighborhood groupings when relocation is necessary helps preserve informal networks which are an important source of support for women in times of crisis.

There is a critical need for the World Bank and other donors to involve local communities in long-term planning and reconstruction. One example of this is the 1993 Argentina Flood Rehabilitation Project, which involved beneficiaries at all stages. The interaction between beneficiaries and the local authorities resulted in the timely availability of construction materials and the accommodation of local customs in the architectural design of new houses; this created a sense of ownership among beneficiaries and increased maintenance. Thousands of low-income families were able to obtain new homes by participating in the construction of their own new housing units. Ultimately, over 11,500 people received construction-related training, which led to quality of life improvements. Many individuals who had never worked in construction have learned enough about a trade to work as a mason, carpenter, electrician, plumber, plasterer, or painter. Further, many beneficiaries have seen their social status change because they now have a numbered address on a real street, making it easier to fill out job applications and perform confidently at interview.

Better global and market-based financing mechanisms

Managing risk also involves better financial options — to help spread the risk and provide more stable financing rather than the mad scramble that seems to occur whenever disaster strikes. Without contingency financing for disasters, critical infrastructure may not be reconstructed. Studies have shown that unless infrastructure is fully reconstructed, long-term GDP losses are likely to result. Today's typical response to a disaster is a massive fundraising drive involving public figures, but often leading to uneven responses. Such donation drives are a helpful stopgap, but considering that two out of five people in the world are affected by disaster, and that donor fatigue can set in very quickly, an internationally supported financing mechanism is needed. In its continuing absence, the need for post-disaster liquidity far exceeds the ability to meet that need, forcing countries to fall back on their own limited resources. At the moment in most developing countries, costs not borne by the disaster-affected households are the responsibility of the government, which must divert scarce resources from long-term development into disaster recovery. Much disaster assistance is also from person to person or government to government. The market plays a limited role.

If we know more disasters are on their way, we need more stable funding mechanisms with built-in rules for engagement. Regional and global funding mechanisms are being proposed and provide another way of reducing individual country costs and scattered responses.

For example, the Global Facility for Disaster Reduction and Recovery (GFDRR) is a new initiative intended to support national capacity building, to deal ex-ante with the risks of natural disasters in high-risk countries and to enhance speed and efficiency of international assistance for disaster recovery operations when disasters occur. Besides improving the delivery mechanism of recovery assistance through greater institutional preparedness and coordination, the new global facility with the participation of the World Bank and other key global stakeholders of the International Strategy for Disaster Reduction (ISDR) is proposed to move the focus away from merely responding to disaster losses through reconstruction, to mitigation and pre-disaster preparedness activities as a critical dimension of the global poverty reduction agenda. At the country level, GFDRR through a multi-donor trust fund will provide technical assistance for developing national strategies and plans for risk reduction. Above all, this new programme will strengthen partnerships among the members of the ISDR to achieve some of the strategic goals of the Hyogo Framework for Action.

With such a mechanism, it becomes important to include an oversight body that can persuade governments to be more proactive. Otherwise, an incentive against investing in risk reduction in-country could be created. It could also help focus financing on more long-term solutions. A global financing facility to accelerate response and to start mitigating risk is badly needed.

New and innovative insurance mechanisms are now being developed. For example, in Turkey and the Caribbean, where a disaster strikes once every two years, such schemes can help diversify risk internationally through reinsurance and must be encouraged. Insurance schemes will also put market pressure on the building industry to meet minimum construction standards. Turkey was able to sell reinsurance in international markets of up to USD1 billion. But as risks rise, so will the cost of insurance. Unless carefully priced, insurance schemes can create perverse incentives for people to build in harm's way — as occurred in New Orleans, stimulated in part by the availability of government-subsidized flood insurance.

We neglect disaster risk at our peril

The risks associated with disaster will only increase as population pressures rise, unless we change the way disaster risk is brought into development thinking in an integral manner. Climate change will, in all likelihood, bring with it additional changes and new risks. As sea temperatures rise, the risks of cyclones will increase. As sea levels rise, more coastal areas will be affected, and as weather patterns change, droughts and floods will increase in number and will affect new areas. These are not one-off events — they are among the risks that international organizations must help countries to deal with in the context of their development plans. If we do not adapt our approaches to ameliorate these growing risks we will only ensure two things: donor fatigue, and that the poorest citizens in the developing world will be subject to the ravages of natural disaster for decades to come.[5]

Subregional strategies for preventing and managing disaster-related food crisis

Abdoulaye Niang, Jean Luc Mastaki and Meheret H/Selassie, UN Economic Commission for Africa

Heads of State and Government of the African Union (AU) have recognized the need for a comprehensive strategy to prevent and manage disaster-related crises, within the framework of the New Partnership for Africa's Development (NEPAD).

In its review of disaster-related crisis, the AU/NEPAD secretariat noted that although some national disaster risk reduction (DRR) plans make provisions for financing their operations, in practice, most of those in Africa suffer from inadequate financial support. Moreover, in some countries, donors provide the bulk of financial resources but find it difficult to meet financing requirements for DRR.[1]

The secretariat therefore established the African Regional Strategy for Disaster Risk Reduction, comprising the AU Commission (AUC), NEPAD secretariat and all regional economic communities under the chairmanship of AUC, with support from the United Nations International Strategy for Disaster Reduction (UN/ISDR). The group will work toward integrating DRR into all phases of development in Africa.[2]

The UN Economic Commission for Africa (UNECA) produced a report on subregional strategies for preventing and managing disaster-related food crises. Many types of disasters can cause such crises. However, between 1975 and 2000, drought affected more people than any other disaster and it affects Africa every year.[3, 4]

UNECA's focus is on developing an African comprehensive long-term drought impact reduction strategy (ACLDIRS) through mainstreaming drought risk reduction into agricultural and overall sustainable development. The strategy is biased towards preparedness, mitigation and risk management rather than crisis management. It is consistent with the Hyogo Framework for Action and with the Millennium Development Declaration, and is conceived to accelerate and contribute to realizing the Millennium Development Goals (MDGs).

The spread of drought-related food crisis across Africa and the expanse of population affected by food emergencies, malnourishment and chronic hunger provide opportunities to African governments, business communities and civil society groups to strive for leadership and work in partnership, jointly contributing to broad-based economic growth with food security, poverty reduction, equity and better environmental management.

The capacity of vulnerable populations must be harnessed to minimize the negative consequences of risk and exploit the potential born out of agriculture-related drought, estimated at over USD24 billion, which is currently exploited by non-African organizations.

The goal is to give meaningful content to the vision of Africa as a group of nations networked into a unified continental economy, to help it achieve economies of regional scale. This should lead to the structural transformation of African economies to help capture a larger share of global wealth generated from Africa's own production capacity, especially in the agricultural sector, and to achieve an equitable distribution of regional wealth across African communities.

African governments have always expressed commitment to preventing and managing disaster-related crisis. However, commitments have often taken the form of overlapping governmental and non-governmental organizations (NGOs) and the adoption of inefficient policies and strategies at national, subregional, regional or international levels.

Throughout the continent, efforts geared towards minimizing vulnerabilities and disaster risks to prevent, mitigate and prepare for the adverse impacts of disasters within the broad context of sustainable development are limited. Indeed, interventions are biased towards relief operations despite the fact that African governments and their partners recognize that disaster planning and proactive mitigation programmes are the best option.

For every dollar spent on prevention and preparedness, between USD100 and USD1,000 are required for an equivalent effect after a disaster. In addition, interventions are too often dependent on foreign aid and resources. There is a need to shift from relief operation to a forward-looking strategy to reduce vulnerability and improve resilience to all types of natural hazard, including the drought-related disasters and agricultural droughts that made Africa a net importer of commercial food grain, a recipient of food aid and a famine continent.

African agriculture is highly dependent on the weather, and agricultural drought takes a heavy toll on farm families, the environment, and other areas. Considerable efforts have been made in the Sahelian subregion to minimize drought-related losses, but the drought events of 2005 in Niger showed the weakness of the mechanism.

In 2002, agricultural imports reached USD22 billion while annual food aid demand reached USD1.7 billion. African agricultural trade accounted for only 4 per cent of the world total, with the continent representing 13 per cent of the world population.[5] Against this background, UNECA advocates an African comprehensive long-term drought impact reduction strategy.

Defining drought

Drought occurs in virtually all climatic zones, but its characteristics vary significantly between regions. It is a temporary aberration; it differs from aridity, which is a permanent climatic

feature restricted to regions of low rainfall. It originates from deficient precipitation over an extended period, which results in water shortage for some activity, group or environmental sector.[6]

Drought drives farm families off their land and livestock producers out of business, and brings hardship to water-dependent enterprises. It may cause loss of income, in turn creating revenue shortfalls for local governments. It can have devastating impacts on the lives of migrant agricultural workers, and can lead to conflicts over the use of water for humans or ecosystems.[7]

The conceptual definition of drought, as a protracted period of deficient precipitation resulting in extensive damage to crops and loss of yield, is important in establishing drought policy. For example, the Australian Government provides financial assistance to farmers only under "exceptional drought circumstances," when drought conditions are beyond those considered part of normal risk management.[8]

The operational definition of drought helps identify its beginning, end, and severity. For agriculture, this might compare daily precipitation values to evapotranspiration rates to determine the rate of soil moisture depletion, and express these relationships in terms of drought effects on plant behaviour (i.e. growth and yield) at various stages of crop development. It could be used in an operational assessment of drought severity and impacts by tracking meteorological variables, soil moisture, and crop conditions during the growing season.[9]

Drought in Africa

African farmers often lack the information and resources to develop and implement a water conservation/drought plan. Planting crops becomes a gamble, based on the assumption that there will be enough rain to produce a successful harvest. The risk is spread across the continent, where much of the total area is vulnerable to drought with low and medium rainfall, largely explaining the critical food situation across Africa.

Water availability constitutes the primary natural constraint to agricultural development in Africa, but only 4 per cent of its renewable water resources go into irrigation, compared to 40 per cent in Asia. Only 7 per cent of African arable land is irrigated. In addition, there is low use of yield-enhancing inputs such as improved seeds, breeds or fertilizers.[10]

Consequently, over one-fifth of the population of Africa's 30 countries (26 per cent of 832 million people) is undernourished. In 2003, 23 out of 53 countries experienced food crisis. Nearly 38 million people are facing food emergencies, while around 207 million are chronically hungry, a number that is growing in absolute terms.

Minimizing risk and the impacts of drought demands an emphasis on community-based drought preparedness. This entails the integration of drought management plans, especially mitigation strategies and preparedness, with sustainable development plans and the inclusion of drought in comprehensive water management, land use, and long-term planning strategies.

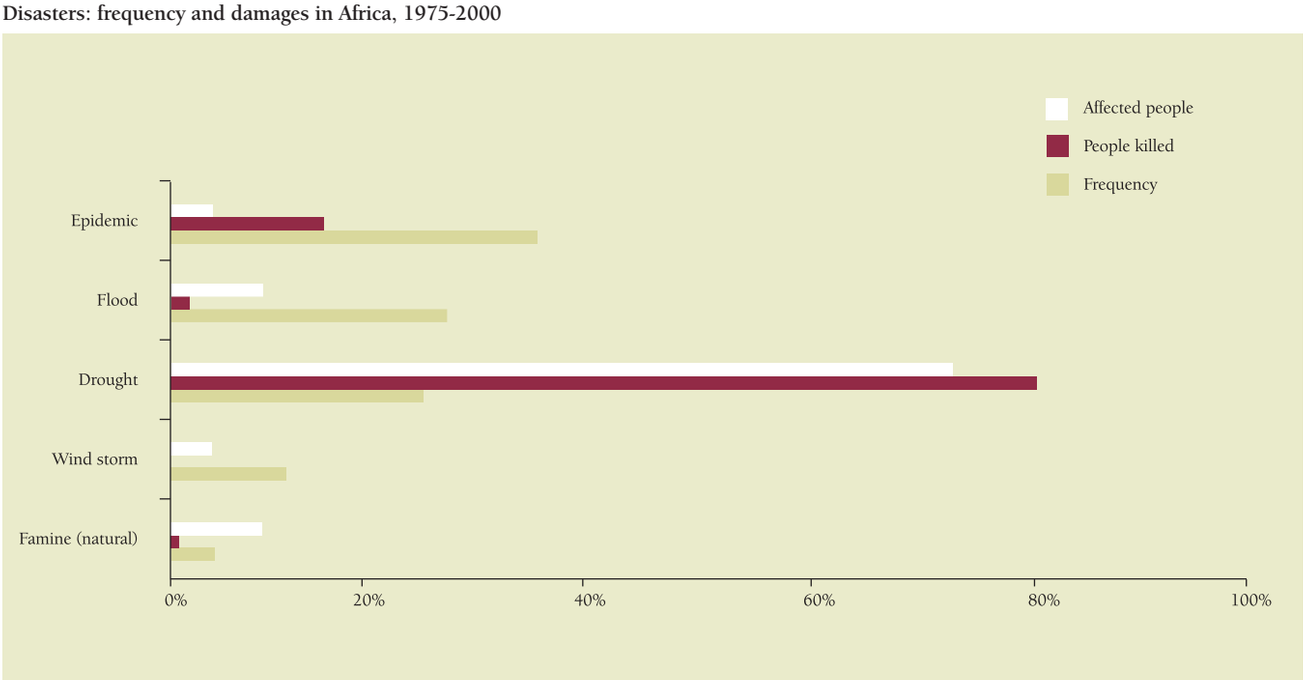
According to the AU/NEPAD secretariat, integrating DRR with development can only be sustained if disaster management institutions are themselves sustainable. Their governance must improve to develop the requisite capacity; access to adequate and secure resources; focusing interventions on the needs of people at risk; participatory processes; and coordinating activities with other stakeholders.[11]

Long-term drought impact reduction strategy

UNECA's advocated strategy aims to increase resilience to drought-related disaster based on a greater measure of self-help, self-reliance, and self-determination. Preparedness measures, particularly for comprehensive drought planning and proactive mitigation, are essential to lessening the impact of drought and reliance on emergency measures.

Interventions should focus on disaster planning and proactive mitigation programmes within the framework of the AU and based on NEPAD's guiding principles for owning and leading Africa's development process. Planning should help coordinate

Disasters: frequency and damages in Africa, 1975-2000



Source: ADRC, 2002

and integrate drought management activities among all organizations partnering under the strategy.

Clear objectives and performance standards should be set, along with a clear picture of regional vulnerability to drought. Targets should be set for bringing more areas under sustainable land and water management systems, and preparedness plans should include comprehensive insurance, incentives and financial strategies. Monitoring, prediction and research are essential to help farming communities, in particular, make informed decision on how to achieve the strategy's goals.

Disaster management information centres would help a community make risk-based choices to address vulnerabilities, mitigate hazards and prepare response and recovery plans. A strategic communication programme is needed to build awareness of the value of preparedness in reducing drought impacts, through partnerships at all levels.

Mitigation and preparedness

Proactive drought mitigation comprises a range of preparedness measures from installing livestock watering ponds to technologies for capturing storm water and wastewater treatments that allow water reuse.[12]

A new, transboundary economy of agriculture, water for food and ecosystem and water governance must be facilitated to help harness water resources and achieve a unified African economy, which will help facilitate, through a smart regional public-private trade and investment partnership (SRPPTIP), cross-country links for increased private and public investments in the form of African transnational corporations (ATNCs) and African sectoral development zones (ASDZs) to achieve economies of regional scale for major agricultural commodities.

ASDZs will constitute the hub for strategic commodity production, and will be located where conditions permit large areas to be brought under sustainable land and water management systems. Conditions should be provided to help integrate similar, medium-size production structures into the hub through the ATNC concept, and contract farming should enable the integration of small-scale, marketed-oriented agribusiness.

Adherence to mitigation measures would require secure property rights for water and land, which in turn will help create conditions where land can be used as collateral for loans.

Sustainable and reliable management systems for land and water are the best insurance against disaster-related shocks like bad harvest. However, these should take the form of a cost-sharing programme between African farming and business communities and governments.

A dedicated drought funding mechanism should support the proposed African Working Group on DRR. Restructuring of Africa's integration would capture a larger share of global wealth via Africa's own wealth creation capacities.

Regional corporate tax

A regional corporate tax (RCT) could support the comprehensive financing of drought impact reduction with emphasis on mitigation. The RCT could levy agricultural imports, currently estimated at over USD24 billion, and contribute to a regional programme of government-based incentives (RPGI), suggested under a NEPAD support facility.

RCT proceeds could be used primarily to cover public-related investments (permanent water supply infrastructures) and provide agricultural drought assistance and financial incentives. The scheme could help to finance mitigation measures through subsidized and guaranteed loans, including commercial loans to launch ASDZs and ATNCs related to high-demand food crops.

Loans should be used to adopt irrigation technologies, water management practices and more resistant and productive seed varieties, provide innovative policies for sustainable agricultural production development, provide extension services for farmers and improve agricultural, irrigation, input and farm management.

RCT proceeds could finance drought research and training on drought risk management, support contingency plans and trigger emergency response efforts including debt subsidies, income support and guaranteed loans during a drought event that is declared a disaster (although not all drought events should be declared disasters).

RCT could contribute to a low-interest regional loan programme or help promote microfinance and microinsurance solutions, promoting welfare and economic development in the smallest of communities. Other sources could include enforcing bank quotas for microcredit, using insurance proceeds against agricultural drought-related crisis, and public development aid — the demand for food aid is currently estimated at over USD1.7 billion, which should be provided in cash, two years in advance through AU/NEPAD to support the microcredit programme.

Microcredit should support and promote the structural transformation of subsistence-oriented operations into small and medium market-oriented agribusinesses, minimizing the vulnerabilities of more farmers.

Special financial incentives would help spread the best practices of farmers who use sustainable land management techniques and reliable water control and management systems. Farmers who normally produce a surplus could be given savings and tax incentives.

Insurance

According to the commission, even the best preparedness and proactive mitigation measures will not adequately address some drought-related risks.[13] Insurance and relief are needed to minimize risk further.

Insurance penetration across Africa is low, especially for weather-related natural disasters.[14] Most farming communities diversify activities as a risk coping mechanism, keeping a quantity of food crops to cover consumption for 2-3 months above annual requirements wherever possible. They raise livestock to sell in case of crop failures, and undertake off-farm activities to ensure economic security. Severe agricultural drought affects all these activities.

Under these conditions, an insurance scheme becomes essential. For drought-related losses, this should cover food and cash crops and livestock, emphasizing self-help and the provision of a socio-economic safety net.

Households could pay an annual premium above the self-insured level in the form of maintaining their own farm food storage at 2-3 months above requirements. The premium could be paid in the form of food crops or cash during a drought-related disaster period, and disaster-affected farmers would be guaranteed food security commensurate to the level of premium paid.

Food crops paid as premiums could be stored in strategic locations, with amounts above a set level sold off to subsidize the insurance programme, public investments, mitigation measures or microfinance programmes.[15] If the rainfall (or other climatic variable) falls outside the established limits, all those who have paid the premium will be compensated for their probable losses.[16] Insurance could be sold in standard units, with all

buyers paying the same premium and receiving the same indemnity per unit of insurance.[17]

The scheme is being tried in Morocco, Malawi, South Africa and Ethiopia, bringing together the insurance industry, public institutions on disaster, NGOs, the World Bank, international reinsurance companies and private international banks.[18] Microfinance institutions and other organizations can serve as a conduit in 'joint products' with loans.[19] The scheme's credibility depends on government action in helping to develop basic infrastructures, data collection, regulatory framework and the integrity of monitoring.

Emergency relief

An effective mechanism should be developed to trigger response to distressed communities, helping to guide drought-response decisions via supply-type triggers reflecting moisture deficiencies caused by acts of nature, and demand-type triggers reflecting drought impacts, as practised in Australia.[20, 21]

NEPAD's review of emergency relief[22] resulted in a number of relevant suggestions for the advocated strategy:

Regional financial reserve in a major trading currency — Where pooled food-reserve funds lower the contribution of each country in a region.

Facilitating commodity exchange — Where this is mutually advantageous, neighbouring countries could borrow from each other's reserves.

Contracting food aid donors to manage stocks — Stocks will be pre-positioned in a few central locations for delivery to countries urgently needing imported food to back up their safety net or emergency programmes.

Coordinating humanitarian relief — In case of a large-scale food crisis affecting several countries, regional emergency preparedness and response units could mobilize relief supplies and logistics support at short notice and coordinate contributions.

Equally on 11 November 2004, the United Nations General Assembly addressed a number of issues relevant in shaping the advocated strategy when it was discussing the need to strengthen the coordination of UN humanitarian and disaster relief assistance. These include:

- Stressing the importance of including the views of and working with local groups in developing emergency programmes in order to ensure their long-term success
- Emphasizing the need to ensure a more equitable distribution of humanitarian assistance across emergencies, including those of a protracted nature
- Noting the need for improving the quality and effectiveness of humanitarian aid and for an effective response to today's humanitarian challenges
- Broadening views, to include political, military and developmental partners. The UN recognized that by better listening to and coordinating with governments, NGOs and affected populations, and by building local capacities, better ownership and participation could be ensured, and the chances for sustainable results could be increased
- Underlining the need to respect the principles of neutrality, humanity and impartiality needed to guide all humanitarian action which should be undertaken at the request of the recipient government
- Noting that aid was abundantly provided in humanitarian emergency situations that benefited from wide media coverage and that by contrast, as soon as the media spotlight faded away, resources tended to be scarce, especially in some specific regions and when the more difficult task of reconstruction began
- Underlining the need to have a mechanism that would enable a timelier implementation of programmes and a more rapid disbursement of funds through productive partnership
- Underlining the importance of policy coherence and coordination in the delivery of humanitarian assistance
- Underlining the need to close gap between relief and development to ensure a smooth transition from humanitarian emergency assistance to sustainable development.

Currently, African citizens are mere recipients of disaster management activity outputs — mainly relief delivery by governments and donors — and do not adequately participate in the design and implementation of disaster reduction programmes.[23]

Attitudes toward responses to drought must change, to allow the reallocation of assistance to support the building of infrastructure, such as wells or pipelines for water transfers. The growth rate of organizations living on emergency management has been tremendous over the past 20 years, but their success should have been measured in terms of negative growth rate, aimed at developing the capacity of the population to minimize its reliance on food handouts. These rent-seekers must be convinced that they can gain their living from the structural transformation of African economies to contribute to broad-based economic growth with food security, poverty reduction, equity and better environmental management.

Implementation and partnership arrangements

AU/NEPAD noted in its review that government explicitly regards civil protection against disasters as a key governance responsibility.[24] Coordinating the interests and activities of various stakeholders in DRR has been, however, ineffective.

Such arrangements should change, to create a culture of drought risk prevention, reduction and resilience at all partnership levels, through the structural transformation of drought assistance management to ensure that agricultural drought disaster risk prevention and reduction become a shared responsibility while empowering farmers to protect themselves.

Through the SRPPTIP concept, existing intergovernmental organizations (IGOs) should help ensure joint planning to lead to the creation of ASDZs and bring more areas under sustainable land management and reliable water control and management systems for each strategic commodity. The IGOs provide a forum to study, develop, and coordinate policies and positions on common interstate water issues.

Further, African business communities should be motivated to form ATNCs across the continent to develop ASDZs and Africa's capacity to have secure access to additional agricultural markets currently estimated annually at over USD24 billion. ATNCs will then become a source of lucrative job markets, enhancing the capacity of farming communities to pay for water, land and land development, and insurance.

The recent effort of the AUC[25] to revitalize its programme for integrated management of the Fouta Djallon highlands in the Republic of Guinea, which is the source of more than six major rivers in the West Africa subregion, should favour the emergence of ASDZs/ATNCs and facilitate the exploitation of positive synergies between water, agriculture and ecosystems for social and economic development.[26]

Risk reduction and mitigation in the aftermath of Hurricane Ivan: a year and a half after the OECS/ECLAC damage assessment

Esteban Pérez Caldentey, UN Economic Commission for Latin America and the Caribbean

Hurricane Ivan, a category 3 system, impacted Grenada and its dependencies on 7 September 2004, devastating the island of Grenada.[1] The Organization of Eastern Caribbean States (OECS) organized a mission of various experts jointly with the Economic Commission for Latin America and the Caribbean (ECLAC), to assess the socio-economic impact of the hurricane and provide policy recommendations for risk reduction and natural disaster mitigation.

The OECS/ECLAC mission estimated the total damage of Hurricane Ivan at XCD2.4 billion, more than twice the current value of GDP.[2] The bulk of this was direct damage (89 per cent of the total and 201 per cent of GDP). Indirect damage accounted for 11 per cent of the total (26 per cent of GDP).[3]

At the sectoral level the effects were registered mostly in infrastructure and particularly in housing. Estimates indicated that 89 per cent of the housing stock, corresponding to 80 per cent of the total population, registered some type of damage caused by the hurricane.[4]

In the year of the disaster, the economy contracted by 3 per cent and the rate of unemployment rose sharply to 20 per cent. In spite of the subsequent and further damage caused by Hurricane Emily, the economy recovered in 2005 (5 per cent growth in GDP), spurred mainly by the dynamism of the construction sector.[5] Significant imbalances were registered in the fiscal and external accounts. These persisted in 2005 (minus 3 per cent and minus 9 per cent of GDP in 2004; minus 17 per cent and minus 34 per cent of GDP in 2005 for the fiscal and balance of payments outturn respectively).

Following Hurricane Ivan, a series of measures and programmes were undertaken using the recommendations put forward in the OECS/ECLAC damage assessment report as a reference point. The aim was to get the economy back on track and to reduce the risk and exposure to future natural disasters.[6] Some of these measures and programmes were designed at the national level while others were specifically targeted to the housing, education, health, and productive sectors.

A key issue worth examining is the extent to which these measures and respective programmes have been able to strengthen the country's level of resilience to natural disasters and increase the awareness of Grenada's population to natural risk. A corollary question is whether the people of Grenada have been able to learn from past disasters for better future protection and improve risk reduction measures, i.e. whether these measures and policies have been able to 'build back better.'

At the national level, the Government created two important agencies: the Agency for Reconstruction and Development and the National Disaster Management Agency. The former was charged with the task of creating an improved policy and institutional framework for reconstruction, mobilizing resources for reconstruction and the monitoring of project implementation. The agency was launched in March 2005, more than a year and six months after the passage of Hurricane Ivan. In addition, the IMF recently reported in May 2005 that the Agency for Reconstruction and Development was not yet funded and needed to improve the transparency of its operations.

The National Disaster Management Agency drafted a National Disaster Plan and has outlined an organized response to future disaster occurrences. The agency has also started a dissemination campaign on the radio and in the press about disaster management and preparedness.

In the productive sectors, measures have been put in place mainly for the agricultural and tourism industries and, to a lesser extent, in the manufacturing industry. Measures for the former include the restoration of agricultural production and infrastructure and attempts to diversify the sector, improve its competitiveness and strengthen its linkages with other sectors. Notwithstanding these

Photo: ECLAC

The devastation caused to part of one hotel in Grand Anse

efforts, the sector contracted by 52 per cent in 2005 (72 per cent in the case of crops).

In the case of tourism most of the measures have centred on the training of locals to improve their level of skills and on the diversification of the tourism product. Hurricane Ivan created a mismatch between the demand and supply of labour, which had important gender effects. Reconstruction activities required labour skills (demand for skilled labour) that were not found among those who lost jobs (supply of unskilled labour) due to the effects of the hurricane.

Notwithstanding the devastating effects of the disaster, the OECS/ECLAC report identified safety valves such as cruise ship tourism, which if appropriately identified and managed could act as buffer stocks to the general economic downturn. For 2005, tourism contracted by 35 per cent with regard to the previous year. The number of stopover passengers dropped by 4 per cent in 2004 and by 27 per cent in 2005. Contrarily, the number of cruise ship passengers rose 56 per cent and 20 per cent for the same years.

In terms of the social sectors, reconstruction efforts have been fairly successful in the case of education and health. The World Bank reports that at the beginning of the school year in September 2005, all secondary schools reopened on time and only 12 per cent of all schools did not reopen. Most schools have by now been restored. In the health sector, a greater part of the affected infrastructure has been restored to its normal levels of operation, and reconstruction activities involve the use of disaster resistant standards.

However, in the housing sector many homeowners have rebuilt residential homes using the same materials that they used before Hurricane Ivan. This left them as vulnerable as before to natural disasters. In cases where different materials were used for construction, these include asphalt-based material, which can represent a fire hazard. Thus government and agencies' efforts to show people the procedures they should follow in order to rebuild 'better,' have not been very successful.

In the same vein, there are no discernible welfare effects of the measures taken and policies implemented. Grenada is still characterized by a social context that is not conducive to natural hazard risk reduction. Grenada exhibits a high rate of unemployment (currently estimated by unofficial sources at 30 per cent), high levels of poverty (29 per cent of households are poor) and of poor households headed by females (42 per cent of the total), significant elderly dependency ratios (32 per cent), with teenage fertility rates of 17 per cent. Moreover the country has a significant informal sector where official rules and regulations do not apply.[7]

The systemic devastation caused by Hurricane Ivan, the massive donor response, the number of measures and policies put in place to mitigate the damage and the lack of complete preparedness on the part of the population to face such an event, make Grenada in the hurricane's aftermath a source case for the study of natural disasters. From the available data and information we can draw several lessons that can inform the type of policies needed for risk rehabilitation and reconstruction approaches to increase a country's resilience to natural disasters.

First, it is necessary to view natural disasters as a recurrent rather than an isolated event. Although awareness of natural disasters and risk is raised in the immediate aftermath of the disaster, these concerns tend to subside with the passage of time. Ultimately, natural disasters are conceived as a one-time, unlikely event. A major question is how to incorporate the recurrent nature of natural disasters into real risk analysis when the time frame for natural disasters to recur far surpasses that of people's decision-making horizon.

Second, once natural disasters are understood as recurrent events, it follows that their effect can be cumulative. Rehabilitation, mitigation and risk reduction policies have yet to address and incorporate the 'natural disaster cumulative factor.'

Third, natural disasters create impending gaps between the need for the skills required for reconstruction and mitigation purposes and those available in the population stock. In the case of Grenada the reparation of hotels, yachts and housing needed specialized skills that were not found among those who were left without work due to the impact of the hurricane (mainly unspecialized and unskilled female labour). Training programmes and, more to the point, improved skills must become part of any education policy.

Fourth, natural disasters have an inescapable gender dimension. In the case of Grenada, at the time of the hurricane, more than half of the labour population working in the tourism sector and more than half of heads of households were females. However, females cannot easily move as males do from the tourism sector to the construction sector, which is generally the sector that experiences high rates of growth in the aftermath of any disaster due to reconstruction activities. Thus, policies must address the differentiated effect of a natural disasters on men and on women.

Fifth, there are sectors (or sub-sectors) that are resilient to natural disasters — that is, whose performance was not affected by the occurrence of a natural disaster. In the case of Grenada, the activity in the cruise ship sub-sector was unhampered by Hurricane Ivan and in fact, the number of passengers actually increased during the aftermath of the event. The Government must identify these hurricane buffer-stock or safety-valve sectors. They can play a crucial role in reconstruction activities — and in risk mitigation in general — because these are the sectors that prevent the effects of a natural disaster from being totally widespread.

Finally, policymakers, stakeholders and the general population of a country must be cognizant of the fact that there are delays in the implementation of reconstruction and risk mitigation measures and policies. And more importantly, they must be aware that in general, in developing economies there is a divide between policy design and implementation, with the former far surpassing the latter. Thus, the focus should be placed on the degree to which any given policy design can be implemented and on ensuring that there are proper mechanisms in place for implementation.[8]

Photo: ECLAC

The effects of Ivan on Grenada's National Stadium

Dynamic hazard mapping for food security: examples from sub-Saharan Africa

Henri Josserand, UN Food and Agriculture Organization

As the main United Nations organization responsible for food and agriculture, the Food and Agriculture Organization (FAO) works with member countries to promote sustainable agricultural production and trade, reduce hunger, and fight against the causes of food insecurity. For the longer term, this requires expert technical and policy analysis and advice, and support to investment in such areas as production, transport and storage infrastructure. In the shorter term, some of the FAO's critical work includes monitoring of food security trends throughout the world, and providing early warning of impending crises.

In terms of food security monitoring, countries with an already high level of hunger understandably receive the monitoring priority: widespread malnutrition stems from structural causes not amenable to change in the short term, and it often takes a relatively small additional shock to make a bad situation worse. In other words, widespread malnutrition pertains in some countries because of structural factors such as poverty and lack of access to public services like education and public health; the same factors contribute to vulnerability to food insecurity.[1]

By monitoring the current state of environmental, economic and social trends in already 'fragile' or vulnerable countries, the FAO keeps track of the general food security status and short-term prospects of various countries. A map and list of 'countries in crisis requiring external assistance' is updated at least once a month by the organization's Global Information and Early Warning Service (GIEWS).[2]

A quick comparison between the structural hunger map and the shorter-term map of countries currently in crisis shows a high degree of correlation, especially for sub-Saharan Africa, where food crises tend to be longer lasting. But risk analysis and early warning must also consider the following possibilities:

- Slow onset natural disasters for a new set of countries
- Human-induced crises at national or sub-national level
- Quick onset disasters (with limited scope for early warning, but some for preparedness).

Slow onset natural disasters typically lead to food insecurity as a result of significant crop failure, due to drought or other forms of adverse weather, or devastation by pests such as desert locusts. Sub-Saharan Africa being the large part of the world relying least on irrigation for agriculture, the pertinent long-term risk map for food production takes on a different focus according to the major rainy seasons. For example, from June through October the Sahel is monitored most closely, followed by east Africa and the Horn until the end of the year, with Southern African weather and agricultural conditions receiving much more attention from December through April.

Human-induced food crises brought about by conflict and widespread insecurity, or even long periods of economic mismanagement and poor governance are, unfortunately, not uncommon. Indeed, such human-induced rather than disaster-related food crises have become increasingly common. Since the early 1990s, the proportion of emergencies that can be attributed mainly to human causes has more than doubled, rising from around 15 per cent to over 35 per cent. For such cases, the task of hazard mapping is more complex, especially where natural and human-induced factors reinforce each other.

Quick onset disasters such as earthquakes, volcanic eruptions and even large floods offer limited scope for early warning, but in historically high-risk areas there is some opportunity for preparedness and mitigation. That is the case in richer countries, but much less so in developing nations. However, since the major tsunami of December 2004, all have come to agree that early warning and disaster preparedness should be an integral part of the development (and official development assistance) process.[3]

The use of risk mapping and vulnerability analysis is not limited to the more affluent countries. The stakes are actually higher for poorer nations, since disasters can set them relatively further back on the path of development. After a series of devastating droughts, for example, countries of the Sahel[4] have integrated the unpredictability of rain-fed food production into their policies, farming and pastoral strategies, and their patterns of regional population movement and trade. As a result, these countries tend to fall into crisis less often than others located in regions endowed with more favourable conditions for food production. When crises do occur, as with the 2004 combination of drought and desert locusts, they tend to be relatively less severe and significantly shorter.

Ethiopia, a large and very diverse country with a population of well over 70 million, has also been suffering from recurring periods of drought and food insecurity. The country has established a highly decentralized and wide-ranging system for disaster preparedness and prevention and, with donor support, a social safety net to address chronic vulnerability to food insecurity. It is also implementing, in partnership with the World Food Programme, a prototype weather-indexed insurance scheme to safeguard basic household-level productive assets in case of disaster. Ethiopia is building up its capacity to do timely vulnerability analysis mapping, or what may be considered dynamic risk mapping. A nationwide population census will start shortly, agricultural statistics methods and processes are being upgraded, and are about to be complemented with state-of-the-art satellite data and imagery. These will enable better estimates of the timing of agricultural activities in various parts of the country, and of the extent of cultivation.

Long-term, or structural risk mapping has been in practice for a long time; it basically consists of identifying the areas which

have historically been subject to adverse weather conditions and, in a statistical sense, are more likely to face similar problems in the future. Vulnerability analysis mapping, on the other hand, commonly used since the late 1980s, combines the probability of exposure to adverse conditions in a certain area with some measure of 'coping capacity' by people living in that area. Simply put, coping capacity refers to a population's ability to manage a crisis, either in the short or longer term. It depends on such factors as level of savings and liquid assets, diversification of production and other economic activities, mobility, and access to alternative employment, usually through seasonal migration.

For a given area, exposure to risk for a point in time can be expressed as the current relative level of risk compared to its historical average — for a drought-prone area, one might use the standardized precipitation index (SPI) for example.[5] Measures of coping capacity are, on the other hand, usually expressed in qualitative terms, by type of livelihood system. A 'typical' household in a traditional transhumant pastoral system, for example, is assumed to have certain attributes with respect to income diversification, access to alternative earning opportunities, etc.

Obviously, once one has established, for a given area, the relative level of vulnerability compared to others (and, therefore, mapped this area as having 'high', 'medium' or 'low' vulnerability), one still has to account for changes over time in the variables determining exposure to risk and extent of coping capacity. National food security monitoring and early warning systems in many countries do a good job of mapping long-term, or structural, vulnerability. When historical patterns repeat themselves, they provide a good guide of where vulnerability to food insecurity is being heightened by a disaster. However, adverse weather can be atypical, and the variables underlying coping capacity, such as the terms of trade between cereals and small ruminants, for instance, or food prices and seasonal labour opportunities in neighbouring countries, can change in unexpected ways or faster than anticipated.

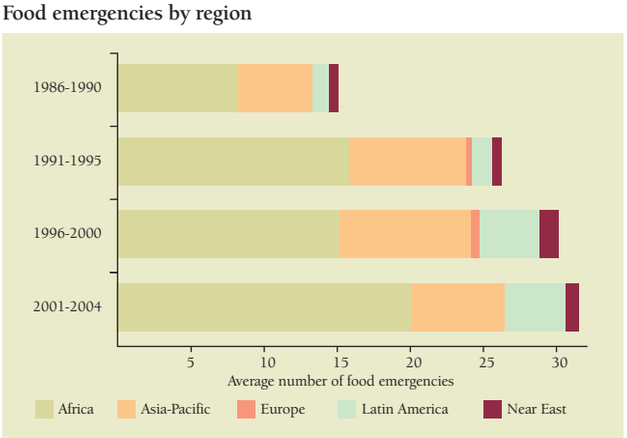
Unless monitoring systems can capture and integrate this kind of information in a timely fashion at the national level, there can be significant differences between 'vulnerability maps' and the actual geographical distribution of the consequences of food insecurity, as measured by malnutrition rates, for example. During the recent Niger crisis of 2004-2005, long-term vulnerability maps provided a good guide to some areas where food insecurity was indeed acute, but they missed significant southern areas with higher rainfall. In such areas, very high population density and drastic changes in land tenure reduced the households' capacity to produce their own food; faced with the record high prices of 2004-2005, they became even more food insecure than populations living in more marginal parts of the country, but where extensive cultivation can still provide a partial hedge against risk.

Overall, population in a given area is considered vulnerable if long-term exposure to risk (such as drought) is higher than long-term coping capacity. In the short-term, however, risk exposure and coping capacity can significantly depart from historical average levels. Timely monitoring and analysis of the determinants of risk and coping capacity, by main ecological or livelihood system, allow for a 'redrawing' of relative vulnerability maps upon which one can base localized surveys or even emergency relief interventions. This type of dynamic risk mapping requires a good understanding of the determinants of risk and of coping capacity by livelihood system, combined with rapid information gathering and analysis capability. This remains a challenge for many countries, but technological advances in weather monitoring, satellite data acquisition and processing, and data collection, communication and analysis are easing the task, efficiently and at relatively low cost.

With support from the European Commission, FAO has developed an analytical tool for vulnerability analysis and early warning — the GIEWS Workstation allows the analyst to combine on one electronic desktop country maps and geographical features, satellite imagery including vegetation index and rainfall estimates, and geographically referenced data such as land use and crop distribution, population and price statistics, etc.

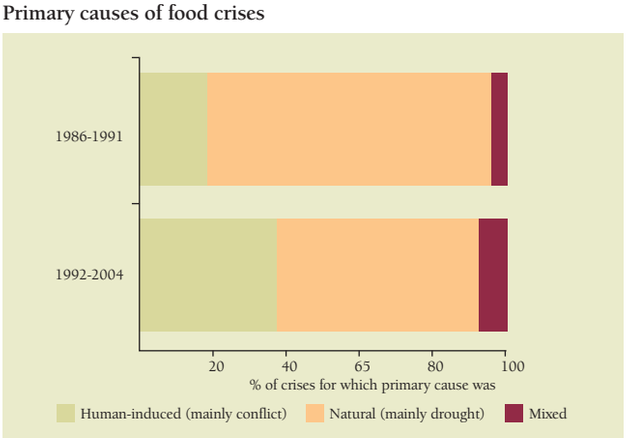
The GIEWS workstation is now being introduced for use at the national level. In Ethiopia, FAO, in collaboration with the World Food Programme, is providing the workstation to the Central Statistical Authority and to the Ministry of Agriculture. The tool is to be used in connection with ground surveys designed to calibrate and validate medium or high resolution satellite imagery to derive much more precise estimates of area cultivated and agricultural production, timing of planting and yields. It will also integrate basic food and livestock prices, as well as district-level information on incomes and other household parameters. Since the workstation is designed to allow for synchronization of data between separate units (ten will be installed in the country), information exchange will be faster and more accurate. With the help of such a tool, countries like Ethiopia will be able to specify not only which areas are traditionally more vulnerable, but also, and in real time, how the weather and economic conditions of each growing season modify the risk landscape of the main ecological zones of the country.[6]

Food emergencies by region



Source: FAO

Primary causes of food crises



Source: FAO

NATO's growing humanitarian role

Maurits Jochems, Deputy Assistant Secretary General, Operations Division, NATO

NATO's responses to both Hurricane Katrina in the United States and the South Asian earthquake in Pakistan in 2005 propelled the alliance into the disaster-relief spotlight. Although NATO has been involved in disaster relief since the 1950s, such a high profile role is unusual. Moreover, some analysts and commentators, including representatives of certain allies, question whether this is an appropriate activity for the alliance.

In the case of the assistance provided to the US, NATO made a useful practical contribution and demonstrated alliance solidarity by offering hurricane victims much-needed supplies in their hour of need. It was not, however, critical to the wider relief effort. By contrast, NATO's contribution to the Pakistan relief effort was substantial. Indeed, if the many bilateral contributions of NATO allies, and especially that of the US military, are added to the NATO operation, the overall allied effort was critical to the wider relief operation and helped save many lives.

Recent disasters have highlighted how useful certain military capabilities can be when first responders find themselves overwhelmed. Although the NATO operation in Pakistan clearly made a great difference to the overall relief effort, it also raised a number of questions. Why, for example, should military capabilities be deployed in international disaster relief operations? Why should NATO be involved? What added value can NATO bring to relief efforts? And who should lead operations dealing with the consequences of natural or industrial disasters?

Some commentators clearly believe that disaster relief work can be done better and more economically by civilian actors, whether they be national authorities, international organizations, or non-governmental organizations. While this may be the case for most disasters, there are unfortunately occasions when the scale of the disaster is so great that first responders — local authority and/or interior ministry forces — are simply overwhelmed. It is in these instances that the military can and should become involved. Indeed, helping national authorities in responding to natural or industrial disasters is a fundamental mission of the armed forces in most NATO (and non-NATO) countries.

Deploying military capabilities

The recent disasters in the US and Pakistan have highlighted how useful certain military capabilities can be when first responders find themselves overwhelmed. Strategic airlift is crucial to transport urgently needed relief supplies as commercial aircraft are not always available in sufficient numbers. Moreover, helicopters have proven essential in the first phase of a disaster relief operation when roads are often too badly damaged to be passable and sealift capabilities are critical to sustaining the relief effort in a more cost-effective way in the weeks and months following a disaster. Rapidly deployable military hospitals and medical personnel can also help overburdened first responders. In addition, military engineers, water purification units and search and rescue teams all have the skills that can greatly improve crisis response capabilities and save lives.

While the military clearly has useful capabilities to bring to disaster relief operations, such assistance should be provided according to the principle of subsidiarity. Civil responders should always be in the lead and must formally request military support. It is demand-driven assistance, not a supply-driven relief contribution. In principle, local authorities and/or the interior ministry or other competent national body should ask for external, including military, assistance, if and when they decide that the scale of the disaster is too great for them to handle alone.

In the case of both Hurricane Katrina and the South Asian earthquake, the respective national governments formally requested NATO assistance. In addition, in the case of Pakistan, the United Nations publicly and emphatically asked NATO for assistance in putting together its own relief operation. As a result, most of the crucial shelter material provided by the office of the UN High Commissioner for Refugees was transported to Pakistan via NATO's air-bridge before the onset of the harsh Himalayan winter.

NATO recognizes that the UN, specifically the UN Office for the Coordination of Humanitarian Affairs (UN OCHA), should always be in the lead, together with the authorities of the stricken country, in any international disaster relief operation. Indeed, NATO's Euro-Atlantic Disaster Response Coordination Centre (EADRCC), the alliance's principal crisis-response mechanism involving 20 partner countries in addition to the 26 allies, hosts a UN OCHA liaison officer, who advises NATO where necessary. In the case of the Pakistan relief operation, NATO also participated in the overall coordination meetings in Islamabad, jointly led by Pakistani government officials and the UN resident representative, as well as in the relevant UN-led cluster meetings, such as the health and shelter clusters.

NATO's added value

If one recognizes that military capabilities may usefully be deployed in disaster-response operations, the next issue to address is that of NATO's added value. Clearly, military contributions do not have to come via NATO and may be made on a bilateral basis. Moreover, decision-making in response to disasters needs to be rapid and the alliance's multilateral approach is in theory slower than that of individual allies.

Given that no two disaster relief operations are identical and that innovative and pragmatic solutions are almost invariably required, it is not possible to say definitively that NATO should automatically be involved or that individual allies should take the lead. However, several factors should be taken into consideration.

Firstly, only very few allies, such as the US, are capable of transporting significant relief capabilities rapidly over great distances to stricken areas and to sustain the effort. Secondly, NATO's primary contribution is the coordinating, liaising and facilitating function that the EADRCC and the alliance's military structures provide. These enable smaller allies to contribute capabilities, such as a military hospital or water purification unit, that they would not be able to contribute on their own. In addition, this coordination role that characterizes NATO-led operations has proven useful both to the authorities of the receiving country and to the UN, which was thereby able to deal with a single actor rather than many.

Can NATO take a decision on disaster relief almost as quickly as a national government? In general, when there is a precedent, the alliance is able to move rapidly. The decision to set up an air-bridge to Pakistan, for example, could be taken quickly, above all, because there was already a precedent, namely the airlift to the US in the wake of Hurricane Katrina. The decision to send medical personnel and engineers to Pakistan, by contrast, took longer as there was no precedent at the time for sending military personnel to a non-NATO (or partner) country for a disaster relief operation.

In the wake of both the Hurricane Katrina and Pakistan relief operations, the alliance is now carrying out a lessons-learned exercise. Once this has been completed and issues such as the funding of certain elements of the operation are resolved, it might be possible further to reduce response times. In this way, NATO decision-making could be almost as quick as that of the national authorities of an individual ally.

Funding reform

Looking ahead, one of the most important issues that needs to be resolved before either NATO as a whole or individual allies again make military capabilities available for disaster relief operations is that of appropriate funding mechanisms. If, as at present, the defence ministries of those countries that are asked to provide helicopters for a future disaster relief operation are also expected to carry the entire financial burden of their engagement, they may decide that they cannot afford to become involved. Unless new funding mechanisms are developed, intervention for disaster relief would eat up a great portion of the defence budget. Meanwhile, the first responders, both nationally and internationally, would essentially be receiving help for free.

Some steps to reform and improve funding mechanisms were already put in place during the Pakistan relief operation by individual countries. In the United Kingdom, for example, the Minister for International Development, Hilary Benn, decided to cover the additional operating costs caused by the deployment of three Chinook helicopters and a regiment of engineers out of the international development budget. By using another budget line, Benn was also able to make a significant financial contribution to the NATO 'trust fund' that met the costs of the air-bridge.

The benefits of Benn's improvised arrangement are clear. In this way, a department for international development does not need to operate and deploy its own fleet of helicopters, thereby avoiding duplication of assets. Moreover, depending on how costs are calculated, this solution is likely to be considerably cheaper than any arrangement involving the leasing of commercial helicopters if, indeed, they are available. Of course, there may be other consequences of such an approach. A defence ministry might, for example, decide to acquire more helicopters. But even in this case, overheads, training and maintenance can be limited to one organization instead of two or more.

In order to institutionalize such arrangements, however, it will also be necessary to revise definitions of what constitutes official development assistance (ODA). It seems that the financing of military helicopters for disaster relief operations does not qualify as official development assistance under current definitions. As a result, there is a disincentive for development ministers to copy the initiative of their UK counterpart in Pakistan. But given that many countries are forging ever-stronger working relationships between ministries of international development, defence and foreign relations, it might be time to reassess the ODA criteria.

In the case of the Pakistan relief operation, such a move would be especially appropriate since the UN asked NATO to provide an air-bridge and to deploy helicopters. Logic demands that either NATO nations be allowed to book some of the additional costs incurred by their militaries to the international assistance and development budgets or that the UN reimburse them directly out of funds collected to pay for the relief operation. Since 1989, many walls — both real and virtual — have been removed. It may now be time to tear down some of the institutional divisions that exist between the worlds of international assistance and development on the one hand, and the military on the other.

Photo: SHAPE

Loading relief aid for Hurricane Katrina victims

Katrina relief operation

As the scale of the devastation wrought by Hurricane Katrina in the states of Alabama, Florida, Louisiana and Mississippi on 29 August 2005 became apparent, the EADRCC offered its services to the US. That was on 2 September. A day later, an official US request for assistance was received and forwarded within an hour and a quarter to the capitals of all 46 members of the Euro-Atlantic Partnership Council (EAPC). At Washington's request, an EADRCC liaison officer was deployed on 4 September to work with the Federal Emergency Management Agency and the Office of Foreign Disaster Assistance in Washington, DC.

The first two offers of assistance arrived on 4 September and, in total, 39 EAPC members provided assistance through the EADRCC. On 8 September, the North Atlantic Council authorized a NATO transport operation consisting of NATO's Airborne Early Warning fleet training and cargo aircraft and NATO Response Force (NRF) air and sealift to help move urgently needed items from Europe to the US. The EADRCC acted as a

clearing house, matching requests and offers of assistance. Donations needing transportation were coordinated by the Allied Movement and Coordination Centre, in conjunction with the EADRCC. Additionally, two civil aviation experts were deployed to the EADRCC on 9 September to help coordinate civil transport requirements.

Relief items were consolidated at Ramstein Air Base in Germany. Donations were moved there either by road or by NRF-assigned tactical airlift under the command of Joint Command Lisbon. All cargo consolidation in Ramstein from European donors was completed by 19 September 2005. More than 90 flight hours were flown by French, German, Greek and Italian C-130 and C-160 tactical NRF-assigned transport aircraft.

By 2 October, 12 NATO cargo flights had taken relief supplies from Europe to the United States and some 189 tons of relief goods, including food, first-aid kits, medical supplies, generators and water pumps, were delivered via the NATO air-bridge.

Pakistan relief operation

Two days after the South Asian earthquake of 8 October that left more than 73,000 people dead, 70,000 injured and some 4 million homeless, Pakistan requested NATO assistance for the humanitarian relief operation it was mounting. The North Atlantic Council agreed to help and approved a two-stage alliance response.

The first stage focused on the air-bridge. The EADRCC established links to its members' national aid coordinating bodies and the Pakistani authorities. The EADRCC worked in conjunction with the NATO military authorities to coordinate the response of members of the EAPC willing to channel their assistance through this mechanism.

On 13 October 2005, the EADRCC received the first request from the office of the UN High Commissioner for Refugees (UNHCR) to airlift 10,000 tents, 104,000 blankets and 2,000 stoves from Turkey to Pakistan. Several other requests from UN agencies followed. The first NATO relief flight to Pakistan arrived on 14 October. At the request of the Pakistani authorities, priority was initially given to moving tents and blankets, with the majority of the relief items being provided by the UNHCR. Eventually, some 160 flights delivered about 3,500 tons of relief goods.

Forty-two out of 46 EAPC members provided assistance to Pakistan, including through the EADRCC. The NATO air-bridge was used by 19 EAPC and two non-EAPC countries — Malta, and Bosnia and Herzegovina — as well as by the UNHCR, the World Food Programme and the UN OCHA.

Military liaison officers were dispatched to the EADRCC and embedded in the Centre's working structure while civilian experts from the Senior Civil Emergency Planning Committee's Transport Planning Boards provided assistance to the EADRCC, Supreme Headquarters Allied Powers, Europe and the NATO Maintenance and Supply Agency from their usual places of business when needed. By the end of the operation, all assistance offered to Pakistan through the NATO air-bridge had been delivered.

The second stage of the operation added elements drawn from the NATO Response Force, including a deployed headquarters command and control structure, engineering units, helicopters and military field hospitals, all with appropriate support. NATO worked closely with both the Government of Pakistan and the UN on a daily basis and was plugged into the UN cluster system. NATO's contribution to the relief operation was to maintain the air-bridge, support intra-theatre lift, restore critical road infrastructure and provide makeshift shelter and medical support. The aim of these relief activities was to help earthquake survivors make it through the winter.

By early December 2005 most elements were in place and contributed effectively to the relief efforts in the Bagh region, which the Pakistani authorities had identified as the area for the NATO relief operation on the ground.

NATO helicopters lifted more than 1,700 tons of relief from Islamabad to forward supply dumps and from there directly to the point of need. They moved more than 7,500 sick, injured and displaced from the immediate earthquake zone. The NATO helicopter-refuelling site refuelled more than 1,000 helicopter flights from the international helicopter force. The NATO field hospital accepted nearly 5,000 patients and treated a further 3,500 with mobile medical teams. NATO engineers built more than 110 multifunctional shelters at high altitude and cleared and repaired 60 kilometres of road, removing some 42,000 cubic metres of debris. NATO engineers also provided fresh water for more than 1,000 people per day and repaired a permanent spring water distribution and storage system to serve a further 8,000 people per day. By 1 February 2006, all NATO units had left the Bagh region for a staging area, from where they then travelled back to their home countries.

In addition, after initially contributing to the relief effort on a bilateral basis, Canada placed its Disaster Assistance Response Team (DART), under the NATO operation. DART medical personnel treated some 10,000 patients and left a clinic behind when they withdrew. Ottawa also made helicopters and water-purification units available and financed three helicopters for three months for the UN.[1]

Photo: SHAPE

Helicopters have proven essential in the first phase of a disaster-relief operation when roads are too badly damaged to be passable

Natural catastrophes: are increasing intensity and costs a long-term trend?

Ernst Rauch, Head of Department Windstorm/Weather/Climate Risks, Munich Reinsurance Company

In terms of natural catastrophes, 2005 broke all negative records. Natural catastrophes have never been so expensive, either for the world's economies or for the insurance industry. It was also one of the deadliest years of recent decades. In the North Atlantic the most active tropical cyclone season since records began in 1851 is costing the private insurance industry more than USD80 billion, with Hurricane Katrina being the most damaging windstorm of all time. The increase in losses from natural catastrophes over the past few decades is largely due to a series of socio-economic factors, including the growing concentration of people and economic activity in cities. The cities themselves are becoming more vulnerable, and are often located in highly exposed regions. And as events have repeatedly shown, the susceptibility of buildings and infrastructure is increasing rather than decreasing — in spite of modern building codes and technological development.

However, these changes in exposure and vulnerability do not sufficiently account for the increase in natural catastrophe losses in its entirety. There is mounting evidence that the frequency and intensity of weather-related natural catastrophes are increasingly being influenced by global environmental changes, and above all by climate change. Between 1950 and 2005 there has been a general trend towards ever higher losses from 'great natural catastrophes' worldwide. This has been duly analysed by Munich Re's Geo Risk Research division, giving a reinsurer's perspective on how climate cycles and global warming affect risk evaluation.

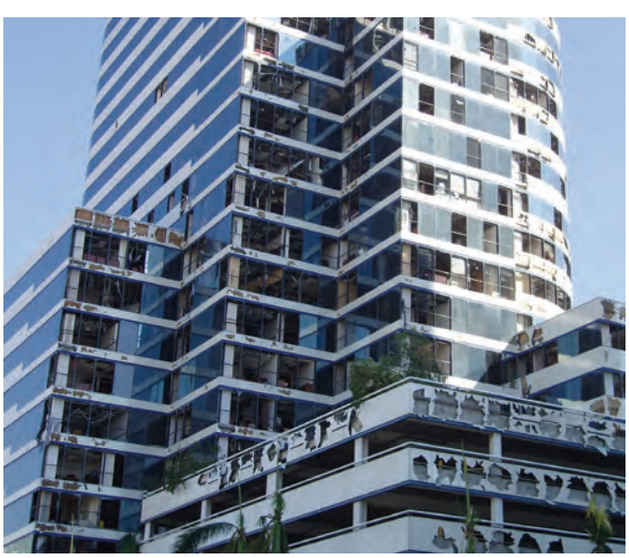


Photo: American Re, Princeton

Wind damage to a commercial building:
Hurricane Wilma, Fort Lauderdale, Florida, October 2005

2005: the trend toward increasing losses continues

About 650 loss events occurred around the world in 2005. The number of events was in line with the average of the past ten years. The monetary and human consequences, however, were extraordinary, since 2005 was the costliest natural catastrophe year ever for the insurance industry and one of the three deadliest years in the last quarter of a century.

Six natural hazard events complied with the definition of 'great natural catastrophes' in 2005. They accounted for more than 91,000 deaths out of a total of 100,000. They generated overall losses of USD170 billion (from a total of USD212 billion) and insured losses of more than USD82 billion (from a total of USD94 billion):

- Floods, India (August)
- Hurricane Katrina, USA (August)
- Hurricane Rita, USA (September)
- Hurricane Stan, Middle America (October)
- Earthquake in Pakistan and India (October)
- Hurricane Wilma, Mexico, USA, Caribbean (October).

A detailed analysis of this time series of losses demonstrates that five out of every six great natural catastrophes throughout the world are due to extreme weather events, as are almost half of the catastrophe victims and three-quarters of the economic losses. They account for approximately 90 per cent of insured losses. While humankind cannot influence earthquakes or volcanic eruptions, anthropogenic climate change is exerting an increasing influence on all kinds of weather-related natural catastrophes.

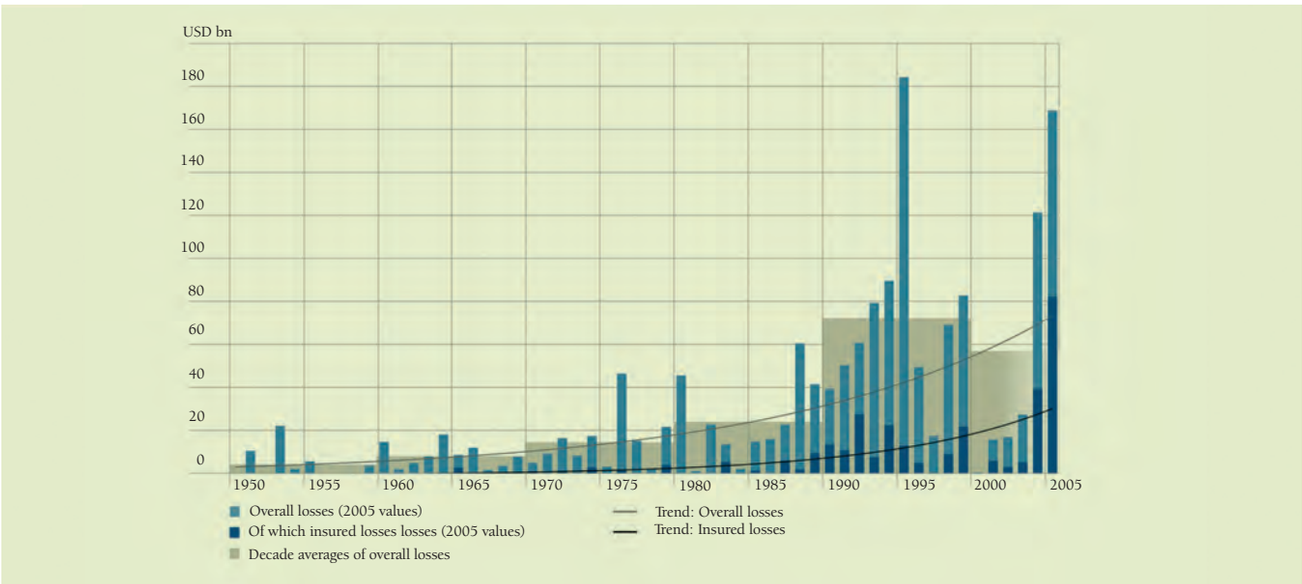
Natural catastrophes are increasing in size and frequency, and there are several key reasons for this:

- Population growth
- Rising standard of living
- Concentration of population and economies in conurbations
- Settlement and industrialization of heavily exposed regions
- Vulnerability of modern societies and technologies
- Increasing insurance penetration
- Changes in environmental conditions and climate change.

Great natural catastrophes

In line with definitions used by the United Nations, natural catastrophes are considered 'great' if the affected regions' ability to help themselves is clearly overstretched and supraregional or international assistance is required. As a rule, this is the case when there are thousands of fatalities, when hundreds of thousands of people are made homeless, or when the overall losses – depending on the economic circumstances of the country concerned – and/or insured losses reach exceptional orders of magnitude.

Great natural catastrophes 1950-2005, Overall losses and insured losses – Absolute values and long-term trends



Source: NatCat*SERVICE*, Munich Re

Hurricane activity in the North Atlantic and climatic setting

Recent scientific findings in climate research confirm that the tropical cyclone hazard in the North Atlantic has increased markedly since the mid-1990s. Cyclones there have become more intense and have been reaching very high wind speeds for longer periods of time. This increase in intensity is associated with a global increase in sea surface temperatures, averaging approximately 0.5°C (0.9°F) during the summer season in all tropical ocean regions since 1970. A comparison of the recorded trend and computer simulations reveals that this warming can only be the result of anthropogenic climate change. Globally, the annual number of strong tropical cyclones (categories 4 and 5 on the Saffir-Simpson Scale) has more than doubled, from around eight in the early 1970s to 18 in recent years.

In the North Atlantic, it is not only the intensity that is increasing but also the frequency. The primary factor for this is — according to scientific studies — the natural cycle of sea surface temperatures (Atlantic multidecadal oscillation or AMO). The record number of cyclones in the 2005 season coincides with what current data indicates to be the highest mean annual temperature measured in the North Atlantic since records began around 1870. This is most likely due to the simultaneous influence of two processes that determine sea temperature and hurricane activity: natural climate oscillation in the Atlantic, and the long-term warming process caused by anthropogenic climate change.

Building vulnerability

Catastrophe events of recent years have provided the insurance industry with a vast amount of claims data that has also enabled conclusions to be drawn regarding the effectiveness of mitigation measures discussed in the aftermath of major historic disasters.

Some key observations were made in the wake of the US hurricanes of 2004 and 2005. As seen in the Florida hurricanes of 2004, newer residential constructions typically fared much better during Hurricane Katrina than older buildings, due to the relative newness of their structural components.

However, new buildings in Louisiana and Mississippi did not perform as well as in Florida, because neither Louisiana or Mississippi had statewide residential building codes enacted at the time of the storm. Both states left the adoption and enforcement of building codes up to local municipalities, and only a few opted to take such measures. When compared with Florida, which has strict wind design codes, differences in new buildings' performance were apparent.

Mitigation measures that are effective in preventing wind damage to buildings, such as hurricane shutters and seawalls, are practically nonexistent along the Gulf Coast outside of Florida, except in some affluent residential neighbourhoods. To protect a building against wind damage, it is extremely important to keep its envelope intact. Window shutters are very effective because they resist wind pressure better than glass and they can protect windows from being shattered by flying debris. This lack of shutters and other protection measures is likely to have led to increased property damage due to blown-in windows and subsequent wind and water damage.

Consequences for the insurance industry: new loss distributions

The loss statistics from natural catastrophes clearly indicate a long-term trend toward higher costs. Besides socio-economic reasons, changing weather patterns and only limited mitigation measures are the key drivers responsible for this adverse development. What is to be done from a risk-taker's perspective?

The insurance industry must adjust the assumptions at the very basis of its definition of hazard (windstorm, flooding) where scientific data and studies provide strong indications that this is necessary. Science has made considerable progress in this area, particularly in 2005. For instance, today we know that the description of a hurricane hazard as the average of a time series of over 100 years cannot serve as the basis for adequate risk management.

This discussion has focused on changing hurricane frequencies and vulnerabilities in the US due to the outstanding hurricane catastrophes of 2004 and 2005 in the context of long-term loss trends. However, Munich Re is continuing its analyses of natural climate cycles and the effects of climate change with regard to hazards in other regions too, such as tropical cyclones in the Pacific and Indian Ocean and winter storms in Europe. This will enable us to anticipate future changes in risks and incorporate them in risk models.

Property insurance in the post-Katrina world

Geoffrey Bromley, Chairman, Europe and Asia, Guy Carpenter

FOR THE HURRICANE-EXPOSED regions of the Americas, 2005 was a watershed year. Worldwide, estimated insured property catastrophe losses currently stand at an all time record of USD83.4 billion; USD72.6 billion of those insured losses occurred in North America. That figure could prove to be conservative, as litigation continues on key issues such as wind versus flood cover. The level of global losses owing to catastrophes is increasing, and seven of the ten most costly hurricanes have occurred within the past two years.

The storms of 2005 imposed a disproportionate burden on the reinsurance industry, members of which provide 'insurance for insurance companies'. Reinsurers have reported estimated losses of USD20 billion from Hurricane Katrina alone. With assumed total insured losses of USD45 billion, according to Swiss Re, close to 50 per cent of Katrina losses were ceded to reinsurers, a much higher proportion than the historical average of approximately one-third for major catastrophes (Swiss Re defines a catastrophe as an event with losses over USD77.5 million).

Caribbean nations have had a tough time over the past two years. The 2004 wind season in the Caribbean was one of the most active and destructive on record. Four major hurricanes affected the region and the total industry loss for the Caribbean was in the billions. This loss was distributed among various islands, with the Cayman Islands, Bahamas, Dominican Republic, Puerto Rico and Grenada all suffering losses. In 2005, the region was again struck by hurricanes, with six major storms making landfall in the Caribbean and inflicting heavy losses.

Changes in weather patterns

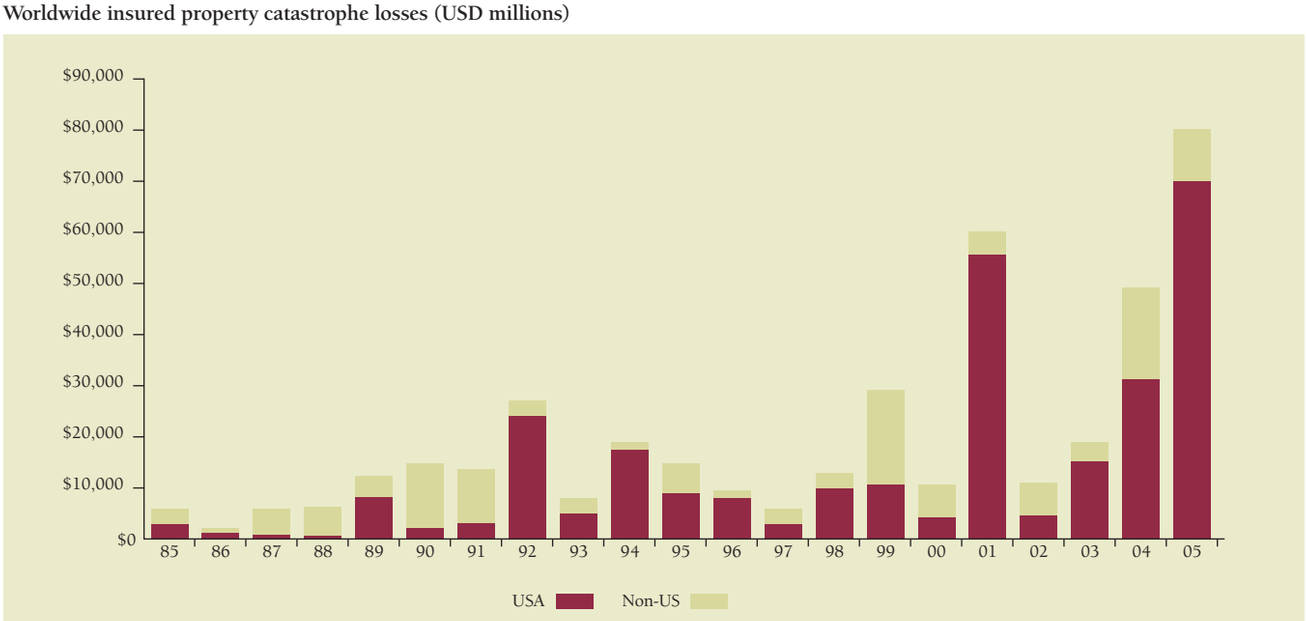
Studies by climatologists have suggested that recent increases in the severity of US hurricanes may be linked to the sharp rises in land and sea temperatures that have been recorded over the past 10-15 years. While land and sea temperatures have increased over the past 100 years, there has been a steep incline in the past 20 years.

Experts also believe that temperature changes influence the increased hurricane frequency that has occurred during the past ten years. Scientists theorize that the frequency of hurricanes is probably related to long-duration changes in the surface temperature of the sea. These changes typically run on a cycle period of 20-50 years. This cyclical event, called the 'Atlantic multidecadal oscillation', is projected to continue for another 10-30 years. These cycles of hurricane activity have been monitored over the past 50 years. Above-normal activity was recorded from 1950 to 1969, followed by below-normal activity from 1970 to 1994. From 1995 to the present, we are witnessing a return to above-normal activity levels.

Impacts of increased North Atlantic storm activity for the insurance industry

For the purposes of rate-making and risk management, insurance companies increasingly rely on the information provided by model-

Worldwide insured property catastrophe losses (USD millions)



Source: Swiss Re, sigma No 2/2006

ling companies. Traditionally, modelling companies have based their forecasts on averages, calculated over a period of 100 years or so. No explicit account was taken of shorter-term phenomena with decadal intervals of higher or lower than normal years of storm activity.

In early 2006, one of the leading modelling companies announced that it was adopting a five-year, forward-looking view of risk for estimating potential catastrophe losses rather than using a long-term historical average baseline in its modelling. This was done to address the company's perception that there is likely to be a period of more frequent and more intense storms related to higher sea surface temperatures in the tropical North Atlantic, and to associated changes in the atmosphere. As a result, the modelling company's US hurricane model will increase modelled annualized insurance losses by 40 per cent on average across the Gulf Coast, Florida and the Southeast, and by 25-30 per cent in the Mid-Atlantic and Northeast coastal regions, relative to those levels derived using long-term 1900-2005 historical average hurricane frequencies.

Ratings agencies have also changed their methodologies as a result of the severe hurricane season. In the autumn of 2005, insurance information company A.M. Best announced that it would continue to use the Best Capital Adequacy Ratio (BCAR), but will update the underwriting risks to reflect the current environment. According to A.M. Best, these changes are not likely to lead to rating downgrades. However, reinsurers are responding to the rating and modelling changes by reducing limits in high catastrophe zones as well as attempting to move exposures to other financial sectors.

Photo: courtesy of Herman Kokojan

Hurricane damage in the Caribbean

Capital comes charging

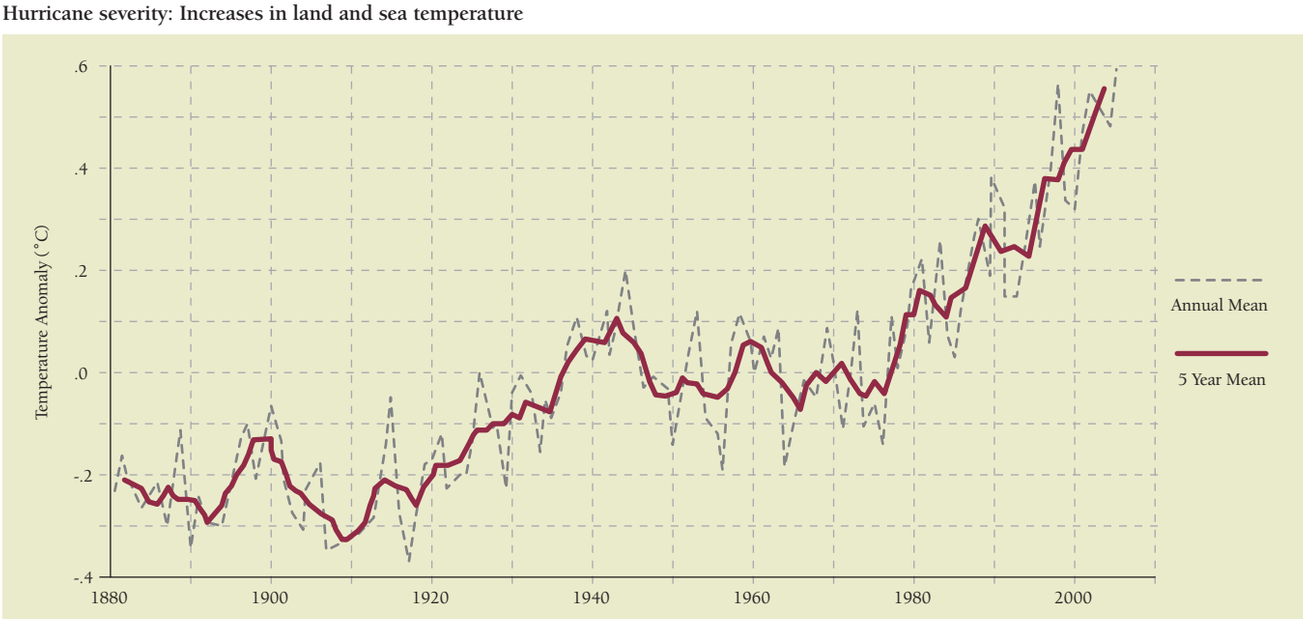
The losses of 2005, compounded by the pressure for more capital from ratings agencies, have led to the need for more risk capital. Capital markets have responded in a dynamic fashion to this need for more risk transfer. For example, within a few months following Hurricane Katrina, the group of 17 top reinsurers in Bermuda had replaced all of the capital lost in 2005. At the same time, capital was forthcoming to finance the start-up of 13 new companies.

Further evidence that insurance markets had attracted the interest of investors can be observed in the increased activity in catastrophe bonds, which directly link investors to insurance risk. In 2005, total issuance was a record USD2 billion, a 75 per cent increase over the USD1.14 billion of issuance in 2004. And this momentum has continued in 2006. In fact, based on our knowledge of transactions completed this year and those in the pipeline, total new issues in 2006 could be double those of 2005.[1]

In terms of less direct investment in reinsurance ventures, following the record losses from Hurricane Katrina, new capital raised for insurance and reinsurance entities exceeded USD20 billion, of which USD8.5 billion went to new start-ups.

Hedge funds increased their presence in insurance markets in 2005, investing in start-up reinsurers and other insurance vehicles, or 'sidecars,' which were brought to the market after the 2005 hurricanes. A sidecar is a special purpose vehicle in which third-party private investors, such as hedge funds, provide extra

Hurricane severity: Increases in land and sea temperature



Source: Goddard Institute for Space Studies, Global Temperature Increases

underwriting capacity to existing reinsurers for property catastrophe retrocession and other short-tail lines of business.

Given the revised outlook for major North Atlantic storms, insurers are seeking higher prices for property insurance in areas of heavy exposure. Rate increases as high as 400 per cent have been filed along the Gulf Coast. In addition, insurers are very closely managing their book of business to avoid over-concentrations of risk.

Insurance markets play a critical role in society by signalling through the price system that costs are reaching unsustainable levels. In parts of Florida, we already see that the price of residential insurance is reaching economically prohibitive levels. The net impact of such price signals, coupled with pressures from emergency managers and environmentalists, is likely over time to reshape basic development patterns along the coastline in exposed areas of the Caribbean, and the Gulf and Atlantic coasts of the United States. Parks and entertainment venues may be expected to take up more of the shoreline, with residential and commercial structures moved back to higher and less exposed land.

While the 2004-2005 storm season was a harsh reminder that the destructive force of nature cannot be stopped, there are ways to reduce its impact by mitigation and intelligent land use. The storms of 2004-2005 can provide the necessary spur to such efforts, overcoming the normal lethargy of the political and regulatory process.

Photo: courtesy of NASA

Hurricane Francis, 2004

Case in point: Long Island[2]

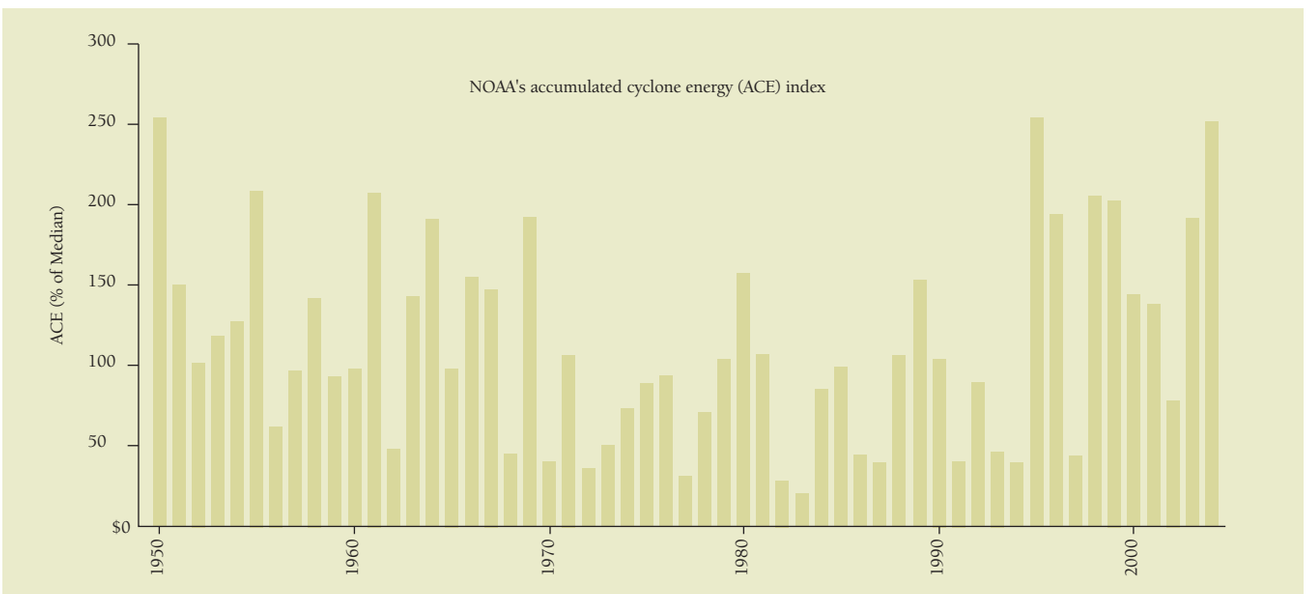
In 1938 a violent hurricane known as the Long Island Express tore through the south shore of Long Island, causing waves up to 50 feet tall and killing 50 people and 750,000 chickens in Nassau and Suffolk counties. Now, instead of chickens, some of the most expensive homes in the US are located in these areas.

In Long Island and New York City, Allstate has been dropping customers while MetLife Auto & Home is restricting new policies in hurricane-prone areas. Premiums are increasing by 20-30 per cent and hurricane deductibles are expected to follow.

Residents of Long Beach are finding it increasingly difficult to find any hurricane coverage at all, and where it can be found it is expensive. Federal flood insurance figures suggest that many residents of Long Island are not protected against a hurricane, although it is thought that another major event of this kind is statistically overdue. Around 40 per cent of households in Long Beach are covered by the federally-backed flood insurance programme, compared with more than 60 per cent of households in many of the metropolitan parishes of New Orleans when Hurricane Katrina struck. Indeed, in many areas of Long Island, the percentage of households with flood insurance falls below 40 per cent. In Freeport, the figure is just over 20 per cent, while in the richer precincts of Southampton it barely reaches 16 per cent.

The damage done by the Long Island Express was limited because of the large proportion of farmland in the area. Now, the 600,000 population of 1938 has grown to more than 2.8 million, while median home values have risen 30 per cent in the past three years to become some of the highest in the US — the cost of a major storm would now be extremely high in both human and material terms.

Decadal North Atlantic hurricane activity



Source: NOAA, *The 2004 North Atlantic hurricane season — A climate perspective*

Taking risk off the backs of the poor: *Afat Vimo* disaster insurance

Mihir R. Bhatt with Mehul Pandya and Tommy Reynolds
All India Disaster Mitigation Institute

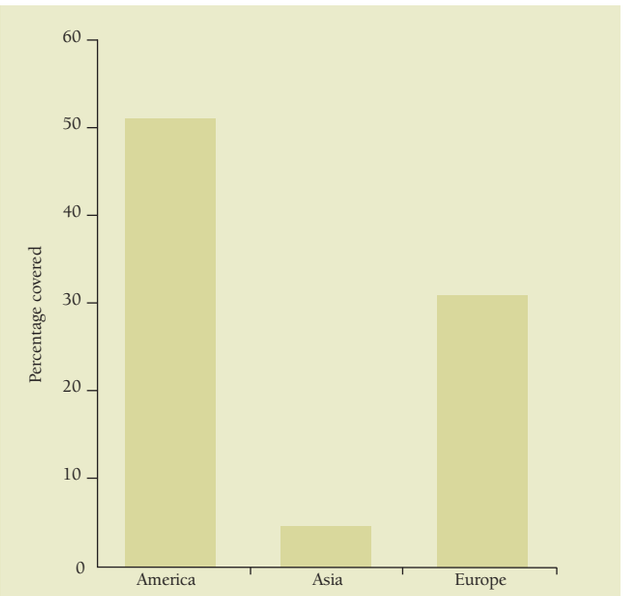
In India, personal, household and small business assets are often unprotected against disasters. Relief and rehabilitation often rely on aid to cover the costs, but support from outside entities is often unpredictable — this makes it difficult to replace the damaged assets of the poor, thus making recovery difficult. Groups that fail to recover are more vulnerable to subsequent disasters.

Insurance covers many losses but is often unavailable to the poor due to the high transaction cost to affordable premium ratio. Microinsurance has emerged in a policy environment that has made recent progress towards disaster risk reduction. Recent insurance regulatory reforms within the Indian Government and the prioritization of risk reduction by the UN ISDR, the ProVention Consortium, and DFID have contributed to the viability and advancement of microinsurance for the poor.

Afat Vimo (Gujarati for 'disaster insurance') was born in this environment as a product of the All India Disaster Mitigation Institute (AIDMI). Demand for the *Afat Vimo* product has been growing, and currently covers more than 5,500 small businesses.

Due to a combination of high exposure to natural hazards and high human vulnerability, South Asia perennially experiences significant losses to disasters. Present studies estimate that more than 90 per cent of the Indian population does not benefit from any kind of social protection.[1] Despite high and steady growth in the country, the cycle of disasters and vulnerability deprives many millions of poor of the human development that might have accompanied such growth. Within Asia, 24 per cent of deaths due to disasters occur in India because of its size, population, and vulnerability.[2] Since 2004 alone, India has faced two major disasters — the Indian Ocean tsunami and the South Asia earthquake. The tsunami killed over 10,000 people in India, and the earthquake over 2,000.

Percentage of 2005 disaster losses covered by insurance



Source: Munich Re (2006). Topics Geo. Annual Review: Natural Catastrophes 2005

Each year, India suffers disaster losses of USD1 billion according to World Bank studies.[3] On average, direct natural disaster losses amount to two per cent of India's gross domestic product and up to 12 per cent of central government revenues.[4] These estimates do not fully include losses incurred by informal sector businesses and workers, which constitute a major proportion of India's economy. The Calamity Relief Fund of the Government of India spends USD286 million towards providing relief to the victims of disasters. Over the past 35 years, India has suffered direct losses of USD30 billion. Losses are also increasing: USD9 billion of direct losses were suffered between 1996 and 2000 alone.[5] The 2001 Gujarat earthquake caused losses of USD2.7 billion.[6] The price tags of the tsunami and South Asia earthquake are surely enormous but are yet to be seen.

Assuming that the impact of natural disasters remains at this level (and many estimates predict an increase), how will India cope, let alone use the benefits of economic development to uplift the millions of poor? Poor countries are the most adversely affected by natural hazards, and the poor within those countries face the greatest difficulties. Their small but important assets are often unsecured, and their financial risks are not spread across insurance markets.

According to the Munich Re Group's Annual Review: *Natural Catastrophes 2005*, the proportion of disaster losses in 2005 covered by insurance were 51 per cent for the Americas and 30 per cent for Europe. Over the same period, only five per cent of losses in Asian countries were covered by insurance. Even within Asia, it is mostly the wealthy that purchase and use insurance.

It has been the experience of AIDMI that the poor, especially the poor amongst disaster victims, are repeatedly exposed to and affected by disaster. Their access to vital financial services is also perpetually restricted. This increases vulnerability to future disaster-induced loss, and impedes sustainable recovery and long-term development. AIDMI has found that for the most vulnerable sectors of society, there is a substantial lack of viable options for reducing and transferring risk. This is true before disasters, but particularly acute during relief provision.

Photo: AIDMI, Gujarat flood recovery 2005

Though insurance can provide immediate cash for replacing essential assets following disasters, the poor are mostly unprotected

Background of *Afat Vimo*

"Microinsurance is the protection of low-income people against specific perils in exchange for regular monetary payments (premiums) proportionate to the likelihood and cost of the risk involved. As with all insurance, risk pooling allows many individuals or groups to share the cost of a risky event."[7]

Microinsurance products are increasingly important for disaster risk reduction. They transfer financial risk from vulnerable individuals to the insurance market. Generally, insurers bundle several hazards in one contract; this allows premiums paid for better-understood hazards to reduce the rates of less predictable ones such as earthquakes.[8] *Afat Vimo* is a version of microinsurance designed for the poor among the vulnerable. It protects people from the impacts of hazards on their assets by providing cash payouts in the aftermath of a disaster. Monthly premiums are paid to the insurance companies through AIDMI.

Afat Vimo promotes learning across insurance companies, authorities, donor communities, and non-governmental organizations (NGOs) to facilitate the convergence of microfinance tools and disaster risk reduction strategies. The *Afat Vimo* scheme represents an innovative approach to risk identification, pooling and transfer, which recognizes the fact that the majority of poor disaster victims have little or no access to risk transfer schemes.

The *Afat Vimo* project has arisen under the Regional Risk Transfer Initiative of the ProVention Consortium; it builds upon the significant work done on risk identification undertaken by the ProVention Consortium through the Disaster Management Facility and Hazard Management Unit of the World Bank and the International Federation of Red Cross and Red Crescent Societies. The main objective of *Afat Vimo* is the convergence of micromitigation and microinsurance as a precondition for effective local, low-cost risk transfer.

Demand for insurance

In 2002, the majority of beneficiaries from Gujarat earthquake relief were still exposed to disaster induced financial losses. Studies including the Gujarat Community Survey of 2002 by AIDMI and ProVention Consortium revealed that access to risk transfer is correlated with sustainable economic recovery among victims.[9] AIDMI found that only two per cent of those surveyed had insurance. As a result, AIDMI designed a microinsurance scheme to augment its ongoing Livelihood Relief Fund activities.[10] The resultant scheme was the product of extensive discussions and negotiations with insurance providers who might be interested in supplying low-premium insurance policies to poor clients. This was a challenge.

Product description and client profile

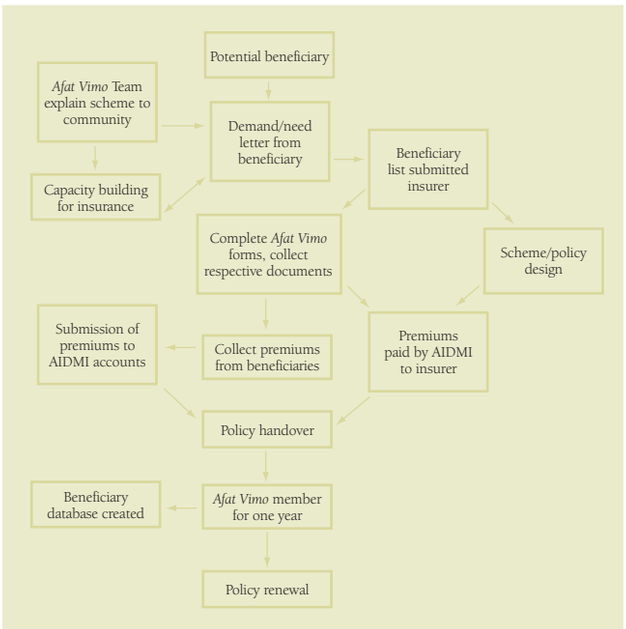
Afat Vimo policyholders are covered for damage or loss up to the value of USD1,744 for non-life assets and USD465 for loss of life — giving a total coverage of USD2,209. Current *Afat Vimo* clients include individuals from low-income households with an annual income of USD280. These households are mainly involved in small enterprises in the informal sector and have assets worth approximately USD209.

Disasters such as fire, explosion, riots, malicious damage, aircraft damage, cyclone, tempest, flood, inundation, earthquake, lightning, implosion, strike, impact damage, storm, typhoon, hurricane, tornado, and landslide are covered under the scheme. *Afat Vimo* policyholders are also supported with micromitigation measures such as fire-safety training, seismic-safe construction practices and business development services. The policy is available for an annual premium of less than USD4 (approximately three days' wages). Damage to policyholders' house, household assets, trade stock, and loss of wages incurred by accidents are covered. The life of the earning household member is also covered.

Afat Vimo is a partner-agent microinsurance model, where AIDMI has brought together a group of poor communities and commercial and public insurance companies have developed a policy to cover them against 19 disasters.

AIDMI is both the facilitator and intermediary of the *Afat Vimo* scheme. Firstly, the *Afat Vimo* team compiles a list of potential candidates eligible for the scheme based on their registered demands. Once the insurance companies have designed operational policies

The *Afat Vimo* operating structure



Source: AIDMI

and premiums have been set, AIDMI reconfirms the beneficiaries on the list and ensures that all the requisite information has been collated and passed to the insurance companies. Once this is complete, AIDMI pays the premiums to the insurance companies on behalf of the beneficiaries, ensuring immediate coverage. Subsequently, the *Afat Vimo* team begins to collect the premiums from the beneficiaries. The process is effective but time-consuming and costly, especially when renewal is optional.

When disaster strikes, the beneficiary immediately informs the *Afat Vimo* team of the occurrence. The team then responds quickly to process the claim. AIDMI assists beneficiaries in filing claims properly. Since many *Afat Vimo* beneficiaries are illiterate or have poor literacy skills, they require this type of assistance. The need to build this general capability among policyholders is recognized. Therefore training is provided to help policyholders understand exactly how they can best use the policy.

Feedback from beneficiaries who have made claims under the *Afat Vimo* policy has been very positive and encouraging. To date, 41 claims have been made, and 23 of these have been successfully settled, giving a combined payout of USD5,635. Of the claims that have been made, ten were for loss of life, 11 for personal accident (some resulting in fatality, others causing loss of earnings), two for house fires, and 18 for damage to property and contents as a result of monsoon flooding.

Success

Microinsurance offers several advantages. It can be a transparent means of providing compensation against damage, and it decreases the need for humanitarian aid. Additionally, it offers those affected by disasters a more dignified means to cope than relying on the generosity of donors after disaster strikes.[11] Microinsurance may also make tracking trends in vulnerability and hazards easier when claims are charted with geographic information systems.

Part of the success of *Afat Vimo* can be attributed to the affordable premium negotiated on behalf of the clients by AIDMI. This puts insurance within the reach of those who otherwise would not be able to access conventional insurance services. Similarly, AIDMI has had a great deal of success in the prompt settlement of claims, which has translated into client satisfaction and a good relationship with the insurance companies. It has also contributed to the good policy renewal rate, which currently stands at 88 per cent. From an original membership of 829 beneficiaries at the launch of *Afat Vimo* in August 2004, coverage has grown to a staggering 5,519 members in only 20 months. *Afat Vimo* policyholders are now spread across several districts in Gujarat, as well as in Tamil Nadu and Pondicherry in South India.

A particular strength of the *Afat Vimo* scheme is its unified policy design. Under *Afat Vimo*, life and non-life coverage are brought

Photo: AIDMI, Jammu and Kashmir earthquake recovery 2005

While 'victims' manage the majority of disaster recovery themselves, microinsurance can help accelerate their efforts

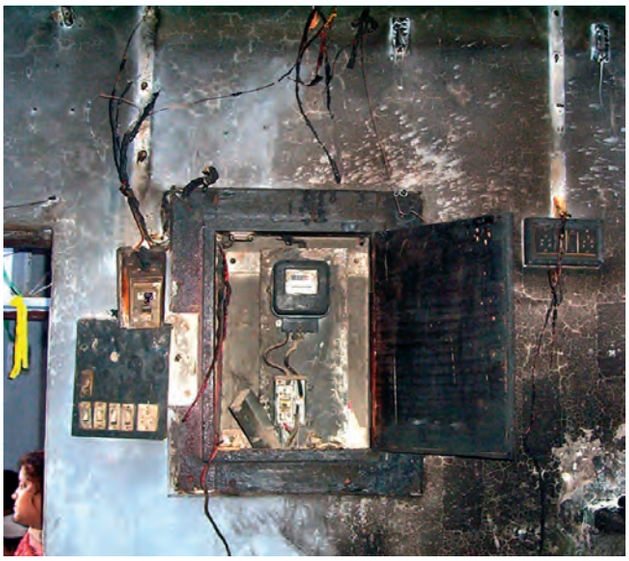


Photo: AIDMI, Gujarat communal riot recovery 2002

The poor face disasters on a day-to-day basis. *Afat Vimo* covers risks that have impact on a small and large scale

together under one policy. According to a recent study by the International Labour Office, 45 per cent of the microinsurance schemes researched cover only a single risk.[12] Only 16 per cent of schemes cover three risks, making *Afat Vimo* one of the most simple and comprehensive products in India. This not only makes the policy more attractive to clients, but also makes investment in it more efficient in economic terms. Another aspect that sets *Afat Vimo* apart from other microinsurance policies is the extensive range of eventualities covered. To combine micromitigation with microinsurance, community capacity building and involvement in *Afat Vimo* has provided more stability and viability.

Reducing an entity's disaster risk is possible through increasing that entity's physical/material, social/organizational, and behavioural/motivational capacities.[13] Using this framework, *Afat Vimo* is successful in reducing community risks to disasters. Physical/material goods are insured and can be replaced after loss and damage; social/organizational capacity is supported as informal businesses are brought together and receive a product unaffordable to individuals directly; motivational/behavioural capacity is built as understanding of risk and disaster issues is increased.

International initiatives have strengthened the impact of *Afat Vimo*. The Hyogo Framework for Action has brought attention, discussion, resources, and commitment to disaster risk reduction and to finding opportunities to address it. The United Nations (UN) Year of Microcredit facilitated commitments via the 'Disaster risk mitigation: Potential of microfinance for tsunami recovery' conference in October 2005. Delegates spoke on the strengths of microfinance as a tool for poverty and disaster risk reduction, and experiences of microcredit and tsunami recovery. The *Afat Vimo* team was able to exchange lessons with other practitioners on its microinsurance product and how microfinance may be used for recovery. It learned about opportunities working with primary stakeholders to combine support grants and microinsurance services, and was able to share progress and opportunities from the *Afat Vimo* experience.

Corporate sector

Increasingly, partnerships with private commercial sector actors are being forged for the application of microfinance and risk reduction. Much can be learned from private sector insurance providers in terms of risk management; they have a wealth of experience that can be shared, and this can facilitate the provision of microinsurance policies for the poor. AIDMI has engaged in a commercial partnership with the Life Insurance Company of India to provide life insurance, and the Oriental Insurance Company to provide non-life insurance cover under the *Afat Vimo* scheme. It also continues to raise awareness of the opportunities and benefits of insurance provision to the low-income strata of communities. There is additional scope within microinsurance to motivate private sector insurance companies to develop and provide products for low-income individuals as initiatives for their own corporate social responsibility.

Challenges

Though defrauding is one of the most common challenges for the microinsurance sector, AIDMI has experienced only one incident of a false claim. Premium defaulting is another challenge, and the retrospective collection of payments from clients can be seen as a threat to the long-term sustainability of the *Afat Vimo* scheme.

At present, AIDMI must absorb all of the operating costs of the programme, and recovers only the premium total from the beneficiaries. AIDMI must therefore shoulder all the administration costs and the costs of premium collection, field visits, supervision and claims assistance. In terms of long-term sustainability, this means that unless the clients meet the operating costs, the scheme is not financially self-sustaining. In addition, there are a number of reasons why beneficiaries do not renew their policies — migration, inability to pay, and low desire to renew are believed to be factors.

On a broader scale, commitment among donors and international organisations should exist for similar risk transfer initiatives to refine and thrive. AIDMI is a core manager of the Tsunami Evaluation Coalition's forthcoming thematic evaluation on "The Impact of Tsunami Response on Local Capacities". Under this initiative, stakeholders in Maldives and Sri Lanka (in April 2006) have clearly identified the need for risk transfer. This need, however, is not articulated broadly and remains latent.

The 2005 Community Survey by AIDMI and the Disaster Emergency Committee identified low levels of risk transfer awareness among communities of India, Sri Lanka and Indonesia. Organisations across the Asian Region should identify and initiate opportunities for similar experiments for transferring risk from the poor.

Next steps

There is clearly scope for additional capacity building exercises designed to impress upon beneficiaries the long-term benefits of insurance coverage and the importance of continued coverage. Additionally, greater emphasis on adherence to the correct procedures for making claims to the insurance companies should

Disasters covered by *Afat Vimo*	Typical loss/damage from disasters in South Asia
Cyclone/hurricane, flood, earthquake, fire, explosion, riot, malicious damage, aircraft damage, tempest, inundation, lightening, implosion, strike, impact damage, storm, typhoon, tornado, and landslide.	Life, income, livelihood assets, household assets, shelter, health, livestock, crops.

Photo: AIDMI, Indian Ocean tsunami recovery 2005

Tsunami recovery is a huge opportunity to transfer financial risks of the poor. Following a major disaster like the 2004 tsunami, people understand the value of insuring their assets

perhaps be made. This would both reduce the likelihood of claims being rejected, and increase client satisfaction.

The *Afat Vimo* scheme has tremendous potential for rapid expansion. Currently, microinsurance coverage under the scheme is only available to communities where AIDMI has presence. Offering a similar policy in earthquake-affected Jammu and Kashmir and tsunami-affected areas is being considered. An emergent area of experimentation and international debate, weather-indexed insurance is being explored as a means of effective management of catastrophic risk, particularly in vulnerable rural areas. Based on a round table meeting with the Agriculture Insurance Company of India and a group of farmers from Kutch, Patan, and Surendranagar, AIDMI will be covering 1,000 small and marginal farmers in June 2006 against monsoon. In addition, AIDMI is about to launch insurance coverage for school children and staff.

Converging interests

In India, partnerships between the commercial sector and NGOs are increasingly emerging for microinsurance provision. Much can be learned from private sector insurance providers in terms of risk management. The impact of *Afat Vimo* has been strengthened through national policies that encourage private insurance companies to provide support to poor clients. The Insurance Regulatory and Development Authority (IRDA) also plays an important role in the provision of insurance to the poor. In March 2002, IRDA published a set of regulations applicable to insurance companies operating in India, entitled *Obligations of insurers to rural social sectors*. Essentially, these regulations establish quotas of insurance provision to low-income clients.

The establishment of such regulations has greatly increased the volume of microinsurance policies being supplied to poor clients. The quota rises each year, reaching a maximum of 16 per cent after five years of the total number of life policies sold for life insurance, and five per cent of premium income for other types of insurance. This condition has generated massive pressure on insurers, as without selling microinsurance they cannot sell their more profitable products. IRDA has fined a number of insurers for failing to meet their targets, but there have also been a number of perceived and reported problems associated with the imposition of quotas.

Pro-poor financial risk transfer initiatives combined with risk reduction measures such as *Afat Vimo* are rare in South Asia. There is a real potential for disaster risk management at community level through insurance. The 2004 tsunami and the 2005 Jammu and Kashmir earthquakes provide a huge opportunity for local institutions to transfer the future financial risks of victims by facilitating access to the microfinance services. However, this is not easy. It needs planning, awareness building, suitable services, and long-term commitment. Convergence of interest and attention from academics, researchers, policy makers, donors, and risk mitigation practitioners along with victim communities is also highly desirable.

Generating the awareness — and building the commitment — to initiate microinsurance costs money, time, and effort. These must be found if *Afat Vimo* is to be suitably resourced. AIDMI welcomes inputs and ideas for recasting and up-scaling *Afat Vimo*, or similar microinsurance schemes, in India and outside.

Obligations of insurers to rural social sectors

Rural areas: more than 400 population per km² or 25 per cent of workers in agricultural pursuits:

- **Life insurance**: 5 per cent of total policies in year 1, up to 16 per cent in year 5
- **General insurance**: 2 per cent of gross premium income in year 1, 3 per cent in year 2 and 5 per cent thereafter.

Social sector: casual workers, economic vulnerable or backward classes in urban and rural areas:

- 5,000 policies in year 1; up to 20,000 in year 5 for both life and general insurance.

Source: Roth, J. et al (2005). 'Microinsurance and Microfinance: Evidence from India,' CGAP working group on microinsurance 'Good and bad practices: Case study #15.'[14]

Microinsurance for natural disaster risks? Insights from a ProVention/IIASA research initiative

Reinhard Mechler, Joanne Linnerooth-Bayer, International Institute of Applied Systems Analysis
David Peppiatt, ProVention

Following the United Nations year of microcredit in 2005, there is growing interest in microfinance solutions to help alleviate poverty in developing countries. Furthermore, with the international community placing more emphasis on disaster prevention, the potential of risk transfer as part of an effective disaster risk management strategy is being explored.

Whereas microcredit and to a lesser extent microinsurance for life and health risks are now widely established, microinsurance to indemnify losses from severe and catastrophic natural disaster risks is only emerging, a major constraint being the nature of disaster losses, which can affect whole communities and risk pools at the same time (so-called covariant risks). Due to the limited experience and specific challenges with such schemes, the ProVention Consortium has been collaborating with the International Institute of Applied Systems Analysis (IIASA) on a microinsurance research initiative.[1] A first outcome of this initiative is an independent review of the potential benefits, viability and limitations of microinsurance as an instrument for transferring risk in developing countries.

Insurance is an established instrument for transferring natural disaster risks by providing indemnification against losses from a disaster event in exchange for a premium payment. Yet governments, households and businesses in poor countries cannot easily afford commercial insurance to cover their risks, or they lack access to such services. Instead of insurance, they rely on family and public support, which is not always forthcoming for catastrophes that affect people throughout a region or country at the same time.

Without support, disasters worsen poverty as victims take out high-interest loans (or default on existing loans), sell assets and livestock, or engage in low-risk, low-yield farming to lessen exposure to extreme events. Many poor people in low-income countries have two or more sources of livelihood, and often they encourage their children to take on jobs in and out of the region to hedge against family disasters. When all else fails, the poor rely on their governments and the ad hoc generosity of international donors, which in the past (with the notable exception of the Indian Ocean tsunami) has often been woefully inadequate to assure timely assistance.

The objective of disaster microinsurance is to provide low-income households and businesses with easily accessible and affordable insurance for loss of life, health expenses, loss of small-scale assets, livestock and crops in the event of a flood, typhoon or other natural disaster. Microinsurance for unexpectedly severe disasters can provide low-income households, farmers and businesses with access to affordable means to spread losses, which will secure their livelihoods and improve their creditworthiness. Also, for many, an insurance contract is a more dignified means of coping with disasters than relying on (or begging for) the generosity of donors after a disaster strikes.

In India for example, microinsurance for sudden-onset disaster risks is offered by non-governmental organizations (NGOs) in conjunction with insurance companies. These schemes build on microinsurance arrangements for independent risks such as unemployment, fire and accidents by extending cover to loss of life, property or livestock due to natural disaster events. Coverage for property losses due to floods, earthquakes, cyclone and other natural calamities is offered to groups such as women with a minimum group size of 250, or to community groups established to manage the impacts of disasters post-event.

Microinsurance can also take the form of index-based weather derivatives. Such pilot schemes have been implemented in India, Malawi and the Ukraine, with other pilot projects underway globally, providing financial protection to farmers against weather risks such as drought. Contracts are written against a physical trigger, such as severe rainfall measured at a regional weather station. Contracts are designed by insurance companies and sold by rural development banks, farm cooperatives or microfinance organizations. Since payouts are not coupled with individual loss experience, farmers have an incentive to engage in loss-reduction measures such as switching to a more robust crop variant. A physical trigger also means that claims are not always fully correlated with the actual losses experienced, but this 'basis risk' may be offset by the reduction of moral hazard and the elimination of long and expensive claims settling.

The review of disaster microinsurance programmes undertaken within the ProVention/IIASA initiative demonstrates the potential of microinsurance schemes for protecting the poor against the consequences of natural disaster shocks, and also reveals significant challenges in making this protection viable. Microinsurance programmes are already providing post-disaster liquidity to poor households, and thus helping to secure livelihoods and facilitate disaster recovery and reconstruction. Yet the long-term viability of these programmes in the face of large, covariant losses and the overarching need to reduce the immediate

human and economic toll of disasters is still to be determined. Reducing disaster-related poverty through microinsurance presents formidable challenges to local, national and international communities.

A major challenge is assuring the financial sustainability of microinsurance providers and at the same time providing affordable premiums to poor and high-risk communities. Many people support subsidies to meet this challenge and caution against shifting responsibility from national or international solidarity to the poor, while others warn against the negative incentives promoted by subsidies. One of the most salient observations of this review is the different roles played by national and international solidarity in supporting microinsurance schemes. India is playing a leading role with its pro-poor insurance regulation, which provides pre-disaster solidarity through a cross-subsidized insurance system. At the international scale, the World Bank is exercising global solidarity through its financial and technical support, mainly for starting up risk-transfer systems for low-income households, farms and governments. At the same time, many microinsurance programmes are providing products to clients, who can purchase protection in the absence of subsidies, and private insurers are optimistic that they can market affordable products.

If microinsurance is to become a welfare-enhancing instrument, an equally challenging prerequisite is its propensity to reduce the unacceptably high human and economic impacts of disasters on the poor. While some schemes embed insurance within a disaster risk management framework, this review has revealed a lack of direct links and incentives on the part of present microinsurance programmes to reduce the direct losses from disasters. This finding is not unique to insurance in developing countries, but it flags a more general concern about integrating risk financing into risk management programmes that combine regulatory and citizen oversight to assure incentives and effective regulations. Sceptics rightly warn that insurance may conversely present disincentives to taking proactive risk reduction measures. Index-based schemes offer a possible exception insofar as a physical trigger minimizes such moral hazard.

Microinsurance is only viable to the extent that private insurers remain solvent following large-scale or sequential disaster events, or that they choose to enter these high-risk markets. If insurers with limited capital reserves choose to indemnify large covariant and recurring risks, they must guard against insolvency by diversifying their portfolios geographically, limiting exposure and/or transferring their risks to the global reinsurance and financial markets. This review shows little transparency or commonalities in the financial backup arrangements of private market providers. Since many programmes are in the start-up phase or have not experienced major disasters, further research is needed to track the performance of existing schemes.

A related challenge is creating partnerships and institutional frameworks that contribute to credible and trusted microinsurance systems. Safety nets for high-risk poor communities cannot be put into place without public-private alliances since no one partner can operate without the assistance of the others: highly exposed and fiscally unstable developing country governments cannot fully absorb the risks; informal community solidarity and family systems are overtaxed by large covariant losses; and private insurers cannot offer low-cost policies given the need for expensive reinsurance and large uncertainties in the projected loss estimates. One of the findings of this review is the creative alliances among NGO/community groups, microfinance organizations, government regulators, entrepreneurs and international financial and donor institutions in pioneering microinsurance programmes.

Of special interest is an emerging new role for donors in supporting these schemes. The Global Index Insurance Facility (GIIF), which is already eliciting contributions from donor institutions, may be a milestone in shifting donor focus from reaction to risk pooling. Coupling the GIIF and other initiatives with disaster loss prevention will require up-front capital, but the outlays may be small compared to the international humanitarian assistance and development finance currently channelled into post-disaster relief, recovery and reconstruction.

For disaster microinsurance to serve as a wide-scale safety net for the poor, the current pilot and fledgling programmes will need to be scaled up to cover the large number of low-income households and farms facing risks from natural disasters. The potential is large, and upscaling is occurring, but there is insufficient experience with current programmes to judge their future viability. The research community can contribute by collecting evidence and eliciting lessons from operating experience. The challenge of disaster microinsurance as a pro-poor instrument, and the many unanswered research issues, will be the focus of continued ProVention–IIASA collaboration.

Photo: Yoshi Shimizu/International Federation of Red Cross and Red Crescent Societies

Microinsurance can help low-income households and businesses protect their assets and livelihoods against disasters

Top of the class! Governments can reduce the risks of disasters through schools

Yasmin McDonnell and Jack Campbell, International Emergencies and Conflict Team, ActionAid

On 8 October 2005, 17,000 children died when 6,700 schools collapsed during morning classes in the earthquake that devastated the northern mountain region of Pakistan. In January earlier that year, 168 countries signed up to the Hyogo Framework for Action, to 'build the resilience of nations and communities to disasters,' at the World Conference on Disaster Reduction (WCDR) in Kobe. Never had there seemed a more timely and urgent commitment.

Of the five priorities for action in the Hyogo Framework, the third states that governments must "use knowledge, innovation and education to build a culture of safety and resilience at all levels." This article focuses on this priority for action and is informed by a review commissioned by ActionAid to document good practice so far.[1] Its aim is to set out a core agenda to enable governments to focus on what they can practically do through education and knowledge to reduce the risks of hazards that their citizens face. The focus is on disaster risk reduction (DRR) through schools — a core priority for ActionAid — but the knowledge management and risk awareness opportunities outside formal education are also considered.

For governments to meet their commitment to the Hyogo Framework third priority for action, they should adopt a three-tiered core agenda:

- Risk and hazards in the national curriculum
- Physical safety and resilience of schools
- Promoting a 'culture of safety' through schools.

The elements of this agenda come from an analysis of current experience, gaps and opportunities. This agenda should guide the creation of national policy on DRR. In working to this agenda, governments will be able to integrate DRR into existing commitments — most notably the Millennium Development Goals (MDGs) and the Education For All (EFA) initiatives.

There is widespread agreement that education must play a central role in making development sustainable. An equal truth, increasingly irrefutable, is that development cannot be sustainable without dealing head-on with the risk of disasters. The Hyogo Framework is perhaps the most important acknowledgement that DRR is an integral part of development — not just a specialists' side issue.

Risk and hazards in the national curriculum

Governments signed up to the framework must consider how their own national curriculum can incorporate teaching on local hazards and reducing risk. Teaching in the classroom about hazards in the local environment is a cost-effective and concrete step governments can facilitate that will have long-term and far-reaching impacts. There can be few other public institutions with greater outreach and potential to educate whole communities than the school. What is more, we are not starting from scratch.

Many countries already benefit from a wide variety of methods for teaching about natural hazards, disaster preparedness and prevention. At the time of the Kobe WCDR, around 40 per cent of countries responding to a UN information survey were reporting some kind of disaster-related teaching in their curriculum.

In Cuba there is a strong history of reducing risk. The national curriculum covers disaster preparedness and response to hurricanes, the most significant local natural hazard. The Cuban Red Cross produces teaching materials and safety messages that are given to children in school, and these are reinforced by what parents hear in training courses and drills in the workplace. In South Africa, without specific reference to disasters or hazards in the curriculum, different initiatives — such as a board game concerning risk — have been developed for the classroom.

The methodology and quality of teaching in different countries on local risks and hazards is highly diverse. However, the foundations are there for sharing pedagogical practice and adapting

Hyogo Framework: Priority for Action 3

Use knowledge, innovation and education to build a culture of safety and resilience at all levels, incorporating:

- Information sharing and cooperation
- Networks and dialogue across disciplines and regions
- Use of standard DRR terminology
- Inclusion of DRR in formal (school curricula) and informal education
- Training and learning on DRR in communities, local authorities, targeted sectors, with equal access for all
- Research capacity
- Public awareness and media

ActionAid's DRR Through Schools project

In Malawi, ActionAid's DRR Through Schools project will galvanize the central Government to promote risk reduction in the school curriculum. The Malawi initiative is part of a pioneering multi-country project in which 15,000 children (and their parents) in 56 schools in high-risk areas will take part. This is a five-year project funded by DFID, and spanning seven countries (Malawi, Ghana, Kenya, Haiti, Nepal, Bangladesh and India).

The purpose of the project is to demonstrate how schools can be made safer so they can act as centres of awareness and action on local hazards and risk reduction. While reducing the vulnerability of the targeted communities themselves, the experience gained on the project will also be used to help institutionalize DRR in the education systems of participating countries, so success can be replicated in other schools and other countries. This project is ActionAid's key initial contribution within the Hyogo Framework.

curricula to use schools as a conduit for physical scientific knowledge to communities, to inform their practical actions for reducing the risks they face.

Governments must make commitments to teacher training and curriculum development to support large-scale teaching of DRR. In centralized state education systems, teaching on locally relevant hazards could be incorporated into existing subjects such as earth science or geography. In decentralized state systems, community-based vulnerability analysis tools can be used to develop teaching methods on hazards and risk from the bottom up — centralized systems should also learn from these tools. Partnerships with non-governmental organizations (NGOs) and the private sector will be key to provide training, resources and learning networks.

Physical safety and resilience of schools

It is the right of every child to be safe in school, just as it is for their parent to be safe at the public library. It is therefore the responsibility of governments to ensure the physical safety and resilience of school buildings. This is not a question of cost analysis: safe schools should be a given.

This can and is being done in some places. The Iranian Parliament recently announced a new bill (after years of campaigning) that will see the improvement in seismic safety (through retrofitting and reconstruction) of 39 per cent of its school buildings with a budget of USD4 billion. This was based on a countrywide review of school safety.[2]

But the startling statistics that emerged from the 2005 Pakistan earthquake expose the urgent need for all governments to face up to their responsibility to ensure disaster risk factors are systematically incorporated into new school building design and location, and in the retrofitting of existing buildings. This, as in Iran, may well require widespread reviews of school safety in the context of local hazards.

The death toll of children in schools in Pakistan is an extreme example, but other cases where poor design or location decisions killed children are too numerous. In Italy in 2002, 26 children were killed when a school collapsed during a moderate earthquake. In Turkey in 2003, it did not take a powerful earthquake to kill 83 children in their building. In the Philippines in February 2006, 200 children perished when a mudslide engulfed their building.

Lessons should and can be learnt. History tells us that they have — albeit sporadically. In the US, a 1908 school fire killed 172 children in Ohio when they were trapped behind inward opening exit doors. This led directly to a Government ruling on mandatory outward opening doors and 'panic-bar' latches on schools and all public buildings — an excellent example of how governments can take a lead in changing practice to save lives.

The MDG and other education initiatives have implications for the number of new school buildings. No special attention is given in these initiatives to disaster preparedness. One estimate proposes that if all EFA initiatives are successful in the 20 most earthquake-prone countries, an extra 34 million children could be exposed to risk while attending school — illustration enough of the need to integrate DRR into existing commitments.

Research finds that simple, cheap changes in building practice would save lives in disasters. But the technical know-how rarely reaches the people. This core agenda not only recommends that governments play a lead role in school building regulation and retrofitting, but also in disseminating public safety messages and bridging the gap between scientific knowledge and practical reality. Policy change and high-tech early warning systems at the national level are one thing; practice change and dissemination of information on the ground is the 'last mile' in disaster risk reduction.[3]

Governments should seek to develop a legal and institutional framework for systematically implementing, monitoring and evaluating school protection. This process should involve stakeholders from all levels.

Promoting a culture of safety through schools

A culture of safety is an environment where everyone is aware of their local hazards and is active in reducing the resulting risks — behavioural change must happen at all levels. Governments must demonstrate commitment and leadership in promoting a culture of safety.

Schools can play an important role in instilling values of safety in community life. Children in the classroom can act as a route for information to families at home. To build a culture of safety at the community level, governments should look to their education system to disseminate knowledge and information.

Photo: Liba Taylor / ActionAid

Children must learn about local hazards and reducing risks in the classroom. They can be a route for taking risk reduction messages to parents and whole communities

Furthermore, disaster risk analysis is not an activity that should be led from the office meeting room. Assessment must happen 'on location' where the risks are faced: in the community. This core agenda suggests the classroom as a prime location for community vulnerability assessment. Participatory vulnerability tools are now numerous,[4] and ActionAid's Participatory Vulnerability Analysis (PVA) tool is one example.[5]

Aside from schoolteachers, local and district civil servants are on the front-line of any 'culture of safety' drive. Governments must consider the training needs of their local and district offices, and must develop an ongoing training programme that will cope with the reality of high staff turnover. The successful completion of the 'last mile' of DRR will rely on this.

A thriving culture of safety cannot rely only on government actions. All children and communities should learn about local hazards and what to do about them, and sometimes schools will not be the most effective way of reaching the most vulnerable. Non-formal education and the role that the media has to play must be considered simultaneously.

On the global scale, the media can set agendas, push debate and spark political will. Governments and NGOs have an ongoing challenge to work with the mainstream media to find the story in disaster prevention and risk reduction, not just response. There are some excellent efforts already. Reuters established AlertNet[6] and has set the benchmark for publishing humanitarian stories and communicating DRR to a wider audience. The key role of local media must not be overlooked. In focusing on reducing hazards and risks in a local context, governments must look to existing local communication channels to disseminate messages.

Governments should establish working groups that link up journalists, academics and NGOs to create a regular exchange of information and resources that bring all to a common understanding of the nature of hazards, the ways different actors can reduce risk and how to communicate this to the public. The public engagement opportunity in times of high-profile response must be better exploited to communicate messages on DRR.

No easy challenge

The 'last mile' is really tough. There are several hurdles that stand between the current situation and the finish line where schools are safe and playing a role in a culture of safety in the community. One major obstacle is political will; with many competing priorities, the case for dedicating resources to DRR must be carefully presented. Another challenge is coordination, or lack thereof, between key stakeholders. Most obviously, work done at policy level — for example the Hyogo Framework for Action — must be put into practice on the ground.

The most vulnerable communities are so often the poorest and least accessible, and the most overlooked. The finish line will have been crossed only when any DRR strategy has reached the most vulnerable. And it is the teachers in these communities who, with their poor working conditions, low pay and lack of support, will be expected to lead any widespread programme on DRR through schools.

Governments have made their commitment to the Hyogo Framework. Now it is time to put words into practice. With this core agenda as a starting point, governments must draw up their own DRR policy agenda and implementation strategy.

This will first mean a revision of the national curriculum at primary and secondary level. Issues of hazards and reducing risk in the local reality must feature in the curriculum in order to reduce the vulnerability of whole communities to disasters. This is not a blank slate — around the world, there is a wealth of experience in teaching practice to draw on, and initiatives such as ActionAid's DRR in Schools project will reinforce the efforts of governments.

Children have the right to be safe in school, and governments are obliged to make systematic efforts to improve the safety and resilience of schools. A safe school can be a safe haven in disasters for entire communities. Building standards for school buildings — both new and existing — must be government-regulated and relevant to local hazards.

A safe school can be a used to instil a culture of safety in a community. Governments should take responsibility for promoting a culture of safety and show leadership. Schools can act as centres for children and parents to assess their vulnerability to local hazards. As is set out in the Hyogo Framework, a culture of safety permeates all levels of society, and is reliant also on local and district government and the media. The training and support of local and district public servants and teachers is fundamental.

Governments are lucky: the steps towards integrating DRR into existing commitments are clearly marked out. The disastrous effects of earthquakes, floods and other natural phenomena will only be reduced once DRR moves into the mainstream public agenda. Reducing risk through education and knowledge — with schools at the centre — is a manageable, tangible way for governments to start. With this core agenda as a foundation that addresses the curriculum, building safety and a culture of safety, governments can now negotiate their own specific targets and objectives with their civil society.

Photo: Gideon Mendel / Corbis / ActionAid

Schools, both new and existing, must be designed and located to be resilient to disaster. Children have the right to be safe at school

Yasmin McDonnell is Policy Analyst and Jack Campbell is Communications Officer on ActionAid's International Emergencies and Conflict Team.

ActionAid is an international development agency with its headquarters in Johannesburg. Its new five-year rights-based strategy, "Rights to End Poverty", tackles head-on the unacceptable truth that poverty and injustice remain deeply entrenched in many parts of the globe. As part of this strategy, ActionAid works in emergency and conflict situations with a long-term development perspective, and is a leading voice on Disaster Risk Reduction.

For more information.visit
http://www.actionaid.org.uk/100261/disaster_risk_reduction.html

Disaster reduction in schools

Manu Gupta and Anshu Sharma
Sustainable Environment and Eco Development Society

A series of catastrophic events claiming tens of thousands of lives in the earlier part of the current decade created considerable concern among Gujarat citizens, leading to rethinking about the disaster risk management systems being followed in the region. The Gujarat earthquake on 26 January 2001 claimed 13,805 lives and amounted to direct losses of over USD3.1 billion. At least 1,884 school buildings collapsed and 5,950 classrooms were destroyed.

The earthquake occurred on a public holiday when the country was celebrating its anniversary of becoming a republic. Schools were closed, and therefore classrooms were empty. However, small contingents of students and teachers who had gathered for public celebrations were buried under falling debris. A total of 971 school children and 31 teachers were killed, while 1,051 students and 95 teachers were seriously injured. The loss of precious young lives through the destruction of schools in disasters has fuelled public demand for safety in schools. The lack of an institutional framework and policy on disaster mitigation became the biggest barrier for any desired change.

This earthquake took everyone unaware. The last earthquake had struck the region almost 50 years ago, and had caused great damage. However, the lessons learnt then were never put into practice, and even the fact that the area is earthquake-prone was lost from public memory. As a result, the town of Anjar, which was rebuilt after the 1956 earthquake, collapsed yet again in the 2001 earthquake.

Photo: SEEDS

The Gujarat earthquake of 2001 devastated school buildings and cost lives

Community participation

One significant outcome was the shift of focus towards community based disaster risk management. Recognizing communities as the first responders in disasters, both the Government and humanitarian agencies began equipping local village communities and urban neighbourhoods against possible disasters. These communities were now directly involved in planning, implementation, monitoring and evaluation at each stage of the disaster management cycle.

Within communities, specific groups such as school students and teachers, women, leaders, construction workers and other 'change agents' became targets for specialized training and capacity interventions. The Government of India, with support from UNDP, initiated the Disaster Risk Management programme, covering 169 multi-hazard districts in the country. This programme has created a strong institutional structure within the current administrative set-up that can respond more quickly to disasters. The recent Disaster Management Act, and the establishment of the National Disaster Management Authority, has not only validated but also institutionalized the process of disaster management in the country.

Schools as pillars of change

Among the various interventions carried out towards disaster mitigation and preparedness, schools responded most earnestly. Teachers and students more often took the lead in taking disaster reduction issues into the community. The Government's Central Board of Secondary Education introduced disaster education into the curriculum for senior classes. The board caters to 900,000 children in schools across India.

Encouraged by the enthusiasm of teachers and students, the Sustainable Environment & Eco Development Society (SEEDS), along with the Gujarat State Disaster Management Authority, designed a pilot programme to promote school safety in the state. For people in Gujarat this was a case of learning and applying lessons from their most recent experience in which they had lost friends and family members. The mutually reinforcing efforts of government, civil society organizations, school community and parents have resulted in the programme gaining significant momentum and appreciation.

In July 2004 an accidental fire at a school in Southern India claimed the lives of 93 children in a few minutes. Six months later, in the devastating Indian Ocean tsunami, more than

Photo: SEEDS

Focus has shifted towards community-based disaster risk management

250,000 children were affected in the five worst hit countries in Asia. These events further highlighted the imperativeness of school safety initiatives.

From lessons to action

Real experiences thus turned into lessons that were quickly translated into action. Both institutional changes and process changes were initiated. The Hyogo Framework for Action provided the direction and tied it in with other interventions in risk reduction. The result was a combination of tools, techniques and mechanisms aimed at promoting a culture of safety in schools all across India.

During 2005 SEEDS, in association with state governments and the international humanitarian community, introduced school safety programmes in four regions across India.

The Andaman School Safety Initiative, covering 40 schools in the Andaman and Nicobar Islands is using the window of opportunity offered by the post-tsunami rehabilitation process. The tsunami experience has brought the international community together in the most unique way. One interesting case of sharing and learning at grassroots level has been the efforts of the Asian Disaster Reduction and Response Network, with support from the Asian Disaster Reduction Centre, Japan. It has brought a famous Japanese folk tale, *Inamura-no-hi*, to be shared in nine local languages in schools across tsunami-hit countries in Asia. The story relates how Goryo Hamaguchi, a village elder in 19th century Japan, saved his fellow villagers from an impending tsunami by burning his rice sheaves, thus attracting people away from the coast. This story is now being shared among school children thousands of kilometres away in the Andaman and Nicobar Islands. Children have begun to overcome their fears by learning about tsunamis and the precautions that are needed for protection.

In the capital city of New Delhi, which has been fortunate not to experience any major earthquakes for a long time even though it lies in a high seismic zone, children learnt about non-structural hazard mitigation. Buildings do not always collapse in earthquakes, but the elements within the building can become potential hazards, injuring or killing people. Non-structural hazard mitigation thus becomes important for safety against small and medium earthquakes that happen much more frequently than large ones. The message on non-structural mitigation taught through simple 'hazard-hunt' forms was picked up by students in schools and shared further with their families at home.

In the north, attention has been focused along the Himalayan belt that was most recently hit by a devastating earthquake in October 2005. The Himalayas are notorious for some of the most devastating earthquakes in history. The 1905 Kangra earthquake has been the worst in Indian history. Since then, many earthquakes have struck the region claiming a large number of lives. In spite of such high risk, physical development in the region has continued unabated without incorporating any safety standards. Building construction is largely un-engineered, haphazard and likely to collapse even in medium-level tremors.

In and around Shimla city, the capital of Himachal Pradesh, SEEDS launched a school safety programme with a four-pronged strategy:

1. Structural retrofitting of school buildings to prevent their collapse in future earthquakes
2. Implementation of non-structural mitigation measures to avoid injuries from falling hazards in schools
3. Education of school management and construction workers on safe infrastructure
4. Preparation of school disaster management plans and training of school communities in immediate response, evacuation and first aid.

In the emerging concrete jungle that continues to develop unmindful of the growing risk, the selected school buildings will serve as models for a safe community.

In this way, the school safety programme methodology piloted in 175 schools in Gujarat state and covering more than 105,000 students is being applied in three other regions of India.

Approach to school safety

Addressing safety in schools has been a challenging process. Schools and the education system in India face heated public debate on the usefulness of the current curriculum and the need to address rapidly changing social and economic realities. Introducing a new subject, therefore, was not always welcome. The programme had to be designed to cause minimal additional stress to students, while sending the message across succinctly in a manner that makes the absorption process natural.

Dr Daisaku Ikeda's proposal, *The challenge of global empowerment: education for a sustainable future*, aimed at introducing environmental education in schools, provided a useful cue in designing the disaster education intervention. The approach adopted was to help students, teachers and school management to learn, to reflect and to empower.

To learn — Students deepen their awareness about hazards and risks through understanding realities and knowing facts. Recent natural disasters have been well documented and shared. These serve as case studies for teachers as well as students. Wherever needed, disasters are simulated with the help of portable models. Curriculum changes strengthen the learning process.

To reflect — Students analyze reasons that have led to loss of life and injury in disasters. They are able to make distinctions in development practices and people's actions that can cause disasters or prevent them. Students connect to their own local communities and families and share their learning with them.

To empower — Students take concrete action towards lowering risks in the environment. Classroom and school exercises are introduced to help them take small definitive actions that can become a precursor to bigger investments for disaster risk reduction. School management prepares school disaster management plans in which roles and responsibilities are identified and rehearsed periodically.

Lessons acted upon

Following the Gujarat earthquake, mitigation programmes in India have been accelerated. The techno-legal regime in the country has been strengthened with the revision of the Indian Building Code (IS1893) in 2002. Disaster management acts have been introduced at state and national level. A targeted urban earthquake vulnerability programme has been introduced in 38 cities that face the threat of earthquakes. Public campaigns have been introduced to build awareness among communities at risk.

But have changes such as these really percolated to the grassroots level? Not necessarily. With limited progress being made to foster partnerships between scientists, governments, civil society organizations and community-based organizations, most lessons learnt are not being translated into actions to the extent one would have desired. Response mechanisms have strengthened, but mitigation is still a big dream. The result: earthquakes such as the one on 8 October 2005, with a magnitude of 7.6 in the Kashmir region, continue to kill large numbers of people and wreak havoc in the daily lives of others.

Fortunately though, unlike the little progress made in other areas, school safety has found quick acceptance among stakeholders in the country. Events that occurred in the earlier part of the current decade and directions provided by the Hyogo Framework for Action have contributed to strong government support through legal and policy instruments that would ensure that current initiatives have the capability to make a definite impact. Civil society organizations have taken up the safety and protection of school children as an important concern in their agendas. Parents and teachers are increasingly voicing their worries about the need for attention in this area.

Over a third of India's billion-plus population is of school-going age. The country is vulnerable to multiple hazards. In order to be able to make a tangible change, at least a decade of sustained effort is required. The success of the programme will lie in promoting policies and programmes, and most importantly in fostering partnerships among stakeholders so that we are able to save every child from the next big disaster.

Photo: SEEDS

Education programmes are helping students to turn lessons into actions

Photo: SEEDS

Public campaigns have been introduced to build awareness among communities at risk

The radio at school: transmitting knowledge and awareness for mitigation of natural risks

María Alejandra del Campo, Psychologist, Argentina

San Rafael is a city in a district south of Mendoza province, on the east side of the Andes mountains in Argentina, which border the entire east side of the province. In this region, a wide range of natural adverse hazards are likely to occur, such as earthquakes, alluvium, drought, Zonda wind, floods and landslides. On account of this, there is a great need to spread a preventive culture throughout the region.

Education is one of the best ways to spread this culture. For this reason, a research project[1] was set up, using closed-circuit radio in a school as an educational tool to transmit knowledge and raise awareness that will enable the identification and mitigation of natural risks. It is a means of knowing about preventive and mitigation measures and what to do before, during and after different events. The project's focus is on risk reduction, which includes avoiding hazards and reducing vulnerabilities.

The project was developed in a school that has its own closed-circuit radio, and included the production of 16 radio microprogrammes involving subjects related to natural risk reduction (earthquakes, Zonda wind, alluvium, and drought).

It was an innovative project for several reasons — there is no data in the region about radio programmes in the past decade produced by teenagers for teenagers, and dealing only with natural risk reduction. Using radio programmes to promote risk reduction among teenagers is a different approach to standard education in disasters. It facilitates links between disaster risks, development and the environment in developing countries by addressing these elements through learning about how to reduce vulnerability. By working to learn how to reduce vulnerability, which is an element of risk, we are working to reduce disaster risk. In this way, development is enhanced, and the environment is preserved against the enormous damages disasters cause. In addition, prevention and mitigation are development functions.

The team chose to produce microprogrammes instead of programmes, because these are no more than 15 minutes long. They are intended for inclusion within a programme or to stand alone in a radio station's programming, and provide an easy way to address specific subjects using the characteristics of the radiophonic genre.

General objectives of the project included:

- To produce 16 radio microprogrammes about natural risk prevention targeted at and with the collaboration of teenagers of a school at the south of Mendoza
- To measure the knowledge on the subject acquired before and after listening the microprogrammes
- To compare the differences in knowledge after time has passed
- To publish the results in local newspapers and web pages.

To address the first objective, microprogrammes were produced by students at the School Luis Federico Leloir, a secondary school, including students from every course together with teachers of social communication. Participants were advised by a group of psychologists specializing in prevention. Nearly 100 pupils, representing almost the 30 per cent of the school's population, were involved in the project. Pupils had the option to participate in workshops that were organized in order to produce the microprogrammes, since these were not obligatory and they were carried out after class time. Each course was in charge of studying and producing a script about one issue related to the main subject, and some pupils of each course spoke in the radio programme.

The workshops included the following topics and activities:

- Radio characteristics
- Radio genres and formats
- Elements of radiophonic language
- Music and broadcasting techniques
- Microprogramme production
- Microprogramme recording
- Microprogramme listening and evaluation of the radio workshop.

To fulfil the second and third objectives, a questionnaire inquiring about knowledge on the chosen natural risks was created. Most of the school students answered the questionnaire before the workshops had started, then again immediately after the 16 microprogrammes were completed, and once more two-and-a-half months later in order to assess the effect of passing time on what was learnt.

Photo: María Alejandra del Campo

Students during a workshop

The micro radio programmes were listened to by all school students during break times and free classes. A competition provided motivation for students to listen: on filling out the questionnaire the second time, students voted anonymously for the most creative programme and the one that had touched them most. In addition, a special event was organized to hand out certificates to students that participated in the workshop as a way of recognizing their work and effort. Teachers also received certificates. Some programmes were jointly listed during this event.

Finally, to disseminate the project, a local newspaper published details about it and a website is being created. In addition, letters and e-mails were sent to different mass media.

Further supporting activities accomplished to reach the objectives included the following:

- Meetings in Mendoza with the team, the mentor, the school principal, and a member of the non-governmental organization Psychologists Without Frontiers
- Visits to the school and the radio
- Bibliographical research to compile special materials about the chosen risks
- Selection of social communication teachers, meeting them, providing teacher training sessions about the risks, and coordinating workshops to prepare the microprogrammes
- Invitation posters to participate in the workshops were placed throughout the school.

Conclusions

Results of the project are being processed. Although we do not yet have exact quantitative results, the first comparison between the knowledge on the subject the pupils had before and after listening to the microprogrammes shows a general increase in knowledge.

In addition, teachers who participated in the project and the team think that the workshops have prompted reflection about risk that is not usual in children as well as among adults. This contributes to raising awareness of the natural risks chosen for the project, and to spread knowledge on disaster mitigation, especially among students but also among teachers, the community radio listeners where the school is located, the students' families, and people with access to the Internet or newspapers.

The project also helps to achieve a better use of the school radio as an educational tool for many subjects. As the workshops are an enjoyable activity, they enable the children to take part in knowledge building, and thus to learn in a deeper way. Further, tape recordings of the microprogrammes are a sustainable practice to introduce material and information about natural risks and their mitigation into school curricula. This practice is cheap and easy to embrace in developing countries especially, where the money destined for prevention is a lot less than is really needed.

What has been carried out so far can be considered the pilot phase. It is sustainable beyond this point because it could be carried out in other schools and new programmes could be produced focusing not only on the natural risk reduction, but also on technological risk reduction.

In order to reduce the impact of natural risks, it is important to undertake in-depth studies about the close relationship between risk mitigation and radio education as an effective strategy to stimulate a preventive culture.

This pioneering idea in this province could motivate the creation of others in the country and around the world, which grows more conscious every day of the importance education has in disaster and risks. Using the radio as an educational tool is a new approach to education on these topics.[2]

Photo: Maria Alejandra del Campo

Students received certificates at a special event as part of the project

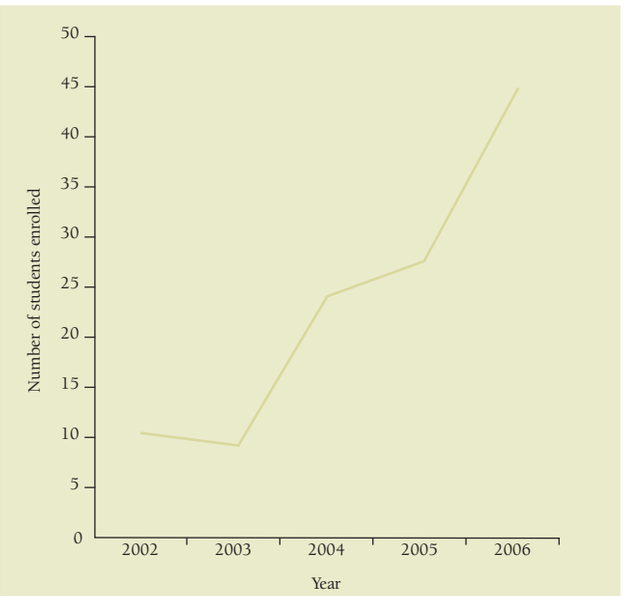
Disaster management graduate training: a contribution towards risk reduction in SADC

A.J. Jordaan, Director, Disaster Risk Management Training and Education Centre for Africa, University of the Free State, South Africa

Disaster management as a formal academic subject is still in its infant phase within South Africa, with only a few tertiary institutions offering it as a graduate course. The promulgation of the South African Disaster Management Act of 2002 (Act 57), and the finalization of the Disaster Management Framework are both regarded as major milestones in the alignment of South Africa's disaster management strategy with international developments.[1] The Hyogo Declaration for Disaster Risk Reduction, adopted during January 2005 by most nations of the world, also supports the new approach of risk reduction as the cornerstone of disaster management in South Africa.

Professional practitioners and academic institutions realized the importance of disaster management as an educational and research topic during 2000. Consequently, at the end of 2000, the South African Qualifications Authority approved the first graduate programme in the subject (a Masters in disaster management). The only formal disaster management tertiary education courses available prior to this were offered at diploma and B.Tech degree level by Technicon SA, and these courses were based mainly on material developed by the United Nations University (UNU).

Growth in first-year student numbers, Masters in disaster management (2002-2006)



Source: Disaster Management Training and Education Centre for Africa (DiMTEC)

During 2002, the first 11 students enrolled for the Masters degree at the Disaster Management Training and Education Centre for Africa (DiMTEC) at the University of the Free State. During the same period, the University of the North-West also instituted two diploma courses (one year and two years) in disaster management through the African Centre for Disaster Studies. This was closely followed by a Masters course at the Disaster Mitigation for Sustainable Livelihoods Programme at the University of Cape Town.

Student profile

The Masters in disaster management offered by the University of the Free State is currently Africa's largest graduate training programme in disaster management, with 91 students enrolled from different African countries. The growth in new student numbers (from 11 students in 2002 to 45 new students in 2006) exceeds all expectations and is proof of the need for disaster management education in Africa. The dramatic growth in numbers during 2006 can partly be attributed to a learnership support programme by the Department of Science and Technology (DST), which supports 15 students with more than ZAR2.3 million for the duration of their course. To date, eight students have successfully graduated from the programme. The remainder of the students continue the process of completing their dissertation component (it has been found that completion of research and dissertation elements is difficult within the prescribed one-year duration).

The importance of graduate training with an African perspective is demonstrated by the demographic breakdown of students enrolled on the course, with 26 per cent being from countries other than South Africa, including Zimbabwe, Swaziland, Zambia, Sudan, Kenya and Angola. Gender equality among disaster management practitioners remains a huge challenge in South Africa, with men taking the majority of disaster management specialist roles. However, with women comprising 36 per cent of enrolled students on the Masters course, this is set to change.

The majority of students in South Africa are employed within disaster management structures at local municipal and provincial government level. More than 60 per cent of these students hold senior middle-management and senior management positions. Only eight of the learnership programme students within the DST programme are full-time students without permanent appointments. Students from other African countries are employed by their home countries' police services, governments and non-governmental organizations (NGOs).

Photo: Courtesy of A.J. Jordaan

Pios Ncube, a member of the DiMTEC team, lecturing risk reduction to local government officials in the Cape

One point of concern is that less than 14 per cent of students undertaking the Masters in disaster management have previously studied in that field. This causes a steep learning curve for students since, where theoretical background is lacking, much additional reading and studying is required to understand the basic principles. About 12 per cent of students enter the programme through the Recognition for Prior Learning (RPL) programme, but with the first RPL students only commencing their research during 2006, the success of this scheme cannot yet be established.

Course content

The Masters degree in disaster management is a part-time, multi-disciplinary, two-year course with a good balance between theory and practice, and with an emphasis on disaster risk reduction theories and strategies. The course consists of eight first-year structured modules, two elective modules, and a dissertation during the final year. Students are required to complete an in-depth scientific research study as the basis for their dissertation. Although not compulsory for qualification, it is also expected that students will publish at least one scientific research paper pertaining to their research.

The part-time nature of the course makes it convenient for students to participate in the programme. Students have to attend a one-week contact session at the beginning of their first year, followed by two more sessions during the end of the first semester, and a final session prior to the year-end examinations. Evaluation is undertaken through assignments (two per module) and examinations (one per subject).

Student feedback on each specific element of the course is obtained from all who participate in completion of that element. Evaluation of these responses shows that most students find the research and dissertation writing element to have the greatest value (it should be noted that student research comes as a culmination of the taught theory, converted into practical application). Beyond this, the evaluation showed no statistically significant difference in value between the structured modules. One significant point noticed, however, is the issue that few students opted to choose options based on quantitative analytical methods, with most students choosing those such as 'Management of Media Relations', and 'Ethnic and Cultural Conduct.'

Analysis of research topics chosen by students shows no specific pattern or specific topic tendency. Research topics undertaken included a focus on the vulnerability of communities for droughts, floods, HIV/AIDS, wildfires (veld and squatter camps), and technological disasters. The psychological effects of disasters, and media management, were also registered. It has been noted, however, that very few quantitative research studies have been registered to date. This is due to a lack of mathematical and econometric skills among enrolled students causing a preference for qualitative research methods. The shortfall in the current process of research project identification has been caused by a lack of collaboration between the National Disaster Management Centre, the provincial disaster management structures and the University.

The future

Critical evaluation of the programme has been undertaken on a regular basis. Feedback from students and disaster management practitioners has indicated the need for change after four years of the programme. Currently, students can specialize by electing two out of the following modules during their final year:

- Trauma management
- Political strategic planning
- Information management
- Ethnic and cultural conduct
- Management of media relations
- Environmental risk and impact assessment
- Disaster vulnerability and risk assessment.

An assessment by alumni and disaster management practitioners in South Africa and Africa showed the need for the development and inclusion of the following electives in the programme:

- Technological disasters
- Public/project management
- Conflict management/civil wars/civil strife/peace building.

The restructuring of some current modules is also under review, with a view to increasing the emphasis on subjects such as mass behaviour and health-related issues (such as HIV/AIDS). The challenge remains to ensure that the course stays relevant, in compliance with international standards, and with a focus on African issues.

The continuous growth of disaster management as an academic subject can be expected, as can an increase in demand for research-based training. A proposal to implement a research-based Masters degree is already being prepared, and the university should be able to register the first students for this degree from 2008. Students enrolling will be required to complete a full thesis, with a greater emphasis on research than is required by the current structured course.

Role players in South Africa, such as universities, research institutions, and the private and public sectors, need to combine and coordinate their resources to produce a focused and efficient research programme that will support the country's commitment to risk reduction. The biggest challenge for the DiMTEC programme during the next few years will be to ensure that relevant research provides answers for Africa's disaster problems, and as a result better collaboration with United Nations organizations, NGOs, governments and the private sector in Africa.

Institutional policy: a concept for integral risk management

Walter J. Ammann, Swiss Federal Research Institute WSL

Over recent decades it has become increasingly likely that natural hazards will lead to catastrophic consequences. While developed countries are mainly affected by damages to material assets, developing countries suffer the loss of 80,000 to 100,000 lives per year due to natural hazards. Factors contributing to an increase in damages and victims are widespread. At the same time, it is difficult to assess the increasing danger of a cumulative risk, especially with regard to critical infrastructure or the influence of global climate change. Natural hazards constrain the use of available living space, which in turn imposes social costs. The limitations are most easily observed in areas where space for settlements, transport and other requirements is clearly limited by the terrain. Reducing disaster risk is of vital importance, especially for developing countries. Sustainable development and poverty reduction have to go hand-in-hand with disaster risk reduction strategies.[1]

To be able to make effective and efficient decisions for disaster risk reduction and mitigation measures leading to transparent and comparable results in different risk situations, a consistent and systematic risk management approach — hereafter referred to as 'integral risk management'[2] — has to be followed. The process contains a systematic framework for risk analysis and risk assessment procedures, finally leading to consistent decisions and an optimized, cost-effective and efficient integral planning of measures.

Risk-based management, rather than a purely hazard-related approach, is key for the future. Dealing with natural hazards involves contradictory requirements when technical, social, economic, and ecological aspects have to be balanced. Aside from risks caused by natural hazards, there are numerous other risks such as technical, ecological, economic, social or political ones. The safety and protection of the people and of private and public goods have to be taken on with this knowledge, and achieved in a sustainable manner.

Risk and safety

In the public perception, risks due to natural hazards are seen differently from ecological, technical or social risks. Conflicting security philosophies do not help to reach consensus on integrated balanced measures. Different ways in which people perceive risks have an important effect on how they will accept any measures that are imposed. A strategy for protection from natural disasters has to find a way to put various risks onto a common scale to allow for comparability and to serve as a platform from which measures can be agreed upon. Any risk to humans and the environment must be considered within the context of social, financial and economic consequences and increased interdependencies between the various risks. The way a society handles questions of safety and security may be summarized by the term 'risk culture', which emphasizes that insecurity can only be controlled by risk-oriented thinking.

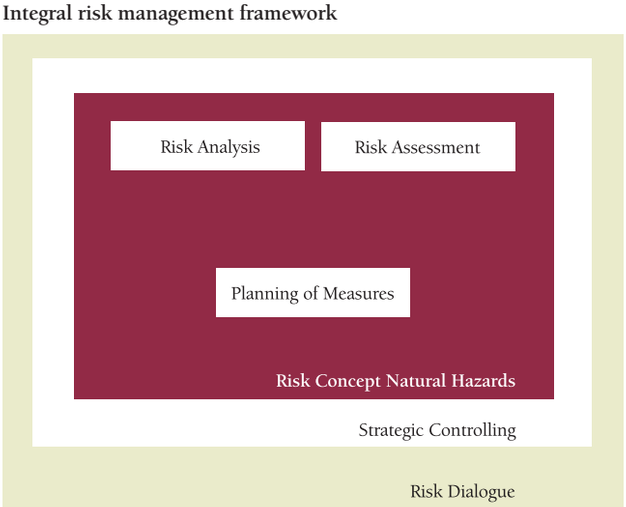
Risk governance looks at how risk-related decision-making unfolds when a multitude of stakeholders or actors is involved, requiring coordination and possibly reconciliation between a profusion of roles, perspectives, goals and activities. The actors' limited problem-solving capacities call for coordinated efforts even beyond the countries' frontiers, sectors, hierarchical levels, disciplines and risk fields. Good risk governance stands for transparency in decision-making, effectiveness and efficiency of measures, accountability, strategic focus, sustainability, equity and fairness, respect for the law and the need for the solution to be politically and legally realizable as well as ethically and publicly acceptable.

An integral and holistic approach to disaster risk management also means that all risks due to natural hazards have to be considered within the context of risks with technical, biological or socio-political origins. Integral risk management and good risk governance are complicated by the fact that many risks faced by people today are not isolated, single events with a limited extent, but are often transboundary risks affecting countries with different political systems and coping strategies.

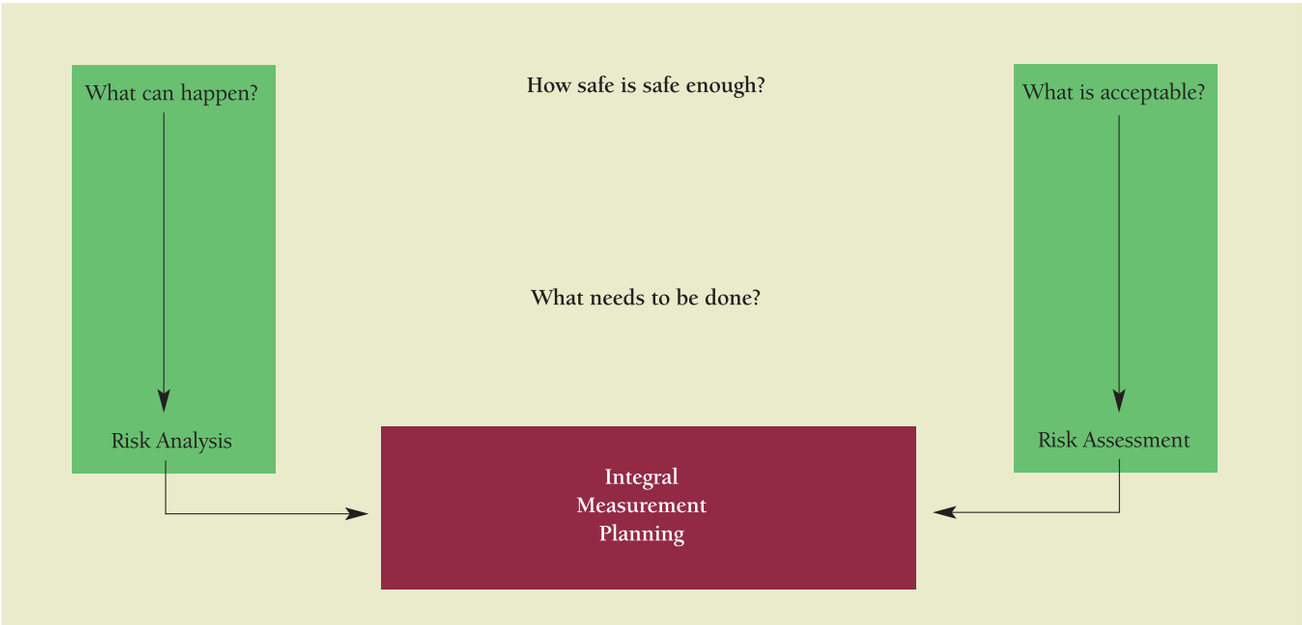
Integral risk management

Risk management begins with the identification and analysis of a risk, followed by risk assessment and the planning of

Integral risk management framework



Necessary steps for risk analysis, risk assessment and integral planning of measures



measures. The underlying objective for risk handling is to plan and implement protective measures. The main criterion for choosing protective measures is cost-effectiveness. To efficiently put this ambitious concept across, a common basis of understanding is needed, consisting of the following:

- A risk-oriented approach and methodology for dealing with uncertainties, applying to both the analysis and the evaluation of risk
- The limits of safety efforts versus the expectations of civil society
- The various points of view, attitudes, and values of all stakeholders involved and affected by the risk
- Disaster risk prevention and mitigation measures must take the whole set of pre- and post-disaster measures into consideration, as well as measures during the event itself or risk transfer by insurance
- The need for dialogue and communication, not only in conveying bald facts and conducting dialogue, but also to ensure the participation of all stakeholders, when setting limits for protection and defining the processes of decision-making. Risk communication can have a major impact on a society's level of preparation and reaction to crises and disasters
- All solutions must fulfil the criteria of sustainability, i.e. a sustainable means of disaster risk management has to be a socially, economically, and environmentally balanced approach.

Integral risk management also needs a strategic and systematic control process, including periodic evaluation of the risk situation and a comprehensive risk dialogue between all stakeholders.

The risk concept

In order to compare different types of natural hazards and their related risks and to design adequate risk reduction measures, a consistent and systematic approach has to be established, from here on called the 'risk concept.' This represents the methodological base for an integral risk management and for the decision-making process of risk reduction and mitigation measures, and serves as a transparent base for risk dialogue between all stakeholders. The basic principles of the risk concept can be summarized by the following key questions:

- How safe is safe enough?
- What can happen?
- What is acceptable (to happen)?
- What needs to be done?

The question: 'What can happen?' has to be answered by a risk analysis procedure, while the question: 'What is acceptable?' Is answered through risk assessment. The goal of a risk analysis is the most objective identification of the risk factors for a specific damage event, object or area. In answering the question of what can happen, a variety of influencing factors need to be considered.

Risk assessment aims for an explicitly subjective answer to the question: 'What is acceptable (to happen)?' by asking how big a residual risk can be handled. Risk assessment is by nature very complex, and has to deal with the fact that risk is a mental construct. One important aspect is risk aversion towards events with great extent. The total effects of a large event rise disproportionately, as does the wish to prevent it.

Acceptance of a risk also depends on whether or not it is taken by choice. Risk categories are defined to the extent of self-reliance being deployed. The assessment is closely coupled with protection goals, a set of criteria for the implementation of the primary goals of all efforts to improve security as they are being used for operational risk assessment — especially if the question is how far the measures should go. The marginal costs of safety measures, representing certain expenses per avoided fatality or per saved human life, have proven to be the most useful protection goal.[3] Safety measures for the protection of people can be increased until that level is reached. Determining the marginal costs can lead to the misunderstanding that a price is being allocated to a human life. But the criterion of marginal costs makes it possible to save as many lives as possible within the limitations of available means and resources.

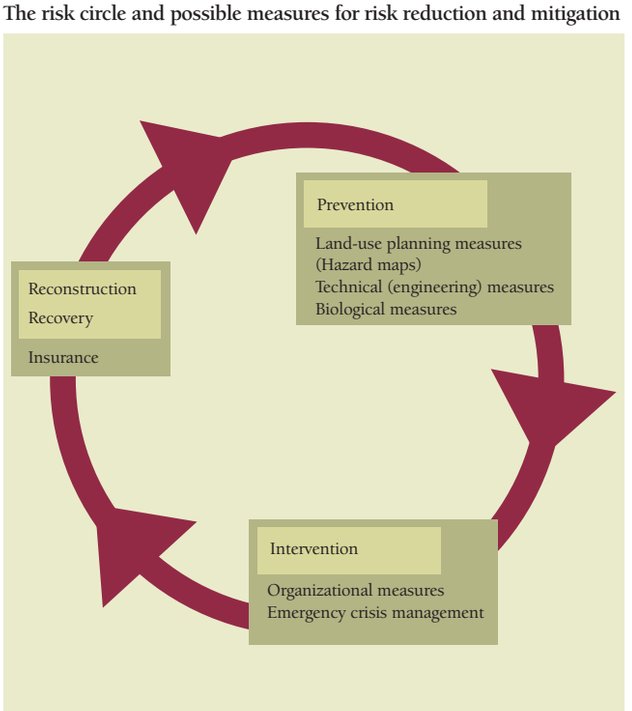
Necessary steps for risk analysis, risk assessment and integral planning of measures

Risk Analysis	Risk Assessment	Planning of Measures
• Hazard analysis – Event analysis – Effect analysis • Exposure analysis • Impact analysis (vulnerability analysis/robustness) • Risk estimation and risk description/visualisation	• Protection goals – Life risk - Individual risk - Collective risk – Assets/material damage • Risk categories • Risk aversion	• Risk-cost-relationship • Marginal costs • Integration of all possible measures • Comprehensive assessment of all measures

The planning of measures serves to identify and assess those measures that are necessary and appropriate to reach the protection goals. The main function of integrated measures planning is to achieve the intended level of safety for agreed limits in the most cost-effective way. Organizational, technical and biological protective measures must be planned, checked for effectiveness and undertaken in concert, while keeping in mind that prevention, intervention and reconstruction are all equally valid risk management measures. Further criteria such as sustainability, acceptability, feasibility and reliability of solutions must also be kept in mind.

Safety measures always come along with 'side effects,' the most obvious of which is the financial aspect. But aspects of ecology, of landscape protection or of land use planning can be of equal importance. The optimal coordination of all measures has to consider all relevant aspects, and all activities in the field of disaster risk reduction must obey the principles of sustainability. Measures need to be environmentally sound, consider societal preferences and be cost effective. Further, disaster risk reduction must be part of the sustainable use of natural resources and of sustainable development, and is therefore considered a cross-cutting issue.

The risk circle and possible measures for risk reduction and mitigation



The socio-political aspects of sustainability are a question of development and welfare priorities and have to be seen in context with other targets such as education or healthcare. Especially in developing countries, reallocation of resources is often needed after major catastrophes for recovery purposes — resources that were allocated originally for use in, for example, investments in education, health care or welfare. A political balance between long-term investments for prevention and short-term measures for intervention and recovery is therefore needed.

Risk dialogue and strategic control

Integral risk management not only dictates that measures are planned, assessed and applied in accordance with the risk concept, but also that all those who are involved and affected are included via a comprehensive risk dialogue, in the process of planning protection measures. Risk communication and risk dialogue with all stakeholders and the public have to start very early. They will be dominated at the beginning more by questions than answers, and by processes rather than solutions. A continuous, comprehensive risk dialogue is therefore of vital importance, thus transforming risk management to become transparent, understandable and a matter of public trust. Active information and communication plays a dominant role in crisis situations — a well-informed public will sustain a catastrophic situation much better and the risk of panic and long-term damage can be limited.

A strategic control process periodically checks the risk situation and the costs and benefits of measures, as well as monitoring residual risks. Integral risk management shows, through the basis of the risk concept, how the underlying aims can be reached with corresponding technically, economically, societal and environmentally justifiable protection measures.

Outlook

Numerous uncertainties can increase risk in the future. Among the most important factors that have to be considered, monitored and periodically checked are globalization, mobility, vulnerability, the spread of populated areas and the increase in their value, sensitivity (through increasing economic interdependencies), international leisure activities, socio-political changes and changing climate and weather patterns. Developments in the hazard and risk process flow must be followed carefully and the potential for optimization exploited. For the future, the challenge will be constant change: new risk scenarios, new hazards, climate change, new social-political conditions, etc. Strategies for dealing with risks due to natural hazards will therefore have to be adapted periodically.

Australia's aid programme: promoting effective disaster risk management in the Asia Pacific region

Australian Agency for International Development

Developing countries in the Asia Pacific region are highly vulnerable to a range of natural hazards, including cyclones, floods, landslides, droughts, volcanic eruptions, earthquakes and tsunamis. Investment in disaster risk management for vulnerable communities is critical to protecting hard-won progress towards poverty reduction and sustainable development.

The Australian aid programme, administered by the Australian Agency for International Development (AusAID), assists governments and communities in the Asia Pacific region to develop their own capacity to reduce the impact of hazards. Australia supports a holistic and integrated approach to disaster risk management within the context of poverty reduction and sustainable development. This approach respects the central role that local communities and all levels of government have in managing risk; addresses multiple hazards; incorporates disaster prevention, mitigation, preparedness and response activities; and integrates disaster risk management into national development planning.

Photo: Kellogg Brown & Root Pty Ltd (KBR)

Living with floods is part of Vietnamese life on the floodplains

Australian support for disaster risk management is provided at several levels:

Community and national level — Through various bilateral programmes strengthening the capacity of local communities and national disaster management offices to prevent, mitigate and prepare for the effects of hazards; and cooperation agreements with five Australian non-governmental organizations (NGOs) to develop their emergency response capacity and foster indigenous disaster risk management in the Asia Pacific region.

Regional level — Through support to the South Pacific Applied Geoscience Commission (SOPAC), the Asian Disaster Preparedness Centre (ADPC), the Australian Red Cross and other regional efforts to promote community-based disaster management, strengthen monitoring and warning systems (including for cyclone and other severe weather events, climate and sea level, and tsunamis), analyse the humanitarian and developmental benefits of investment in disaster risk reduction activities and improve the implementation of laws which facilitate international disaster response.

International level — Through support to several United Nations agencies and the Red Cross/Red Crescent Movement.

An excellent illustration of Australian aid programme support to strengthen disaster risk management within the Asia Pacific region is provided by Australia's assistance to Central Vietnam.

Implementing a holistic and integrated approach to disaster risk management in Central Vietnam

The combined pressure of poverty and the annual threat of floods and typhoons in Central Vietnam present significant development challenges. It is common for more than 20 per cent of the population to be living below the poverty line in many areas.[1] The region also has a topographical and climatic environment that is vulnerable to rapidly rising floods and intense typhoons.

Poor families in rural areas are particularly vulnerable to the impacts of natural hazards because they have limited capacity to absorb the loss or damage of their dwellings, livestock and crops. Similarly, poor families in coastal communities are vulnerable because the loss of fishing vessels results in long-term debt, a situation which is sometimes exacerbated by the death of the main breadwinner.

Central Vietnam is also experiencing rapid industrial and commercial development. Unplanned development has the poten-

tial to worsen disaster risk with wide-reaching impacts on other coastal and floodplain communities. Forest clearing in the hills behind the narrow coastal plain is likely to increase runoff volume, speed and sediment load, with subsequent implications for river flows. Indications of these factors were seen in 1999 when a typhoon and floods in Central Vietnam caused almost 800 deaths, made 55,000 people homeless and caused over AUD500 million in damage.[2]

Quang Ngai Natural Disaster Mitigation Project

In order to reduce this negative impact of natural hazards on poverty reduction and sustainable development, AusAID is supporting improved disaster risk management in Central Vietnam, reflected by the AUD15 million Quang Ngai Natural Disaster Mitigation Project (QNNDMP) in addition to other recent initiatives.

The QNNDMP is jointly funded by AusAID (80 per cent) and the Government of Vietnam (20 per cent).[3] The overall objective of the project is to reduce risk and improve the long-term poverty reduction and sustainable development prospects for a community that in the past has been severely affected by typhoons and floods. Implementation of the project commenced in February 2003, and will be completed in early 2007.

The concept and design stages of the project included extensive consultation with the community, local politicians and government agencies to assess the specific challenges to be confronted by the project. This consultative approach was fundamental to the ongoing success of the project.

Based on risk assessment and community consultation, the following key project components were established:

- A river basin management plan that uses floodplain modelling to inform planning decisions and catalyse community understanding and agreement
- A community-based disaster risk management programme which promotes understanding of the risks of natural disasters and strengthens prevention, mitigation, preparedness and response capacity in vulnerable communities
- Demonstration infrastructure works including riverbank protection, surge control dykes and a safe harbour for some 350 vessels.[4]

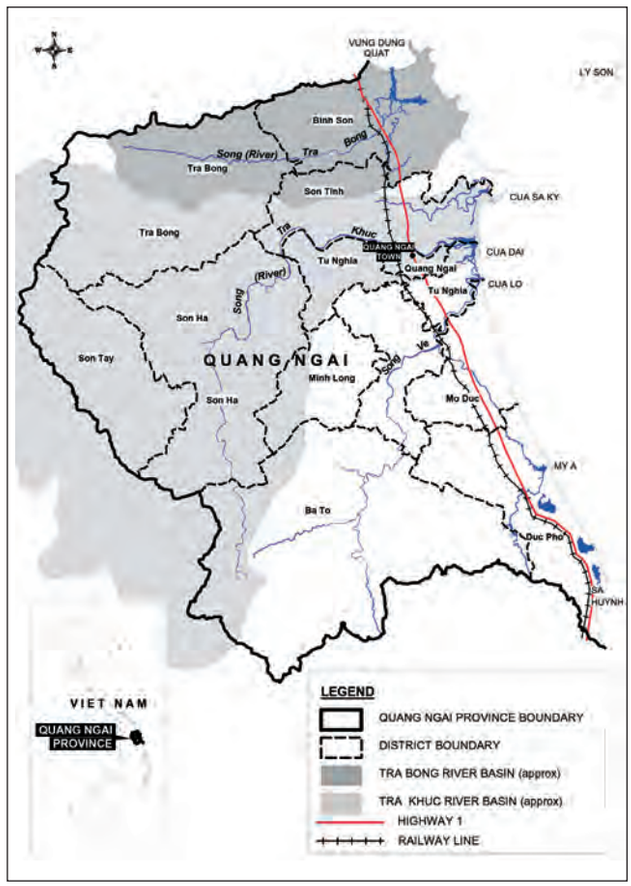
The QNNDMP adopted a holistic and integrated approach to disaster risk management. The project works with the provincial government and technical agencies as well as with communities. It combines land use management planning, community capacity building and risk reduction activities with structural measures. The project provides sustainable benefits by building community capacity through methods including information delivery, skill development and asset provision.

Recent high profile recognition of the lessons learned from the QNNDMP suggest that this approach to disaster risk management could become a model for wider application in Vietnam. Lessons learned from the QNNDMP will be integrated into AusAID-supported projects at the community level, such as World Vision's community-based disaster risk management project in Quang Ngai, as well as at the national level, such as the World Bank's natural disaster risk management project in Vietnam.

Innovative and successful outcomes

Several innovative and successful outcomes have been achieved by the QNNDMP:

Map of Quang Ngai Province, highlighting the two northern river basins where the QNNDMP commenced



Source: Kellogg Brown & Root Pty Ltd (KBR)

Modelling as a catalyst for agreement on planning — The QNNDMP introduced floodplain modelling to foster understanding of the natural disaster risks associated with development planning. Computer modelling was used to assess the nature of flooding across wide floodplains and to examine the potential effects of proposed development scenarios, including floodplain filling, roads and flood protection levees. The outcomes provided the foundation for planning decisions and community and political discussion and agreement.

The ability of the model to generate easily understandable outputs proved invaluable in the consultation processes for development of the floodplain management plan. Despite the fact that stakeholders were initially unfamiliar with some of the concepts illustrated by the model, a solid understanding was quickly developed by using the model to illustrate critical issues. By viewing modelling results, community leaders became aware of the nature of flooding beyond their local area and developed an understanding of floodplain management requirements. Open meetings and model demonstrations developed a common understanding between communities, politicians and government agencies and facilitated agreement on criteria for floodplain management and planning decisions.

Community-based disaster risk management — The QNNDMP has implemented a range of successful community-based disaster risk reduction initiatives which may be applicable to similar programmes elsewhere:

Commune risk reduction plans have been developed for particularly at-risk communes. This involved working with

Photo: Kellogg Brown & Root Pty Ltd (KBR)

The schools safety programme has been enthusiastically taken up by teachers and the provincial Department of Education and Training

commune leaders and other personnel to understand the risks, with the aid of the flood modelling presentations and maps, followed by on-site planning and implementation of risk reduction measures.

Personnel from local organizations, particularly the Vietnam Red Cross and the Women's Union, were trained in community risk assessment and disaster mitigation and preparedness. These people then worked with and trained appropriate personnel in each commune.

Rescue equipment and training have been provided to local groups, and inter-commune and inter-district competitions have created mutual support opportunities. Rescue training includes swimming classes, which are of particular relevance to females who traditionally have not been accustomed to swimming due to social factors. A Red Cross Rescue Centre is being built in one district, providing a possible model for other districts.

A schools safety programme was implemented. This involved teaching over 800 primary school and kindergarten teachers about the dangers of floods and appropriate safety measures. These teachers, with the support of project-provided educational materials, have now taught over 60,000 children. The number of children drowning in recent floods has substantially declined. The schools programme will be applied in another AusAID-supported community-based disaster risk management project, to be implemented by World Vision in neighbouring inland districts.

Safety consciousness has been raised in fishing communities through a communications programme followed by specific initiatives, including the subsidised sale of quality lifejackets. These activities have been undertaken through the existing Fisheries Extension Centre of the Department of Fisheries.

Community-based radio stations were established in five fishing communes. Operators were selected by the commune based on their previous experience as a fisher and their standing in the community. The operator interprets weather forecasts and provides regular advice and warnings to fishers. Fishers are also able to maintain contact with their community. The operational cost is supported by small, voluntary contributions from each of the participating fisher households. Recent rescues using the facility have resulted in national media coverage and a request to extend this initiative to other coastal districts in the province.

Sustainable disaster risk management capacity

The successful partnership between the implementation team and the province has been highlighted by the Provincial People's Committee request for training in modelling and the establishment of a Centre for Management and Mitigation of Natural Disasters. Such a permanent establishment, within the current agency of the Flood and Storm Control Committee, suggests a strong commitment to sustainable implementation of disaster risk management in terms of prevention, mitigation, preparedness and response.

The Centre for Management and Mitigation of Natural Disasters will be the focal point for:

- Use of the developed floodplain models for ongoing review of floodplain master planning, land use and development approvals
- Community-based risk management education and consultation
- Inter-agency cooperation and training on disaster management
- Communication with agencies, district and commune leaders and the public on disaster management
- Emergency planning and management during natural disaster events.

Effective disaster risk management

The holistic and integrated approach demonstrated by the QNNDMP suggests some important elements that contribute to successful disaster risk management programmes in the context of poverty reduction and sustainable development. These include:

- Support for the central role of local communities and government in managing risk
- Integration of structural, non-structural and community-based elements as well as prevention, mitigation, preparedness and response activities
- Consideration of multiple hazards and the interrelationships between different geographical regions in terms of hazard behaviour, institutional governance and the structural, non-structural and community-based elements of the initiative
- Integration of disaster risk management considerations into medium and long-term development planning to prevent and mitigate disasters in countries where development is occurring at a rapid rate
- The use of modelling to integrate structural, non-structural and community-based elements, focus disaster risk management and development planning and catalyse political, government and community understanding and agreement
- Capacity development of both technical personnel and community leaders.

Australia's aid programme is committed to promoting these elements of successful disaster risk management by supporting governments and communities in the Asia Pacific region as they develop their own capacity to reduce the impact of natural hazards and protect hard-won progress towards poverty reduction and sustainable development.

Building local resilience for community transformation in three Latin American countries

Melisa Bodenhamer, Maria-Luisa Interiano and Carolyn Rose-Avila, World Vision

In 1998 Hurricane Mitch, one of the deadliest Atlantic storms in history, devastated much of Central America. Mitch caused catastrophic flooding and landslides — ecosystems, infrastructure and watersheds were devastated. Mitch's devastation included:

- 6,000 deaths; 1.5 million people affected
- 35,000 houses were destroyed and 50,000 were badly damaged leaving 441,150 people homeless
- 70 per cent loss of GDP (USD5 billion)
- More than 70 per cent of roads damaged, 63 bridges destroyed.

Alongside the worst of its effects, Mitch revealed the real vulnerability of local communities to disaster. In the void left in the wake of its damage, important questions emerged. Why had communities not been more prepared and organized to respond to the disaster, and how could Mitch have destroyed decades of development investment in a matter of hours? Unavoidable questions were:

- How could disaster preparedness and mitigation have been better integrated into development work to reduce the toll Mitch took on communities, their environments and livelihoods?
- What could communities have done themselves to be more resilient before Mitch happened?

These questions gave birth to a unique initiative that has sparked a change process in Latin America. The questions and their programmatic response — including the Central American Mitigation Initiative (CAMI) and one of its successors, the Community Emergency Response/Disaster Mitigation (CERDM) project — catalysed a process that has extended beyond the scope of traditional disaster-related fields, influencing human resources, overall agency policy, and programmatic approaches. CAMI and CERDM transformed World Vision's (WV)[1] approach to development and prompted change at a fundamental level within participating communities to proactively address their development and disaster issues, and make and enact plans to build their own resilience.

The communities that participated in CAMI and CERDM continue to grow in awareness and capacity. Many feel ready to withstand a major disaster, and some demonstrated their newly-built resilience through Hurricane Michelle.

Disasters of varying magnitudes occur regularly throughout Latin America and the Caribbean. Over time, community resources become eroded, making it increasingly difficult for communities to break the cycle of poverty. Communities are faced with the ongoing challenge of development while trying to deal with frequent disaster events. When a disaster occurs, community resources can be destroyed or depleted by the response. For example, a flood or hurricane may destroy a community's crops, resulting in lack of food and income. This may worsen existing problems such as malnutrition and debt. The community's development process is seriously disrupted and set back, and the end result is deepening poverty.

Many communities realize that action is necessary in order to lessen the impact of these cyclical events and the resultant deepening poverty, but they lack the experience, knowledge and organization to address them. Their financial and other resources are limited. Within this context, WV identified the need to implement a community-based emergency response and disaster mitigation programme in its Area Development Programme (ADP) areas.

After Hurricane Mitch, 81,224 people in two World Vision Honduras (WVH) regions were affected. As part of its Humanitarian and Emergency Affairs (HEA) strategy, WVH devised a community organization and training project to strengthen local communities' resilience to disaster, using funds from the CAMI project of the United States Agency for International Development (USAID), and with support from WV US and the organizational structure of WVH.

A great deal of Mitch's damage resulted from insufficient watershed management, lack of flood warning systems and flood control infrastructure. However, equally if not more important than infrastructure, was a lack of community organization and preparedness for the initial response. Mitch helped drive home the urgent need to put people first and to focus on their readiness and resilience.

Maria-Luisa Interiano, director of CERDM, commented: "If you have people with basic training, no matter if you have insufficient watershed management, the communities will be able to save their lives, and that is the most important — even more important than infrastructure." CAMI was a catalyst for WVH to begin integrating risk management into the whole of what it does, via a ground-up process that continues today.

CAMI was one of a range of programmes developed by USAID to fund prevention and mitigation activities in Central America. USAID summarizes CAMI as "a post-Hurricane Mitch programme designed to reduce the impact of natural disasters by increasing

the capability of regional, national, and community authorities and organizations to prepare for, respond to, and mitigate disasters. CAMI programmes support readiness for the hurricane season through the formation and training of community Rapid Response Teams (RRTs), the establishment of community hazard monitoring and early warning systems, and risk and resource maps, among other activities."

Such activities were implemented in Guatemala, Honduras, El Salvador and Nicaragua, as well as similar projects in the Caribbean. WVH received a grant to carry out CAMI activities, under which the WV CAMI programme directly supported the broader CAMI goal, to reduce or negate the impact of natural disasters in Central America through the implementation of relevant activities in some of the most vulnerable areas of Honduras. WV initially chose two locations based on need, a high level of vulnerability to disaster, and WV presence and experience. These locations corresponded to the two most impoverished and Mitch-affected programme areas within WVH. CAMI was first undertaken in the Yoro (North) and Choluteca (South) regions of Honduras.

The strategic objective of the WV CAMI programme was to minimize the impact of natural and/or human-made disasters in programme areas. Its expected result was the increased capacity to successfully manage key aspects of disaster mitigation and response at the community level in target areas. CAMI had three specific objectives:

1. Incorporate risk management concepts into development activities in communities served by WVH
2. Strengthen community and institutional leadership capacity for monitoring threats, early warning systems, and planning emergency response
3. Improve community response capacity through formation and training of Local Development Committees (CODELs) and community RRTs.

CODELs were at the heart of the CAMI and later CERDM projects. Formed as community-based entities under CAMI, they remain a key component in the sustainability of the projects, their outcomes, and achievement of their vision.

Activities under the first objective, incorporation of risk management into development, included participatory risk and resource mapping, which dealt with the relationship between typical practices and environmental degradation leading to increased vulnerability, and technical assistance to communities on how to design and maintain risk and resource maps. Through the project, RRTs in 154 communities gained the capacity to create nationally standardized risk and resource maps and to regularly update them. Additionally, a key step in the change process that CAMI instigated in WVH was the adoption of a new policy that meant all new agricultural and economic development projects would be planned and implemented with mitigation components.

The second objective, strengthening ADP and community monitoring, early warning and emergency planning capacity was an important part of the WVH national emergency preparedness and response plan. Training was provided in appropriate and regular monitoring of risks, and 154 communities, 7 ADP and 2 regional offices began to use hazard monitoring and early warning systems with evacuation capacity. Community RRTs and ADPs gained the capacity through training to implement Evaluation of Damages and Analysis of Needs (EDAN), complying with WVH and Commission Permanente de Contingencias (COPECO, the national emergency commission of Honduras) norms. Under this objective, agreement was made to share information and standardize forms and reports with COPECO and other non-governmental organizations and donors, assisting in coordination with the Honduran Government.

Another important aspect of this objective was data processing and analysis, the first stage of which was carried out at the community level. Through CAMI, ADPs, regional and national offices of WVH were able to efficiently consolidate information from EDAN and use it to produce accurate, easy-to-read reports.

Under this objective, CODELs were organized and received training in:

- Risk management and the relationships between risk, threat and vulnerability
- Vulnerability mapping, mitigation plans, early alert systems
- Evacuation, rescue and refuge
- Response planning
- Organization and functioning of the network
- Organizational structure and management
- Emergency response and preparedness including EDAN, first aid, security and logistics.

One key objective of the CODELs was to ensure the formation of a community-level RRT. Through this, the third objective resulted in significantly increased response capacity at the community level, reducing the dependence of local communities on outside assistance and empowering them to deal with the initial response locally. This objective was the first to be implemented, and the majority of the RRTs created was able to efficiently respond to emergencies, reducing casualties, injuries and damages.

The RRTs comprised one each of team leader, EDAN specialist, data specialist, logistics coordinator and hazard monitoring, early warning and evacuation coordinator. Community RRT members were also trained, through agreement with the Red Cross, to provide first aid treatment to the injured during an emergency. In Yoro department, which is extremely prone to flooding and landslides, training was given in evacuation and rescue through agreement with the fire department.

Photo: Carolyn Rose-Avila

Community members in Ecuador in CERDM training

One of the most important objectives of the WVH National Emergency Plan was the distribution of basic food and material supplies for human survival. As WVH already had significant experience in emergency distribution, through CAMI it concentrated on improving existing structures, programmes and personnel. Through CAMI's third objective, the majority of ADPs, regional and national offices were able to implement an emergency supplies distribution programme complying with SUMA standards.

Two important aspects of CAMI were:

- The development of training materials and curricula
- The strong link between community RRTs and municipalities.

Training materials were developed by project staff integrating information from a variety of sources, contextualized to local culture and national context. Training was provided to community leaders and members, representatives of local municipalities (Patronato) and members of ADP local boards. A strong focus was on including women, children, the elderly and other vulnerable groups in training activities.

Significantly, the scope of training included a past-present-future review and planning process, including a review of Hurricane Mitch and previous local disaster experiences, and simulations written into WVH five-year strategies. This helped participants to develop important analytical and planning skills, identifying strengths and weaknesses in their own communities and engaging them in short- and longer-term planning.

CERDM

In 2003 WV expanded the CAMI programme in the region, beginning with Ecuador and Nicaragua, with support from the Government of Australia (AusAID) and the efforts of WV Australia. It was renamed CERDM, and its programme structure continued to be adapted according to changing local contexts. The expanded CERDM had two special areas of emphases: children and advocacy.

CERDM school project

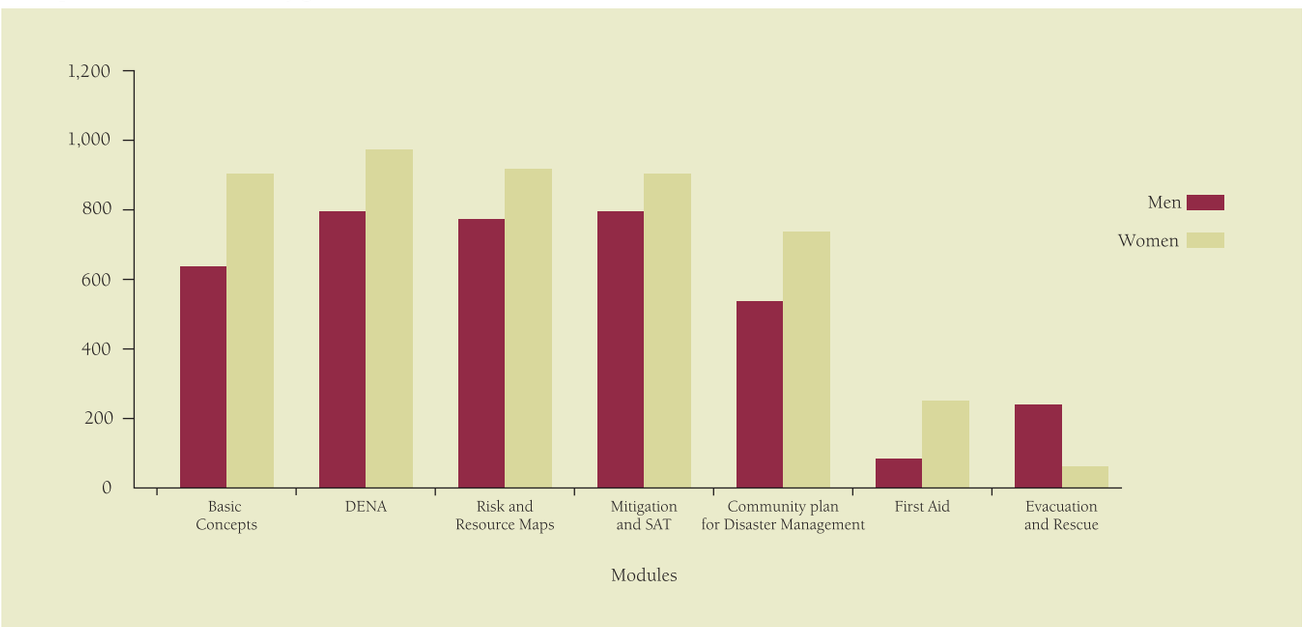
Based on initial CAMI efforts in Honduras in 2004, WVH initiated a school-based project developing the skills and leadership capacities of children to be active members in building the resilience of their communities to disasters. This project triggered as much interest among school administrators as it did among community leaders. The CAMI model was introduced in primary schools through the organization of CODELs elected from the student body. CAMI trainers trained the CODELs and their teachers in essential areas of community-based disaster reduction, so teachers could continue the programme in the future. By creating the youth CODEL through student elections, children were chosen by their classmates and viewed as role models. They were seen as community youth leaders and were more able to influence their communities' preparedness and mitigation prior to an emergency.

According to Maria-Luisa Interiano: "Children want to know what to do before, during and after a disaster. They are very aware of the risks but, like their parents, they do not know what to do." The objective of the CERDM school project was to reach the next generation of community leadership and influence them during their formative years. The project provided a way for the children to become a vital, prepared part of their community before, during and after a disaster.

Community-based advocacy for resilience

It is common knowledge that disaster response and the resources associated with it can fall prey to prevailing political agendas and corruption. Hurricane Mitch, among many other disasters, demonstrated that communities were mainly passive recipients of assistance. An external evaluation confirmed a lack of engagement among local people in assessing and meeting their own needs during a disaster. This is known to lead to corruption at all levels through misappropriation of relief supplies, utilization of affected low-income and isolated communities for political gain, and provision of inappropriate relief goods, such as offering canned sauerkraut to a community that is accustomed to consuming beans and tortillas.

Participants in CAMI, divided by gender



Source: World Vision Honduras

Through expansion of best practices gained from CAMI and in the regional CERDM programme, WV included a focus on increasing a community's capacity to advocate its interests within the existing policy environment on disaster response. Under the expanded programme, affected community members learnt to systematically articulate their needs and circumstances. As a result, they were able contribute to the dialogue that shaped municipal and national response protocols, and were ultimately included in various government planning processes. Advocacy advisors were engaged to support communities' involvement in municipal and national response planning that ensured CODEL structures were recognized as the organized link to the local community in responding to an adverse event.

Results and outcomes

Working with communities, local government and the national emergency structure, WVH was able to establish a viable mitigation programme in 13 ADPs (224 communities) with the following outcomes:

- Communities participated in and managed their own disaster mitigation planning and implementation programme
- Community resources were utilized to assist in the process
- The project was comprehensive, covering local needs from emergency response to disaster mitigation
- There was vertical and horizontal integration of response and mitigation plans within civil society between municipal and local levels
- The participation of women in emergency issues was strengthened
- Awareness of communities was raised about their own risk, and capacities to analyse and plan were built through risk and resources mapping.

Through lessons learnt, workshops and an external evaluation conducted by the University of Miami, the following strengths were identified in the CAMI programme and its sister project CERDM:

- Development of grassroots capacities
- Coordination with local government, specifically with civil defence institutions
- Improved community rapid response capacity
- Improved targeting of aid
- Improved community solidarity and cohesion
- Proactive approach to community management of crises
- Engagement of indigenous participants in Ecuador
- Development of training materials contextualized to local Quechua communities
- Increased leadership opportunities for women
- Increased engagement of children and youths in building community resilience.

In 2001, skills and knowledge developed under the CAMI project were put to the test during the response to Hurricane Michelle. Communities then in the early stages of the CAMI training were already able to apply skills learnt within the context of an actual disaster, dramatically reducing the need for outside assistance. Assessment and record-keeping skills helped municipal-level civil defence authorities to more accurately target distribution of aid. The overall impact was the greater role of communities in leading the response.

The reduction in loss of lives and damage to livelihoods, and the difference in speed and quality of response and rehabilitation activities between Hurricanes Mitch and Michelle were dramatic, illustrating once again the efficacy of building local capacities for disaster reduction. Though Michelle poured as much water over the region as Mitch did, of a total estimated 7,827 families in the five ADPs' sphere of influence, one life was lost — and this of a community RRT leader trying to cross a river to communicate his community's needs to ADP staff. The local emergency response system was activated with available staff almost immediately after the disaster, and an information flow was established and maintained between community, national, regional and international levels throughout the disaster cycle. Distribution of relief supplies — among them, water purification tablets, blankets and food rations — began almost immediately. There was not a massive need to organize shelters — most families that had to evacuate were able to find shelter with family or neighbours. Thanks in part to soil stabilization measures promoted by the sustainable agriculture programme during the three years before Michelle, crop losses were not nearly as bad as during Mitch. The most significant damage was suffered by community water systems and road systems, and there was an upsurge in illnesses commonly related with flooding.

Communication with some communities was cut off, leading to the death mentioned above. This was an important lesson learnt. Overall, however, it was clear that CAMI had achieved important results. After a thorough analysis of WV's response to Michelle, lessons learnt were integrated into the expanded CAMI project and later into HEA project plans as well.

Hurricane Mitch clearly demonstrated the need for mitigation and response capacities to reside at the local level. Hurricane Michelle demonstrated that systematic, sustained investment in these capacities, combined with cooperation between local communities, local government and humanitarian agencies will drastically reduce the number of lives lost and the degree of damage incurred by communities during a disaster. This has long-term positive implications for a community's level of development.

Building local capacities reduces disaster risk and helps foster confidence, dignity and resilience. Ultimately, a community that learns to resist the impacts of disasters also gains greater insight in and wherewithal to address the causes of longer-term poverty and underdevelopment. CAMI and CERDM have demonstrated these changes in three Latin American countries. These important lessons should be integrated into the policies and strategies of stakeholders working to reduce disaster risks worldwide.

2006 CERDM evaluation preliminary conclusions

- CERDM is strong in training, but weaker in implementation
- CERDM needs to increase focus on activities such as community organization, training and education and leadership to improve sustainability
- CERDM must strengthen humanitarian network activities
- CERDM needs to simplify and contextualize educational materials
- The quality of the humanitarian aid provided by the NGO (WV) improved when the community had basic knowledge about risk management and emergency response
- The approach requires significant financial and technical investment.

Impact of storms on coastal communities: Annotto Bay, Jamaica

Shakira Khan, Department of Geography and Geology, University of the West Indies, Jamaica

The catastrophic effect of Hurricane Katrina in 2005, on the Gulf States in the USA, highlighted the importance of understanding the impact of hurricane-generated hazards on coastal communities. Small island states like Jamaica, whose population centres are situated along the coasts, are threatened by these disasters. The impact of Hurricane Ivan on several coastal communities in September 2004 highlighted the need to assess the effects of storms and hurricanes on these vulnerable areas.

The town of Annotto Bay, located on the north-east coast of Jamaica, is one such community that has repeatedly been affected by storm surge[1] and coastal flooding associated with unstable weather conditions, ranging from localized weather systems to hurricanes.[2] This low-lying town (maximum elevation of 4.7m above sea level), sandwiched between a salt marsh and the sea, is transected by three waterways. Two of these, Annotto River and Mother Ford (which has been converted to a culvert), are part of an extensive creek system with numerous branching tributaries and meandering channels. The third, Pencar River, lies to the east. A fourth river, the Wag Water River, forms the western boundary of the town. These drainage systems play an integral role in sustaining and destroying life in the area; the banana industry, which is the primary industry in this area, is located on the fertile flood plains associated with these four rivers and provides jobs for local residents, but these rivers also pose a threat to the community during the rainy season.

The town, which supports a population of just over 5,300,[3] has expanded in size in the past 10 years, and this is reflected by an increase in residential units. Evidence of this expansion is observed from aerial photographs to be common along the fringes of the marsh and the coastline adjacent to the sea. This increase in residential buildings, particularly along the coastline of Annotto Bay, is of great concern because the area, although designated residential, was not subdivided to support the unit density it now supports. Most of these structures are erected on leased land using wood sidings and concrete foundations; the roofs are of metal sheeting, which provide very little protection against strong winds. Some residents have erected houses on the beach berm, and some are even located at the high water mark, nevertheless most homes are an average distance of 18m from the foreshore. This unmonitored growth has placed additional stress on the limited resources of the town and resulted in a densely populated area which lacks adequate infrastructure such as waste disposal, running water and sufficient drainage.

Reports of hurricane-related flood events in the area go back as far as 1963, when flood levels as high as 1m were measured in the town.[4] Subsequent events resulting in severe damage to buildings include Hurricane Allen (1980) which passed north of Annotto Bay, and whose associated surge inundated homes approximately 137m inland,[5] impacting most of the town's facilities including the fire station, health centre, police station and several churches which were used as shelters during these events. Similar reports from the community describe the complete destruction of two houses and the partial destruction of several others along the shoreline from storm surge associated with Hurricane Gilbert. In 2001, rains associated with Tropical Storm Michelle caused the three channels which transect the town to overflow their banks, resulting in damage to 307 homes.[6] The following year, rains associated with Tropical Storm Lili produced flood levels of 1m in the town as the four drainage features in the area exceeded capacity and overflowed their banks.[7] Data collected through this ProVention-funded project determined that storm surge, associated with Hurricane Ivan in September 2004, again damaged homes and blocked roads with sand and debris. Riverine flooding from the four drainage features in the area produced flood levels of up to 1m in sections of the town.

A previous hazard assessment programme in the area, organized by the Office of Disaster Preparedness and Emergency Management, the Jamaican Government agency responsible for disaster management, focused on the impact of riverine flood-

Photo: Richard Coutou

Community members participating in a hazard identification exercise

ing in the community.[8] Through this programme flood maps for the area were developed, a community based flood alert system was created, and members of the community trained in rainfall and river flow data collection. The project also conducted community riverbank erosion training programmes and trained members of the community in related disaster management. These activities increased community awareness and provided tools for the community to be better prepared for future flood events.

A study carried out by C. Wilmott-Simpson in 1980 assessed the effects of storm surge in the area and produced a storm surge inundation map for Hurricane Allen.[9] Anecdotal evidence has also been compiled on the impact of Hurricane Gilbert in 1988, Hurricane Ivan in 2004 and Hurricanes Dennis and Emily in 2005. No similar assessment or report for coastal erosion for this area can be found, although the existence of six groynes located throughout the bay, the remains of gabion baskets and fragments of a broken sea wall which once acted as sea defences indicate that coastal erosion has been acknowledged as a threat to the community.

Risk perception at the local level determines the level of effectiveness that a community-based mitigation programme will have. Presently, riverine flooding is the greatest perceived threat by the community, and is believed to be exacerbated by inadequate and frequently blocked drains. Although drain cleaning is conducted periodically by the parish council, the frequency is not sufficient to keep them clear. This, residents say, is the main problem and needs a revolutionary approach. Through their increased awareness of the causes of flooding, residents actively participate in drain cleaning and removal of sand bars blocking the mouths of Mother Ford and the Annotto River.

Storm surge and coastal erosion are acknowledged as a threat, but impacts from storm surge are felt infrequently (Hurricane Allen, 1980; Hurricane Gilbert, 1988; Hurricane Ivan, 2004). Coastline retreat takes place over an even longer period of time, and is not perceived by some in the community as a major threat.

Through this project we have been able to identify the extent of storm surge inundation generated by Hurricane Ivan and compared it to that identified after Hurricane Allen to better assess the impact storm surge has on the community. Analysis of the offshore bathymetry in the bay was also undertaken to determine whether this influences the impact of storm surge along this section of the coastline. Evaluation of changes to the coastline over the past 40 years was also carried out using aerial photographs and seasonal variability of the beaches, identified at five stations and monitored over an eight-month period. The preparation of land use maps for the community was undertaken to assess compatibility of present practices in the town with the hazards that impact the area.

This project seeks to increase the understanding and awareness of storm-induced hazards at the community level. A hazard map, identifying areas which have been inundated in the past and zones of coastline variability, was prepared through community participation in meetings and surveys. The information may be used as a tool in raising awareness though community group education programmes. The availability of hazard maps of the area as well as educational pamphlets describing coastal hazards, will provide residents with information on the impact that different hazards have on varying sections of the town and will allow them to better prepare themselves in the future — to be forewarned is to be forearmed.

A technical report will also be produce that will provide relevant information for government agencies responsible for developing mitigation strategies, for this and other coastlines with similar characteristics. This may be used as a guide for the future planning and design of developments along shorelines with similar physical features.

Photo: Richard Coutou

Residents living on the banks of the Mother Ford. This drain is frequently blocked by sand bars deposited by the sea, which residents have to clear to prevent flooding of adjacent homes

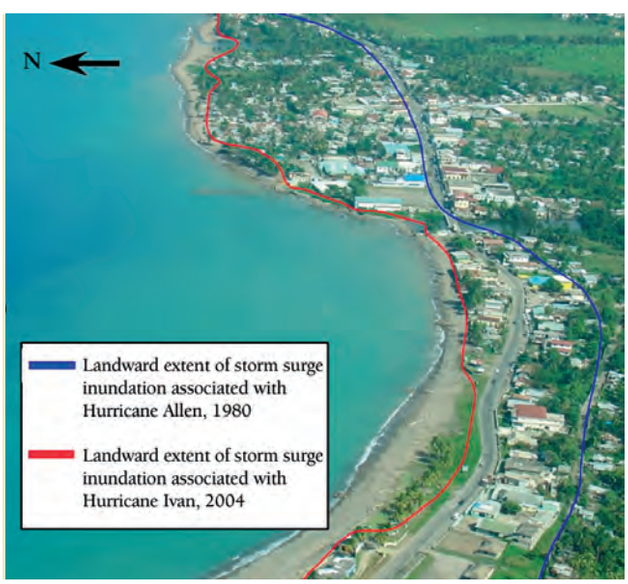


Photo: Nakula Butterfield

Extent of storm surge inundation in the town of Annotto Bay from Hurricanes Allen and Ivan

Managing climate risks through climate information applications: the Indonesian experience

A.R. Subbiah, Lolita Bildan, and Kareff Rafisura, Asian Disaster Preparedness Center

In the past two decades, significant advances have been achieved in tropical climate forecasting. A key development has been the ability demonstrated in the mid-1980s to forecast El Niño Southern Oscillation (ENSO) — the anomalous warming of the equatorial Pacific Ocean — with lead times of as much as six months to one year. The value of this breakthrough cannot be underestimated: if forecasted with sufficient lead-time, El Niño-related forecasts can theoretically provide societies with opportunities to undertake steps that would enable them to address potential impacts, which in many Southeast Asian countries include drought, forest fires, and outbreak of infectious diseases.

Different countries and different sectors are in varying stages of harnessing the present capability of climate science to reduce risks in sectors which are susceptible to climate fluctuations, most notably agriculture and water resources. Arguably, a major task facing countries continues to be the development of an end-to-end climate information generation and application system that is aimed at climate risk reduction. Such a system encompasses a continuous cycle of forecast generation, dissemination, application, and evaluation of results.

In the past eight years, the Asian Disaster Preparedness Center (ADPC) has worked to facilitate the development of an end-to-end climate information generation and application system in Indonesia, particularly to mitigate climate risks in agriculture. Under the aegis of the USAID's Office of Foreign Disaster Assistance (OFDA)-supported Climate Forecast Applications (CFA) programme (2003-2008) and its predecessor the Extreme Climate Events (ECE) programme (1998-2003), efforts have been made to strengthen the capacity of national and local institutions in Indonesia and the Philippines to build such a system. There follows an account of the Indonesian component of the programme and the impacts it has made so far.

Lessons learnt from the 1997-1998 El Niño

The mere availability of climate forecast will not necessarily translate into measures that would enable societies to adapt to the potential impacts of the forecasted climate event. This is one of the key lessons learnt from the massive 1997-1998 El Niño.

An El Niño forecast was made available as early as six months before the onset of the event. Indonesia's national meteorological service — the Meteorological and Geophysical Agency (BMG) — incorporated such information into its dry season forecast, which was released in March 1997. But despite the availability of this information, the 1997-1998 El Niño spawned widespread social and economic damages in Indonesia because adequate mitigation measures were not put in place. Large-scale forest fires generated a regional smoke and haze emergency, and El Niño-induced drought resulted in a production shortfall of 3 million metric tons of paddy. As a consequence, rice imports reached 5 million metric tons.

This experience drives home the point that several conditions must be present for climate information to translate effectively into precautionary actions. First, information would be of little use without well-functioning information delivery systems. While the information was released by BMG six months before the onset of the El Niño event, there was no institutional mechanism to translate the global El Niño index into local impacts. Second, the 1997-1998 El Niño demonstrates that climate information — be it a seasonal climate forecast or an analysis of past rainfall patterns — is not sufficient for issuing early warning until it is translated in terms of impacts on the variables that are of interest to decision makers. For example, reservoir managers need to know how an El Niño event would affect stream flow and evaporation. On the other hand, farmers need to know how El Niño could poten-

Photo: Kareff Rafisura

Farmers participating in the Indramayu CFS study on the process of rainfall formation

tially impact the spatial and temporal distribution of rainfall. Because not all El Niño events are accompanied by the same climate fluctuations, translating a forecast into sectoral impacts is a tremendous challenge that requires well-trained and technically competent human resources.

For the past five years, ADPC has made efforts towards assisting Indonesia in building the conditions that would enable it to reduce climate risks through the development of an end-to-end climate generation and application framework. ADPC's involvement in Indonesia started with the ECE programme, which documented the impacts of and the institutional responses to past extreme climate events in Indonesia, focusing on the 1997-1998 El Niño and the La Niña (cooling of the eastern tropical Pacific) that followed. ECE was undertaken in collaboration with national and local partners.

Based on ECE documentation, ADPC identified further research and capacity building needs for mitigating the societal and economic impacts of climate events. Hence, implementation of the CFA programme was initiated. The application of climate information entails incorporating such information (e.g. past climate, seasonal climate forecast) to change or influence a decision regarding future actions. For example, armed with a forecast of rainfall deficit, farmers switch to crops that require less water. The ultimate goal of the CFA programme is to improve the performance of climate-sensitive sectors.

ADPC-initiated efforts to institutionalize climate forecast applications

ADPC's goal is to assist Indonesia and Philippines in developing a robust and sustainable end-to-end climate information generation and application system. The programme's approach is two-fold: first, it carries out targeted demonstration sites to explore and refine tools and risk management strategies. Armed with the lessons learnt from demonstration sites, the programme will move towards strengthening national capacities to scale up the application of methods elsewhere in the region. The CFA project is initially working in four sites (two in each country) to demonstrate how climate forecast applications may be utilized in managing climate-related risks.

The two sites in Indonesia represent different agro-ecological zones and are embedded within different institutional systems — Kupang, Nusa Tenggara Timur is a dry land agricultural system while Indramayu, West Java is located at the tail-end of an irrigation system. Both sites are exceptionally vulnerable not only to extreme climate events, but also to the annual seasonal cycle. In Indramayu, more than 80 per cent of annual crop losses are due to droughts and floods. In Kupang, false rains are a serious problem. As farmers usually sow seeds during false rains only to lose them, these are responsible for routinely pushing farmers to the brink of food insecurity. In both sites, the ability to anticipate how climate will change from one year to the next will reduce damages and lead to better management of agriculture, water supply, fisheries and other resources.

The steps undertaken by ADPC in implementing the CFA programme include:

- Understanding climate variability and impacts at local level
- Understanding stakeholders' demands for forecast products
- Creating an enabling environment for climate forecast uptake, such as making sure that support institutions make credit and agricultural inputs available to farmers
- Capacity-building for institutions for translating and communicating forecast products
- Ensuring partnership development between producers and users of forecasts
- Processing and delivery of localized forecast information
- Demonstration of climate information's potential value
- Policy advocacy at all levels
- Replication.

A key feature that distinguishes the CFA programme from other climate forecast applications initiatives is the effort to ensure that the climate science research component, which will ultimately lead to the development of forecast products for the demonstration sites, is driven by the demands identified by the stakeholders.

Results

In a huge district like Indramayu with a very heterogeneous rainfall pattern, BMG responded to stakeholder needs by downscaling seasonal forecasting in spatial terms, i.e. dividing the district into different rainfall regions and producing a forecast for each region. Information regarding the varying dates of onset and termination for rain in different parts of the district is instrumental in setting up a cropping strategy (e.g. dry seeding vs. wet seeding) as well as in determining the timing of planting activities. In Kupang, the CFA programme has institutionalized a sustained dialogue between forecast providers and users. Progress in developing forecast products proved to be a lot slower in Kupang because of the scarcity of rainfall data.

On the application side, the CFA programme's efforts to stimulate local capacities for implementing climate risk management strategies resulted in innovative approaches that are initiated by the programme stakeholders themselves. One such initiative is the Climate Field School (CFS), which the district of Indramayu piloted in 2003 with support from the National Oceanic and Atmospheric Administration (NOAA), OFDA, Bogor Agricultural Institute (IPB), and BMG.

The CFS employs practical and field-based learning for agricultural extension workers and farmers to enhance their expertise in using climate forecasts to make appropriate farming-related decisions. While dialogues between farmers and extension workers formally extend over two seasons only, the CFS has become a permanent institutional mechanism that connects producers of climate information, intermediaries (agricultural extension workers), and end users (small-scale farmers). BMG has been utilizing this mechanism to distribute seasonal forecasts and post-mortem forecast evaluation, as well as to evaluate user responses to forecasts.

Farmers who participated in the CFS gained a systematic appreciation of climate variability as well as a better understanding of the probabilistic nature of climate forecasts. For example, in a normal wet season (October-March), rains arrive by mid-October. Based on the farmers' experience, rains may be delayed but only until the end of November at the latest. The district agriculture office, with the help of BMG, reinforced this perception by presenting graphs showing climatological data for the past 30 years.

The farmers' perception, reinforced by scientific data, led them to revise their cropping practices. To adapt to this variability in wet season onset, with confidence that rains would come, some farmers revised their cropping calendars and changed their planting strategies from water-intensive transplanting back to direct seeding (gogo rancah). Gogo rancah is a mitigation measure against both flood and drought that makes the planting of rice viable even if rainfall is low, as long as it is frequent. And because it allows early planting (mid- to late-October), paddies are already

high enough to survive flooding, whose probability of striking Indramayu is more than 50 per cent in January and February.

CFS also made impacts in terms of how farmers set up their cropping calendars. Farmers in the sub-district of Losarang revised their cropping calendars — i.e. the sequence of planting rice, fallow, and planting other crops — in 2004-2005 and obtained higher yields compared to previous years.

Because of these positive impacts, local and national investments have been mobilized to replicate the CFS in other locations. The Indramayu district government decided to sustain CFS beyond the pilot phase and has allocated IDR100 million to replicate CFS in 4-5 sub-districts every year. As of December 2005, 1,000 farmers had participated in CFS. In addition, the Directorate of Plant Protection (DITLIN) within the Ministry of Agriculture (MOA) has adopted the CFS as part of its nationwide agricultural development programme.

Institutional and policy changes at the national level, together with the level of investments mobilized for producing spatially downscaled climate forecasts, indicate that CFA activities will be sustained beyond the pilot phase.

Realizing the utility of producing downscaled forecasts, BMG has been producing localized forecast for 30 more districts as of 2006, and more districts are in the pipeline. This project started in 2004 when BMG developed localized forecasts for ten districts. For this undertaking, BMG, with parliamentary support, invested between IDR3 billion and IDR4 billion in 2006 — a 300 per cent increase from the 2005 budget level. Institutional mechanisms at the district level involving BMG and district officials have also been established to interpret and make use of climate information to manage climate risks in water resources and agriculture sectors.

Policy changes have also occurred, signalling a paradigm shift from crisis management to risk management. From 2001 to November 2005, addressing climate problems was within the purview of the Pest Analysis and Disasters division within DITLIN. But with the realization that the climate problem is huge and should be given more attention, a new division named the Climate Analysis and Mitigation division was formed in November 2005. Operationally, this institutional development means that the bureaucratic unit responsible for climate risk management has been elevated in the bureaucracy and as such, it has been vested with more budget and authority.

Although climate information is not the only information needed to improve the performance of climate-sensitive sectors, it is a potent tool that enables decision makers to manage risks in different sectors. Just three years into implementing the CFA programme, the basic prerequisites for sustaining an end-to-end climate information generation and application system have already emerged. These prerequisites include changing perceptions and practices for managing climate-related risks through the CFS; mobilization of investments for risk management; and institutional development.

The programme stakeholders in Indonesia went ahead of schedule and replicated the CFA programme in several locations and in sectors not initially targeted by the pilot phase. The challenge now is to understand and respond to the new capacity building demands brought by the expansion of climate forecast applications.[1]

Photo: Kareff Rafisura

A farmer leader in Kandanghaur sub-district shows a rainfall graph, which he created from his own rainfall observations using improvised rain gauges. He has been monitoring daily rainfall levels since he attended CFS in 2003

Delineation of potential risk zones, Limbe subdivision, Cameroon

Buh Wung Gaston, GIS and Remote Sensing Department, Limbe Botanic Garden, Cameroon

MOST GEOLOGICAL HAZARDS in Cameroon are linked to the existence of the Cameroon Volcanic Line (CVL), a 1,600km long chain of Cenozoic-Present volcanoes that traverses the country in a SW-NE direction from the Gulf of Guinea island of Annobon across Cameroon to eastern Nigeria. Such hazards include toxic gas emissions from volcanic crater lakes, landslides, floods and hazards from volcanic eruptions.

In the twentieth century and early twenty-first century, the country recorded a series of natural disasters located within and around the corridors of the CVL. These include:

- The Lake Manoun toxic gas disaster (1984) in which 37 people were killed
- The Lake Nyos toxic gas disaster (1986) which claimed approximately 1,700 to 2,000 lives
- The Bafaka Balue landslide (1995) with 3 lives lost
- The Mount Cameroon volcanic eruption (1999) where lava consumed an enormous amount of forest (about 800 hectares) with its rich bio-diversity and cut off 83m of tarred road, disrupting economic activities.

Limbe subdivision is located between latitude 3° 90' and 4° 05'N and longitude 9° 29' and 9° 06'E in the southwestern part of Cameroon. This is a coastal region with an approximate 50.5 km of coastline. The subdivision consists of more than 25 villages with the city of Limbe, the capital.

The project

Over the years, this region has experienced persistent landslides and floods with the worst being in June 2001, taking some 30 lives, rendering over 2,000 people homeless, and destroying properties and social amenities such as roads and telephone lines worth millions of CFA francs. The occurrence of disasters in this region varies periodically, resulting from oceanographic processes, heavy rains and seismic activity from MC, particularly lava flows leading to fire outbreaks from volcanoes. Delineating the potential risk zone is an attempt to provide decision makers and planners with geospatial information on areas where they need to concentrate concerted effort in order to develop mitigation plans.

Geospatial tools were employed in the execution of this project for data collection and analysis. Extensive use was made of existing feature datasets considering their source, quality, and date of publication. Landsat 7 ETM+ satellite imagery was also used extensively for categorizing, interpreting and digitizing features. Unfortunately, only the April 2003 image was cloud-free and therefore was put to full use for this project. Images were orthorectified and georeferenced by EarthSat to its GeoCover dataset, a commonly used and available system.[1]

Image interpretation

The ETM+ scanner measures the sun's reflectance in seven spectral channels known as bands. These include the visible spectrum (bands 1-3), near infrared (bands 4 and 5), thermal (band 6) and medium infrared (band 7). These bands were selectively combined into colour-composite images to enhance visibility. Different band combinations were used to maximize the visibility of landslide scars and different land uses under a range of conditions. To improve the detection of narrow landslides, scars and less prominent features, the panchromatic band (14.5m resolution) was merged with the other bands (28.5m resolution) to create a 'pan-sharpened' image. This greatly improved the visibility of older landslide scars before categorization and digitization.

Topographic map update

A topographic map update was performed by image analysis and manipulation. Pixel transformation was carried out by computing the normalized difference vegetative index (NDVI) to improved visual interpretation of enhanced false colour composite enabling discrimination between different vegetations and non-vegetative surfaces. This visual enhancement of the image permitted easy digitization.

The topographic map of the subdivision was updated with focus on new roads and land use/land cover patterns. Based on an accumulated pattern of NDVI, four main groups were categorized:

1) Non-vegetative areas (settlement, bare ground or outcrop, road)
2) Natural vegetative area (evergreen forest, deciduous forest)
3) Agricultural area (CDC plantations, farmland etc.)
4) Water surfaces.

The Cameroon Development Corporation (CDC) has colossal palm and rubber plantations in the subdivision, accounting for over 30 per cent of total land use. The landscape has undulating relief with heights varying from 2m to 362m above sea level. Most human settlements are around the coast, with a few villages situated above 200m. Low-lying areas adjacent to the sea include Mbojo, Mutowoh, Wovia, Ngeme, Man'O War Bay, Sonara Bota-Land and a host of other villages on the west coast of the subdivision. Areas around the city of Limbe with remarkable hills include Towel, Miletwo, Coconut Island, Mabetal New Layout, Ambas Bay, and Mount Etindi. Over the years the city

of Limbe has experienced rapid evolution in terms of human population and development. With the construction of an oil refining company in 1978, the status of the city was raised to a subdivision.

Landslide delineation

Over 30 landslide scarps (landslide swarms) were identified on the western side of the range of hills bordering Limbe to the east and northeast. The Mabeta-1 landslide of June 2001 was the biggest and most disastrous of these.

At each landslide site, the volume of material displaced gives an estimated level of destruction to human property or environment. Layers of air-fall volcanic material which, although showing signs of chemical weathering, still preserved their original graded bedding structure were observed on the exposed sides of the landslide scarp close to the upper margin.

Flood delineation

Floods are a common occurrence of late in the subdivision. A literature review of flood history in the area, image interpretation, analysis, and field observation accentuated the delineation of flood risk zones.

All settlements along the Djenguele River basin i.e. Animal Farms, Cassava Farms, Lumpsum areas, Church Street, New Town and Down Beach have suffered from persistent flooding over the years. At Maho Bridge during raining seasons, water usually rises to a height of around 2.6m. The width of the riverbed that was formerly just a small channel has now increased to 27m due to a series of flood events.

The number of hours of flash floods causes serious impact in different localities in the subdivision. In August 2005, a series of inundations occurred around the city of Limbe lasting for several hours and disrupting traffic. The rural poor are the most affected by flood.

Causes of the disasters

Seismicity around the Mount Cameroon region is monitored by the Unit for Volcanological and Geophysical Research (ARGV) located at Ekona. Local seismicity for the period preceding the 1999 eruption averaged approximately 15 events per month. This increased from more than 15 events on 26 March to more than 200 events on the 27 and 28 of March 1999. An intensity 4 earthquake on 28 March was felt over a 100km radius around the mountain and destroyed houses in Buea and environs. A macro-seismic study of earthquake activity in Limbe showed that it was felt more by people living upslope on the hillside than by those living in the valleys.[2] Seismicity played an indirect role resulting from the intense pre-1999 eruption shake that probably exacerbated the opening of cracks in the hills around Limbe, which would have facilitated the infiltration rate of rainwater.

Rainfall data for the past 11–27 years was compiled for four CDC-run meteorological stations in and around Limbe. Using this data, a rainfall intensity of approximately 1.1mm/hr is estimated. This is between 10 per cent (Mabeta Bimbia) and 45 per cent (Bota Head Office) higher than the 15-year mean annual rainfall intensity for these stations. Much of the June 2001 rainfall occurred within a very short time. Questionnaire accounts indicate that very heavy rains started in Limbe at about 1700 hours local time on 26 June and continued unabated until about 1300 hours on 27 June, when the landslides and floods occurred. This is confirmed by the daily rainfall data. Of the total June rainfall recorded at the Bota Head Office station, 70 per cent occurred on 26 and 27 June alone. Field reports suggest that this was mostly concentrated within about 20 hours (1700 hours on 26 June to 1300 hours on 27 June).

This is evidence of the occurrence of a rainstorm (prolonged rainfall over days or, as in this case, unusually intense over a short period) during these two days and suggest that rainstorms have been an important contributor to both landslide and floods in this region over the years. All recorded landslides in Cameroon within the last 18 years have occurred between the months of June and September, which are the rainiest months of the year.

Lessons learnt

During the 1970s and early 1980s, the city of Limbe subdivision was free from natural disasters such as landslides and floods, other than activities from the Mount Cameroon eruption. Information gathered from questionnaires points to the fact that the phenomenon started two decades ago with the setting up of new infrastructures, construction of roads and expansion of the city of Limbe without taking into consideration adequate drainage patterns. Despite the existing water channels, bridges were constructed without considering the maximum volume of water expected to flow through them during rainy periods. Thus, during the most rainy months, settlements along Njegele rivers and Limbe river suffer from inundation causing the destruction of properties and human life.

The Limbe Urban Council, working with local partners like the Limbe Botanical and Zoological Gardens, Bonadikonmbo Natural Resource Management Committee and other community based organizations, are now working on a reforestation programme aimed at planting trees on the deforested hill slopes around Limbe. This is aimed at reducing the level of landslides due to the instability of the deforested slopes.

In 2001, the International Federation of Red Cross and Red Crescent Societies in central Africa sent a delegation which financed a mission to evaluate the emergency relief operations carried out in Limbe when floods and landslide incidence occurred. This mission gave the local committee the opportunity to meet with volunteers and community leaders (district leaders and the prefecture leader) to discuss the strengths and weaknesses of the operation and to ensure that it was prepared to deal with floods in the future. Stocks of emergency supplies were established with the support of the DMC, to be used in these activities and to ensure an effective response to disasters occurring in the future. Community leaders are aware of the need to mobilize the population right away on the basis of community activities, such as the reinforcement of house foundations, water canalization and protective dykes made of sand and stone. The level of adequate emergency response is still low in Cameroon and many affected populations are abandoned and helpless.

Government laxity toward incorporating disaster risk assessments into urban planning and managing disaster-prone human settlements, especially in highly populated areas and quickly urbanizing settlements, leads to the great impact of disaster on the local population and increases the level of poverty.

Each year, natural and man-made disasters around Africa cause devastation, loss of life, widespread human suffering and huge economic losses. Images of disaster-stricken areas are often made available too late to be of real use to relief coordination agencies on the ground, as current Earth observation satellites

offer only infrequent image revisits and the delivery of critical information may take months due to periodic cloud cover and tasking conflicts.

Recommendations

Given the potential for population expansion in the subdivision, especially within the city of Limbe, and the eventual need for more settlement land, the following measures are recommended to mitigate future landslides and floods in the subdivision:

People should not be moved away or stopped from building on habitable areas of the 'hazard' zone because this might only be an ineffective and short-term measure. An important proportion of Limbe subdivision is hilly; fortunately most of the hills at the foot and slopes of which people have dug and put up houses only rise to a height of around 350m. Landslide mitigation measures like excavation[3] and planting of soil-reinforcement plants can take advantage of the low-altitude hills and increase well planned development in these hillside areas.

A detailed hydrologic monitoring study of Djenguele River should be undertaken to ascertain the flow rate and volume of water discharged both at high (rainy season) and at low (dry season) peaks. This will provide indispensable data for the canalization of the river from its upper tributaries through its whole course along the city down to the sea.

A stricter building code should be implemented that, amongst other things, prohibits people from building at unsafe distances from the river channel and from disposing of domestic sewage into the river.

An improved drainage system and monitoring of water level and quantity/quality of water in hand-dug wells in the city of Limbe will enhance an appraisal of the volumes and impact of septic waste and rainfall water contribution to the groundwater budget.

Before the above measures are taken, people living on and at the foot of steep hills should quit their houses when rainfall is heavy and continuous (during the rainy season) for two weeks until the rainfall intensity approaches 1.1 mm/hr.

There should be a development of new building codes, standards, rehabilitation and reconstruction practices at the national and local levels as appropriate, with the aim of making them more applicable in the local context, particularly in formal and marginal human settlements, and a reinforcement the capacity to implement, monitor and enforce such codes through a consensus-based approach, with a view to fostering disaster-resistant structures.

The issue of informal or non-permanent housing and the location of housing in high-risk areas should be addressed as priorities, including in the framework of urban poverty reduction and slum upgrading.

Photo: Nsoyunic Lawrence, June 2001

Inundation destroys streams and nearby houses in Cameroon's Limbe subdivision

Community perceptions and response to flood risks in Nyando district, Western Kenya

Hellen Nyakundi, Dr Isaac Mwanzo, Dr A. Yitambe and Stephen Mogere, Kenyatta University, Kenya

Flooding is a recurrent phenomenon in Nyando, one of the 12 districts in Nyanza Province, Western Kenya. The Sondu Miriu, Nyando, Awach and Ombei rivers drain from the Nandi Hills where high rainfall is received to Lake Victoria through the Kano Plains and are a major cause of persistent flooding along their banks as they approach the lake with devastating effects. As per the assessment made after recent floods in the Kano plains, the average annual damage is about USD850,000 with annual relief and rehabilitation measures costing USD600,000.[1] The area supports a large rural population (75 per cent) and the stage of economic growth is undermined by high absolute poverty levels (69 per cent), deteriorating infrastructure and an HIV pandemic (19-29 per cent) over the past decade.[2]

While most studies in the area have concentrated on the physical aspects of the flood disasters, this study shifted focus and instead chose to explore constructs of flood risk by investigating community involvement in flood management.[3] The main objective of the study was to investigate community flood risk perceptions and response in relation to flood disaster management.

Methodology

This was a descriptive cross-sectional study. Both quantitative techniques (questionnaires and structured interviews) and qualitative data collection methods (focus group discussions and key informant interviews) were applied. A list of frequently flooded areas in the region was drawn and two categories, 'most-prone' and 'medium-prone' were selected to give a wider coverage to the sample with a view to accommodating risk level variability. Based on risk levels, 264 questionnaires were administered in the most-prone areas termed 'high risk', and 264 questionnaires administered in the medium-prone areas, which were termed 'low risk'.

Demographic and socio-economic characteristics

Respondents of all ages (18 to over 60) were represented in the household survey. The survey indicates that the main occupation of most households (63.3 per cent) is subsistence farming, which is fairly typical of the general population. The modal gross family income was below KES2,500 (USD35), which represents 72.8 per cent of households. Only 6.3 per cent earned above KES10,000 (USD140). These low-income levels among the study population may be attributed to low levels of education with only a quarter (24.5 per cent) having gone beyond primary level. This trend could be associated with slow economic progress and low income per capita in the area.

Research findings/results

Data from this study reveals only 8.7 per cent of the respondents first become aware of impeding floods through official means. The rest rely on informal flood detection techniques. They predicted floods by observing changes in weather patterns and river levels.

Nearly 96 per cent of respondents reported their most recent flood experience in years 2002 and 2003 (5.8 per cent), 2004 (28.4 per cent), 2005 (47.2 per cent) and the most recent in 2006 (9.5 per cent). The seven emergency flood risks and their response measures considered in this study were damage to shelter, loss of crops, shortage of food, loss of livestock, prevalence of disease,

Photo: Flood Control Unit, Ministry of Water and Natural Resources, Kenya

Nyando community using sand bags to block eroded Nyando river bank

Photo: Flood Control Unit, Ministry of Water and Natural Resources, Kenya

Widening the Nyando river

death and interruption of schooling. Overall results from the study on these key household practices revealed the most notable measures to avoid negative flood effects were:

- Sealing lower door entrances with mud (100 per cent)
- Clearing/digging of trenches (83.7 per cent)
- Piling mud around homesteads (45.3 per cent)
- Raising the floor of houses (28.4 per cent)
- Planting trees/sisal around homes and farms (22 per cent)
- Storing medicine (26.1 per cent)
- Building terraces (10 per cent)
- Evacuating to higher ground (29.2 per cent).

Measures taken immediately after the floods included raising what can be destroyed by flood waters, drilling holes through the wall to allow flood waters to flow through, removing flood waters from the house using containers, cooking on top of tables and other raised surfaces, and de-silting of trenches. It is only during extreme flooding that people evacuated. After the floods subsided, soil was poured on the floor and leaves spread on top to cover damp floors. The two major efforts made to avoid and/or reduce flood-related diseases included buying mosquito nets and treating or boiling drinking water.

The survey data revealed that half (50.2 per cent) of the respondents who experienced flooding received support from multiple sources. Government disaster programmes accounted for 85.2 per cent of the support received, while 28.1 per cent received help from non-governmental organizations and 6.7 per cent were assisted by relatives, friends and private donations from well-wishers.

Government initiatives at the district are coordinated by the District Disaster Management Committee (DDMC), which has incorporated all key government departments: agriculture, roads, health, and water. The flood control unit under the Ministry of Water and Natural Resources is currently overseeing the construction of a dyke along River Nyando. So far, 3.5 km has been constructed on either side. The DDMC is represented at the location and sub-location levels. These committees, together with the chiefs and sub chiefs, organize, implement and oversee the Food for Work programme introduced by the Government to engage the community in managing floods. The community members dig and clear trenches in exchange for food.

The Red Cross, VIRED, CREPP, World Vision and ADRA have been the major non-governmental contributors during flood disasters. Flood information is mainly obtained by volunteers on the ground, who carry out assessments on the extent of damage. This information is used to plan the type and amount of support needed. Red Cross, World Vision and ADRA mainly provide temporary shelter and distribute food, blankets, water purifying tablets and mosquito nets. VIRED International has a food-for-work flood initiative that engages the local community in digging proper drainage systems, de-silting existing trenches and digging dams. CREPP encourages tree planting by distributing seedlings to schools and village youths. It has also introduced a micro-enterprise development programme that targets women's groups involved in farming activities and small business enterprises, giving loans of up to KES60,000 (USD845) per group. CREPP has a water and sanitation programme, which involves the sinking of boreholes. It is also involved in training disaster management committees at the community level on how to handle and distribute food for work. In addition, it is encouraging the local community to use mobile toilets.

As a result of the past flood disasters in Nyando, the Government has allocated more funds toward mitigating floods in the area and the World Bank has pledged USD80 million to be disbursed over a seven-year period to mitigate flood related disasters in Western Kenya. Treatment of malaria is now free in government hospitals and dispensaries, and now pregnant women and mothers with children under 5 years of age can buy mosquito nets at a subsidized rate of KES50 (USD0.7) each, down from an average KES500 (USD7). There has also been more community involvement through the formation of disaster committees at the community level. There is now more community involvement in digging and clearing of trenches through the food-for-work programme, which has resulted in a reduction of negative flood effects in the past two years. The chi-square test demonstrated a significant difference of 0.000 of support received between the high risk and low risk areas; this is a positive indication of equitable distribution of support in the study area.

Conclusions and recommendations

There is still a lot of emphasis placed on structural mitigation measures, and very little on non-structural measures that could contribute to reduced vulnerability in dealing with future floods. The majority of the respondents still believe that the area will be risk free once the dyke has been constructed. This perception has led to the local community undermining its own coping capabilities and beginning to rely more on external aid.

There is therefore need for community sensitization on non-structural mitigation measures that require less reliance on external support. This would encourage more community initiatives and a creation of more sustainable programmes.

Photo: Hellen Nyakundi

Children of Kogwedhi village in Nyando district carrying their fishing rods and displaying fish caught from flood waters

Photo: Hellen Nyakundi

A woman in Ayweyo sub location, Nyando district, receiving her share of maize after completing a day's work (clearing trenches) in a food-for-work initiative

Livelihoods at risk: the case of The Mphanda Nkuwa dam

James Morrissey, New College, Oxford

Mphanda Nkuwa is a hydroelectric dam planned for construction on the lower Zambezi River in Mozambique. Its reservoir will inundate an area of approximately 100 square kilometres, displacing about 1,400 people.[1] People and families displaced by the dam are entitled to compensation for their loss; however those individuals living downstream of the dam site will receive no compensation at all. The total project is expected to cost around USD2.165 billion,[2] while the power generated from the project is marked for use in energy-intensive industries such as coal mining and aluminum smelting, and for export. None of the power to be generated by the project is aimed at rural electrification. In April 2006, the Import-Export Bank of China (Eximbank) agreed to finance the Mphanda Nkuwa dam.[3]

Community risk assessment

In 2006, Justiça Ambiental conducted community risk assessments in two of the bairros[4] located in close proximity to the dam site as part of the World Commission on Dams recommendation to adopt a rights and risks approach to dam construction.[5] The research made use of participatory exercises such as community and resource mapping, threat listing and ranking, seasonal calendars, transect walks, semi-structured interviews, and numerous focus group discussions. Research involved living in the field for around three weeks and making extensive use of observational techniques and informal discussions.

The bairro — Geographically, the study sites comprise numerous isolated homesteads. The area has a well-defined summer rainfall season but rains are variable, resulting in very arid conditions during times of drought.

The bairro is characterized by its exceptionally remote nature. The nearest significant town, Tete, is accessible by a 25km walk and subsequent 70km minibus ride, or a one- to two-day dug-out-canoe trip. Such a level of isolation has resulted in very limited access to formal state infrastructure and institutions. This has in turn resulted in reliance on informal or 'grey',[6] mechanisms for social control, and on the extended family as a vital means for coping during times of stress. The bairro is also highly gendered in terms of access to resources. It has access to only rudimentary technologies, is dependent on the local Nyungwe dialect, and has limited access to cash which results in inadequate access to goods and services that cannot be produced locally.

Livelihoods — Every member of the bairro is reliant, to some extent, upon subsistence agriculture. Vegetables are grown year round where people have access to perennial rivers, and seasonally where access to water is limited. Vegetables are grown in the degraded river channel as regulated flows from Cahorra Bassa have removed the possibility of recession agriculture, and have also reduced the fertility of the floodplain as a whole.[7] Although every individual undertakes farming to some extent, inequalities in access to land mean that many find themselves in some form of remunerative agreement, often working the land of more wealthy individuals for some part of the year. Farming is also supplemented by activities such as fishing, basic carpentry, pottery and basketry, wild fruit and honey collection, hunting, spiritual and medicinal guidance, and livestock. As such, the people of the area and their livelihoods are intimately connected with the state of the environment.

Impacts and risk

The cash-strapped, self-regulated (by grey social control), rural, isolated bairro and its agrarian economy stands to be impacted heavily by the massive social and environmental changes that will be wrought with the construction and operation of the dam at Mphanda Nkuwa.

The construction phase of the project will result in the arrival of a large male migrant labour force at the dam site, comprising both urban and rural migrant labourers from across Southern Africa and accompanied by a host of other individuals looking to make a livelihood out of the secondary economic impacts to be felt at the dam site. Such an event will destabilize the admittedly un-utopian, but currently functioning social system for several reasons.

The system's self-regulation will battle to cope with the newly arriving migrants who neither know nor respect the existing institutions of power in the bairro. This will be compounded by the fact that newly arriving migrants will be cash earners, substantially shifting the axis of power in the cash-strapped bairro. The lack of amenities in the area, into which cash has suddenly been injected, will likely give rise to unsavoury elements such as substance abuse and transactional sex. The uneven distribution of cash in the gendered bairro will likely further compromise women's already precarious position in sexual relationships.

These activities will probably impact heavily on HIV infection rates, for which Tete Province already has the highest in Mozambique — such problems will be exacerbated in the context of limited knowledge about treatment and testing.

The inevitable destabilization of the community, in the context of rapid modernization, will also stress dramatically the already fragile notion of community and the existing sense of family. As such, the local economy and existing informal, social safety nets will come under intense pressure. Such impacts are likely to be felt most acutely by those groups which are already most vulnerable: women, children and the elderly.

Resettlement is likely to stress both the resettled and host communities — there is already intense competition for resources, and this will intensify under the altered ecological conditions as a result of the dam's operation. Resettlement will also stress social support networks which are constrained by the geographical distance over which they are able to stretch. Thus, those individuals who are resettled may be moved away from their existing sources of social support.

Effective resettlement schemes are known to be difficult to achieve and there is a significant possibility that those displaced by the project will find themselves worse off after resettlement than they were before. As Scudder (2001) observes: "Within the major dam building countries, I am aware of none, including the United States, China and India, that can document that they have been able even to restore the incomes of a majority of resettlers."[8]

Dam operation

The operation of the dam will also impact the 200,000 or so people living downstream of the dam.[9] Currently this group is not considered as directly affected by the dam and thus will not receive any compensation.

The operation of the dam stands to significantly alter the existing flow-regime of the river. Currently the dam is being designed to meet peak power demand in Gauteng, South Africa. This will require the generation of twice-daily mini-floods which would destroy the vegetable gardens currently located on the bed of the degraded river channel. This would at worst destroy the fundamental dry-season livelihood strategy of those living downstream of the dam, and at best have dramatic impacts on food (in)security in the area. As well as the generation of mini-floods, the reservoir will also impair the river's 'natural' flooding regime, which will have negative impacts on both commercial and artisan fishing downstream. Further, flood risk will be exacerbated as people's flood memory is lost as a result of a more regulated river flow — this will make the inevitable very large floods more catastrophic than they would have otherwise been.[10]

The inundation of the reservoir also predisposes the area to the generation of seismic activity via reservoir-triggered earthquakes (RTE) and reservoir-induced sesimicity (RIS).[11] The lack of recording of the general plate kinematics in the area,[12] and the conservative manner in which the maximum credible earthquake (MCE) has been estimated for the Estima Fault has generated concern that the maximum design earthquake (MDE) for the project could have been severely underestimated.[13]

Research has shown quite clearly that sophisticated, local-level risk-management systems have evolved in the bairro to cope with the altered ecological conditions as a result of Cahorra Bassa. They continue to evolve under the conditions of a changing climate, and include social mechanisms which allow for the evolution of risk management strategies and which maintain social order and regulate vital microeconomic systems. In addition, they include traditional values which ensure that vulnerable groups and individuals are able to access resources and social capital in times of stress.

The Mphanda Nkuwa dam is likely to bring some benefit to Mozambique in the form of foreign revenue, which could alleviate balance-of-payments issues, and generate room for further growth in large industry. The construction and subsequent operation of the Mphanda Nkuwa dam will at the same time act to undermine many of the aforementioned local-level risk management strategies. Such impacts will be felt as a result of:

- Rapid and dramatic alterations to the river's ecology
- Stress on existing mechanisms for ensuring social control
- Erosion of traditional values through the rapid imposition of modernizing influences.

As such, the benefits and risks associated with the construction and operation of the dam are not evenly distributed, effectively debunking cost-benefit arguments that fail to account for the distribution of such costs and benefits.

Need for an effective medium

Much effort has been spent on mainstreaming disaster risk into the developmental discourse. Despite this, applied research clearly indicates that even in light of recommendations from such reputable institutions as the WCD, risk as a holistic concept continues to be excluded from the development-in-practice taking place on the African continent. The risk fraternity continues to seek out examples of best practice in implementing local risk management activities, and while this is very useful, the need for effective advocacy to implement applied community risk assessment to planned large-scale developmental processes has in this case remained largely untouched or ineffective.

Applied research has significant value on the African continent, and schemes such as those provided by GGF and ProVention's Applied Grants Programme must be supported. However, risk discourse is failing to engage sufficiently to halt large planned developmental projects that could significantly undermine the existing livelihood and risk management strategies being employed at the local level.

In light of NEPAD's approach to mega-projects and China's growing influence on the continent (with its express stance of non-interference), issues of effective advocacy desperately need addressing. As such, the growing numbers of people involved in the field of risk management need to find an effective medium and forum in which they can lend their voices to the developmental dialogue. Without such action, even the best local-level risk management practices are reduced to merely sticking plasters across the gaping wounds of 'development'.

Photo: James Morrissey, 2005

A community mapping exercise

Disaster risks at the quarry site and local coping initiatives: the case of Kunduchi in Dar es Salaam, Tanzania

Benedict Malele, Senior Planning Officer,
University College of Lands and Architectural Studies, Tanzania

In the Kunduchi area of Dar es Salaam, Tanzania, there are 21 companies undertaking quarrying activities — the crushing machines used in the extraction of rocks produce dust that spreads all over the area. Dust pollution is widely spread in the settlement, especially during dry season. Dust comes from many sources, including the crushing machines.

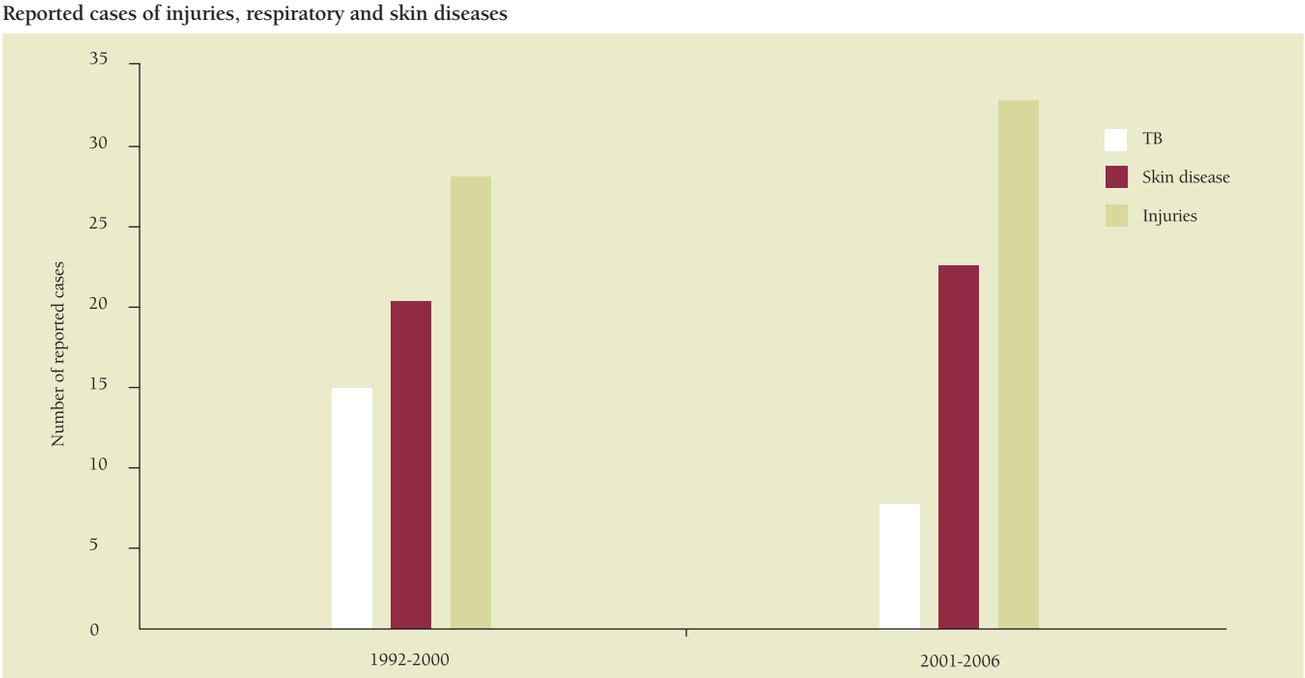
Dust is also produced by the area's 1,500 small-scale miners, who crush gravel and stones by hand. Two different types of small-scale miners have been observed in the area. The first group constitutes those who stay in the area and the second group is those who stay outside the area and they only go in for quarrying activities. Some of the miners who constitute the first group undertake their mining activities right from their residential houses.

On average, 200 lorries go in and out of the settlement every day to load stones, gravel and crush dust for building purposes. These moving vehicles produce yet more dust, which again spread all over the settlement.

Dust pollution immediately affects the people who stay in the area. In a survey of 30 households, 90 per cent indicated that they live and work within the area and small-scale mining activities were their main employment opportunity. This means that this section of the population is affected by dust pollution day and night, thus putting them at very high risk of acquiring diseases associated with dust pollution, such as tuberculosis (TB). Observation in the area has revealed accumulations of dust over the walls, windows and doors of local houses.

Children are the section of the population that is most vulnerable to the effects of dust pollution. In every household visited during fieldwork, the majority of children met were coughing, and their bodies were covered in dust. A discussion with the physician who runs a private dispensary nearby revealed that people who are exposed to dust pollution are likely to acquire respiratory diseases. Records from a nearby Mecco dispensary revealed the presence of respiratory diseases.

Reported cases of injuries, respiratory and skin diseases



Source: Mecco Dispensary Records, Dar es Salaam, March 2006

During the past fourteen years there have been 23 reported cases of TB and 43 cases of skin disease. However, the number of cases could be more, because not all cases are reported and attended at the dispensary. The problem of dust pollution and its health implications seems, however, to be viewed differently by the people who live in the area. There are those who perceive this situation as a normal problem like any other. These people indicated that they have been performing quarrying activities in the area with their families for some time, and they do not see any risk attached to staying in the area. One respondent said: "Why do you think that we are being affected by dust that comes out of the quarrying activities? Even the moving cars along the earth roads produce dust, and yet people still board the cars."

Other people observed that staying in the area puts them at high risk, as most of the time they breathe air that is polluted by dust from mining operations. The narration above shows that disaster risk in the area is viewed relatively, especially by those who are affected.

A survey of nearby settlements revealed that ongoing quarrying activities in the Kunduchi quarry site affect these settlements too. People in these settlements, which include Tegeta, Mbezi Salasala and Kunduchi Mtongani, indicated that they are very much affected by dust pollution from the quarrying operations. According to them, they have submitted requests several times to the responsible authorities to have the quarrying activities closed, but no action has so far been taken.

In facilitating the extraction of stones, gravel and crush dust for building and construction purposes, both the mining companies and small-scale miners use explosive materials (dynamite). In most cases this practice results in property damage and risk to human life. Several cases of property damage and injuries to people from explosive materials were reported. Whereas the subward office indicated about five cases of death for the past five years, some residents indicated three cases and others said that there have been more that five deaths. With respect to injuries, they said that there have been many cases. One respondent said that he witnessed somebody die after being hit by a stone. More than ten cases of damage to houses from explosive materials were reported. It was, however, revealed that there are many other cases in which houses and nearby settlements have been damaged by the effects of explosions. When expressing his views on this issue, one respondent said: "We are staying in an environment which is full of uncertainties because, at any time, one can be hit by a stone and die or get a physical disability."

Since the explosion of rocks is done in daytime, during which children are playing within the settlement, this group of people seems to be more vulnerable and at high risk of being hit by the explosive materials/particles. It was reported that there was a time when one mining company was using heavy dynamite. Before an explosion, the company had to stop the moving vehicles to avoid damage and injuries to the people on board. One respondent who owns a house in the nearby settlement, about 500km away from the case study area, said: "The people who stay within this quarry site must be staying in fear. Can you imagine one day I went to see my house, only to find that it had a very big hole on the roof? When I asked what transpired, I was told that a big stone resulting from the explosive rocks in the quarry site hit a roof and destructed the iron sheet and cycling board, leaving a hole."

One service in the area which is notable for posing a health risk to the people is poor sanitation. The people of the area use pit latrines, but not all households have access to one — indeed, 54 per cent of households were found neither to have nor to use pit latrines. Instead, they use small bushes and open pits. This situation is much exacerbated by small-scale miners who come from outside the settlement. Observation revealed the presence of human waste within open pits and small bushes. It is obvious that whenever it rains, this human waste gets mixed with rainwater and can contaminate the area. Though there were no reported cases of death resulting from poor sanitation (for example, from cholera), it is worth noting that this unhealthy situation will eventually lead to loss of lives unless mitigation measures are taken. As in the case of the other risks discussed, children seem to be more vulnerable to this unhealthy living environment because of their tendency to play in the standing water.

Following unregulated mining activities in Kunduchi, the area is now experiencing a very serious problem of environmental degradation. In view of the extent of degradation, it is obvious that restoration of the area to its normal condition would involve a substantial amount of resources. Observable indicators of environmental degradation in the area include a substantial loss of vegetative cover and extensive pit holes throughout the area.

This unhealthy living environment has necessitated that residents adopt coping strategies to minimize the impacts of dust pollution. The most remarkable strategy observed in the settlement, which the residents pointed out during interviews, is tree planting around the compounds. The importance of trees as filters for air seems to be well understood by some of the residents within the study area.

Despite this initiative, air pollution remains a problem. Observations made in the housing units where trees are planted revealed the accumulation of dust on the walls, windows and doors. The majority of residents interviewed indicated that planting trees was not a very effective solution for preventing dust pollution in the area. Tree planting covers only part of the community, which has been developed over the past five years or more. New areas, which have been developed into residential spaces in recent years, are predominantly bare of trees, and are therefore affected more by dust.

Evidence shows that explosive materials used to break down stones are widely used by both small-scale miners and mining companies. As a result, this practice causes death and injuries to people as well as damage to properties. As a way of avoiding death and injuries to people, whenever the mining companies apply dynamites, they blow a whistle to alert people to take precautionary measures. The small-scale miners shout loudly to alert people. One respondent observed: "When they blow a whistle to alert us we move out of our houses and go to a visible place so that whenever a stone comes we can see it and take precautions."

However, this strategy seems to be of little help, as cases of injuries to people and properties persist. Opinions differed regarding appropriate measures in ensuring the safety of people and their property. Some proposed the closure of the mining activities, as the current practices of blowing a whistle and shouting do not ensure their safety, especially the safety of children. One respondent questioned the efficacy of these alerts, saying: "Even if they blow the whistle and shout, can the children take precautionary measures when they are alone?"

Others who associate mining activity with their livelihoods indicated that closing down the activities would have a serious impact on their way of living, as the majority of them were dependent on this activity to earn their living.

The changing face of disaster management in South Africa: managing the move from response only, to risk reduction and response

Lance Williams, Louis Buys, George Kilian, Johan Minnie, Dr Dewald van Niekerk, Pat Reid and Ferdie Mocke, National Disaster Management Centre, South Africa and the Disaster Management Institute of Southern Africa

South Africa celebrates 12 years of democracy in 2006, having held its first free and fair elections in 1994, a year that also signified a new beginning for disaster management.

In 1994, the combination of a natural hazard with unplanned and unsustainable development created untold misery when flooding occurred in the impoverished Cape Flats area of Cape Town. As is often the case, the disaster became a catalyst for change. Against the background of accelerating political reform in the country after 1990, the Cape Flats floods resulted in the Government initiating an inclusive, consultative reform process in 1994. The first deliverable of this process was the Green Paper on Disaster Management, published in 1998.

The Government's commitment to this reform process was evidenced in 1997 by cabinet approval of the establishment of an Inter-ministerial Committee (IMC) for disaster management, consisting of cabinet ministers carrying portfolios relevant to the field of disaster management. This committee was mandated to table the Green Paper on Disaster Management for cabinet approval.

The Green Paper was followed shortly by the White Paper on Disaster Management, which was gazetted in 1999 and the Disaster Management Bill, tabled in Parliament in 2000. The Disaster Management Act (Act 57 of 2002) was promulgated and, finally, the National Disaster Management (Policy) Framework which was to guide the implementation of the Act was gazetted in 2005.

The changing face of South African disaster management legislation, policy and governance

Date	Development
1977	Civil Protection Act, 67 of 1977
1978	Fund Raising Act of 1978
1997	Inter-ministerial Committee (IMC) for Disaster Management established
1998	Green Paper on Disaster Management
1999	White Paper on Disaster Management
2000	Disaster Management Bill
2003	Disaster Management Act, Act 57 of 2002, promulgated on 15 January 2003
29 April 2005	National Disaster Management (Policy) Framework published
27 June 2005	Inter-governmental Committee on Disaster Management (ICDM) established
28 June 2005	Government-to-government agreement between South Africa and Sweden was entered into, contributing to the establishment of a National Disaster Risk Management System
31 July 2006	Deadline for implementation of National Disaster Management Act at local government level.

Source: Buys, 2005; Reid, 2006; *Government Digest*, May 2006

Developments in education and academic research

Since 1994, pioneering academics and disaster risk scientists within South Africa have contributed continuously to the policy reform process, challenging the mindsets of bureaucratic complacency. Academic and vocational training in disaster management, supported by international and locally developed curricula, continues to play a valuable role in achieving a mind-shift among practitioners.

Today, South Africa is seeing an increased focus on postgraduate studies in disaster risk management (DRM), with various universities starting to offer Honours, Masters and even PhD programmes. There is already a healthy, multidisciplinary mix in these programmes, with some approaching the subject from a natural sciences and disaster risk science perspective, while others approach it from the perspective of government responsibility and public service delivery. Research and higher education institutions are increasingly involved, seeing disaster management as a viable field of scholarship, and there is international interest in engaging with local academic institutions on the subject. The field is gaining credibility, but it is important to ensure that science underpins practice, and that practice feeds back into science.

The influence of the worldwide spate of natural disasters

Did the recent spate of natural disasters across the globe raise awareness regarding disaster management in South Africa, and

has it made the job of disaster management functionaries and disaster risk scientists easier?

There is a general belief that the tsunami and Katrina focused the minds of many decision-makers, in the same way that the 1994 flooding in Cape Town did, and that in some areas it has advanced the South African DRM agenda.

The South African Council for Geoscience has increased its seismic monitoring capacity through its involvement in the Indian Ocean Tsunami Early Warning System, and there is more collaboration among African countries on this subject.

Some academics, however, argue that the tsunami has, quite inappropriately, set back the field of DRM, diverting energy from developmental risk reduction (associated with vulnerability reduction), towards technology and early warning. They believe early warning alone does not go anywhere, and that the resurfacing of an exclusive natural risk approach to disaster management has caused Africa to 'fall off the planet' as far as international assistance for disaster risk reduction is concerned. The South African risk profile, for example, is a mixture that includes food insecurity, drought and complex emergencies along with other risks that have both human and natural origins.

Opinions also differ on whether the uptake of the DRM agenda by South African stakeholders, especially national government departments, has increased. It is encouraging that departments have gone beyond simply attending meetings and have taken full responsibility for reducing disaster risk and planning for response within their own sphere of influence. National departments such as Agriculture, Water Affairs and Forestry (DWAF), and bodies such as the SA Weather Services and Agriculture South Africa (AgriSA) are moving ahead with DRM as it relates to natural risks. However, some academics feel that DRM is not yet a national priority embraced by all departments and agencies.

The National Disaster Management Centre (NDMC) concedes that one major challenge faced by national government during the process of establishing effective legislative and institutional frameworks was how to make disaster risk reduction a major policy issue. "It is always difficult to engage policy makers in a dialogue on reducing disasters and the social and economic benefits of investing in this when these are not always obvious or immediate. To this day, the focus is still heavily weighted on disaster response and not on prevention and risk reduction. Reaching those most at risk is also difficult since they are often more focused on meeting the challenges of daily chronic risk, not disaster risk or sustainable development, and this perspective is difficult to modify."

The tsunami and subsequent international disasters were given extensive media coverage in South Africa, which created sudden concern about seismic risk. Evidence suggests an increase in school programmes on disaster management implemented by metropolitan and district municipalities, and an increase in local media interest in disaster management programmes.

If nothing else, recent global disasters have given disaster management officials vivid pictures and memories with which to associate public awareness and preparedness messages. What remains to be seen is how long the public memory and attention span will be.

The Disaster Management Institute of Southern Africa

Reform in the disaster management discipline in South Africa has gone beyond external policy dictates. Since before the 1994 decision to revisit disaster management policy, another force has been contributing to a paradigm shift away from a response-and-preparedness-only mentality among disaster management officials.

The changing face of DMISA

Date	Development
26 April 1985	Founded as the Civil Defence Association of South Africa
1994	Name change to: Civil Protection Association of South Africa
1996	Name change to: Emergency and Disaster Management Association of Southern Africa
1998	Name change to: Disaster Management Association of Southern Africa
2000	Name change to: Disaster Management Institute of Southern Africa (DMISA)
2005	Decision to investigate transformation to a statutory professional body where disaster management professionals are required to register

Source: Reid, 2006

The Disaster Management Institute of Southern Africa (DMISA) aims to advance the discipline and create learning and networking opportunities. DMISA, which is 21 years old in 2006, has engaged with the NDMC on various occasions. Regular meetings between DMISA leadership and the NDMC ensures a constant flow of information from functionaries in all spheres of government, directly to the NDMC — cutting red tape and improving cooperation and understanding. DMISA is a self-governing body committed to standardization, and hosts the biggest annual DRM conference in Africa — routinely attracting more than 350 delegates.

In partnership with the NDMC, DMISA plays an important role in furthering the interests of DRM practitioners in South Africa and in the Southern Africa region as a whole.

DMISA has kept pace with global changes since its inception, and has undergone several name changes and considerable constitutional reforms in recent years. Founded in April 1985 as the Civil Defence Association of South Africa, it has contributed significantly to South Africa's legislative reform in DRM.

When the institute was established, civil defence services were rendered according to the provisions of the Civil Defence Act (Act 67 of 1977) and the Fund Raising Act of 1978. However, it became increasingly apparent that civil defence and protection had to change to keep abreast with international approaches to disasters and how they were managed. The International Decade for Natural Disaster Reduction (IDNDR), introduced by the United Nations (UN) during the 1990s, was a clear call for the world to shift the focus away from reactive disaster responses onto disaster prevention and preparedness and building resilience through developmental initiatives.

The changes within the Institute reflected the changes in thinking and approach among practitioners in the field, as well as a move away from military influence towards a reaffirmation of the principles of civilian control and democracy.

DMISA organized a study tour to Europe and the United Kingdom in 1990, which contributed significantly to a paradigm shift from civil defence and protection to disaster management in South Africa. Coming at the end of the apartheid era, the tour was accepted by the UN in Geneva. As a result,

the UN Disaster Management Training Programme (UNDP), developed by the UN Disaster Relief Organization (UNDRO), was introduced to South Africa, leading in 1996 to a partnership with Technikon SA to offer Certificate Courses in Disaster Management based on the UNDP modules. The courses were jointly accredited and certified by Cranfield University in the UK; the University of Wisconsin in the USA; and the then Civil Protection Association.

The introduction of additional membership categories linked to qualifications and experience heralded the start of another transformation process for DMISA, which is currently gaining momentum with efforts toward achieving professional status for the function.

A disaster management emblem for South Africa

An emblem plays an important role in expressing any philosophy, promoting awareness and engendering a sense of belonging and identification. For this reason, DMISA viewed the need to develop a disaster management emblem that could be adopted nationally to replace the defunct civil protection triangle as a matter of urgency. A democratic process was followed whereby stakeholders expressed their opinions and voted on a number of design options. The initiative was embarked on with the support of the NDMC, and the new emblem was officially gazetted by the National Department of Heraldry in October 2004. It was officially handed over by the President of DMISA to the Deputy Minister of Provincial and Local Government at the DMISA Conference on 20 October 2005.

Although DMISA consulted on an international level, it did not blindly transplant a symbol from abroad. The emblem's colours and shapes follow ancient examples from across Africa, as well as elsewhere in the world. The emblem is currently in use in many countries, from the Far East to South America, including the industrialized north and many developing southern nations. This means that international visitors to South Africa will recognize the emblem in an emergency situation. Consistent use of the emblem will ensure the visibility and recognition of disaster management among South African citizens.

Perhaps the most beneficial effect of the new emblem is the way in which disaster management officials from the three different spheres of government will work under one emblem and one corporate identity. This will cement relations between spheres of government, reducing the perceived distance between spheres and going some distance towards providing a seamless service to the public.

The deputy minister accepted the logo on behalf of the Government of South Africa, with a commitment to ensure that its use is legislated in regulations and encouraged within all spheres of government. Other countries within the Southern African Development Community and the African Union were invited to use it to show where people and governments are working towards reducing disaster risk.

Innovations in response

The number of natural disasters has increased over recent years, and with it, losses have increased too, on account of urbanization and population growth. As a result, the impact of natural disasters is now felt to a larger extent. Between 1999 and 2003, the financial impact of natural disasters was more than ZAR8.7 billion, a dramatic increase due to drought in the country.

Runaway fires destroying hundreds of informal dwellings during hot, dry and windy summer periods remain a serious concern for

South Africa's disaster management emblem

Cape Town Fire and Rescue Services and Disaster Risk Management. With the successful use of helicopters and fixed-wing crop sprayers to combat mountain fires during the summer, there has been a temptation to try and use the aircraft to stop shack fires as well. While many technical and safety aspects remained unresolved, it was decided to perform a trial run of aerial fire fighting for urban informal areas. Possible complications included injuries to residents due to the weight of 3,500 litres of water coming down on a flimsy wood and corrugated iron structure, flying hazards in urban areas, response times and visibility. The test did not raise additional concerns, and indicated negligible risk of injury to residents. During the trial period, in which the airborne response was complemented by smoke-detecting cameras installed at strategic high points, helicopters successfully arrested fire spread and assisted ground crews in bringing fires under control.

The trial was jointly conducted by the NDMC, the DWAF Working on Fire project, the City of Cape Town, and the Provincial Government of the Western Cape.

Rolling out and implementing the Disaster Management Act and Framework

Two-day workshops were held in every province from 6 June to 8 July 2005 to discuss the National Disaster Management Framework and implementation strategy. These proved very successful and provided a great opportunity to clear up any remaining uncertainties regarding respective roles in disaster management.

A national workshop was held on 19 and 20 July 2005, to which all national government departments and relevant government entities were invited. The purpose of this workshop was once again to ensure that all stakeholders were aware of their roles and functions in respect of disaster management as provided for in the Disaster Management Act.

A national DRM system

The Eastern Cape pilot project being rolled out in the Amatole District Municipality (including Buffalo City) is the result of a

DRM cooperation agreement between the governments of South Africa and Sweden in June 2005.

The agreement saw Sweden allowing South Africa the use of its proven advanced DRM systems and processes, and the relevant training in their application. Key areas for future cooperation were identified as information systems technology, education and training.

Subsequent to the agreement, the South African Government and Saab GrIDS (based in Centurion, Gauteng) signed a contract for the implementation of a national DRM system for South Africa.

The Swedish systems and processes are now being tailored and introduced in the Eastern Cape, in close consultation with the relevant local municipalities, and the personnel who will be applying them.

A total implementation strategy and a provincial framework have been successfully developed and are now in place. Installation of technical systems and provision of the appropriate technical and bridging training have commenced. Once this is completed, attention will be focused on how to use the technology and newly-acquired expertise to create risk reduction strategies and contingency plans that comply with DRM requirements.

The pilot project will culminate in February 2007 in a complex, integrated disaster management exercise, the planning directive for which is already completed.

The Department of Provincial and Local Government (DPLG), charged with converting the country's Disaster Management Act and Framework into reality, has arrived at the following conclusions:

- DRM must include a decentralized management and control system, to directly involve the main support services such as essential services, fire brigade, police, ambulance, water affairs and public works
- Management and control centres need to be established on national, provincial and municipal spheres
- Disaster management officials in municipal and provincial spheres must be educated and trained to conduct basic risk assessments for geographical areas for which they are responsible. This includes hazard identification, vulnerability assessment and risk definition
- Reliable communication links between all spheres of government need to be established
- Risk reduction and contingency plans can then be developed on realistic risk profiles.

Saab GrIDS and its specialist consultants in DRM were required to ensure that the knowledge transfer and intellectual empowerment of South Africa was an integral component of the pilot project in the Eastern Cape.

An integrated disaster management information system has been developed and is nearing completion. A government-to-government agreement between South Africa and Sweden was entered into on 28 June 2005, addressing collaboration between the two countries in the field of disaster management and providing software tools, valued at ZAR28 million, free of charge. These tools will be customized to suit South African conditions and the source code will reside in South Africa. The agreement also allows for the utilization of the tools through all organs of state.

Challenges ahead

Across South African society, government bodies have gone through a rigorous process of legislative reform, and are now into the implementation phase. Reorientation, seamless engagement, and a different style of collaboration are now required.

National systems for disaster management involve the active participation of a wide range of stakeholders including government, civil society, the private sector, media, the scientific community, development sectors and the community, to name a few. All these entities, at various levels, need to be actively involved in the process as each has a unique role to play. Because, in South Africa, disaster risk management is everyone's business.

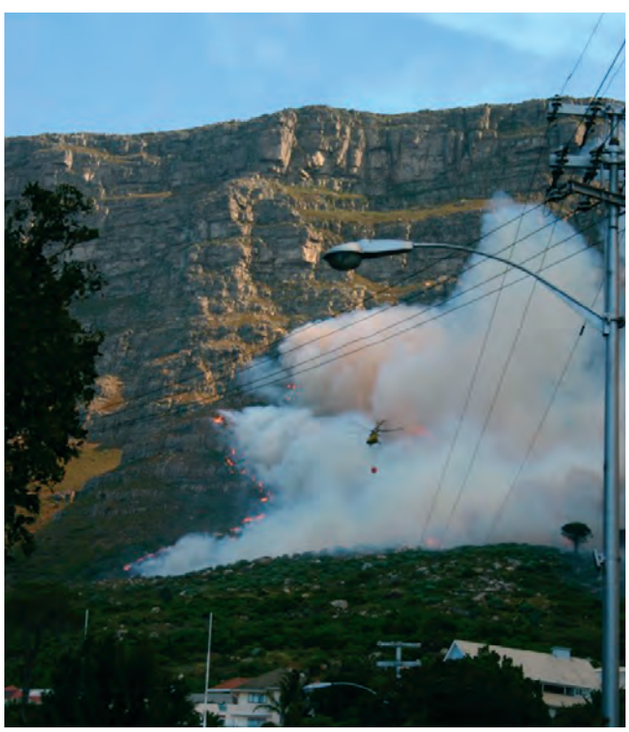


Photo: Johan Minnie, DMISA, 2006

Aerial fire fighting has been used to successfully combat mountain fires

Photo: Johan Minnie, DMISA, 2006

Runaway fires remain a serious concern

Community participation may lead to disaster (disease) reduction in camps: the role of the Ugandan Government and United Nations

Prossy Namuwulya and Trevor kaita Tumwesige

DISASTERS CAN HAPPEN to anyone, anywhere and at any time. Katakwi district, located in northeastern Uganda, is one of the areas where war and cattle rustling from the neighbouring Karimajong warriors have displaced more than 1 million people. The Lord Resistance Army has been fighting the Ugandan Government for the past 20 years, and has since spilled over to the northeastern town of Katakwi. Meanwhile, the Karimajong neighbours have raided people in this district for the past 40 years or so. As a result, thousands have been displaced to secure areas but little did they know that they were creating a suitable environment for another form of disaster — disease.

Internally displaced people's (IDPs) camps are highly congested, making the occupants prone to various diseases. United Nations agencies have worked closely with the Ugandan Government to see that people in camps try to live better lives. The research detailed here was focused on malaria, cholera and sexually transmitted diseases. Malaria and AIDS were found to be very common, whereas cases of cholera were not mentioned by anyone in the camps despite the fact that few of the people living there used toilets.

The World Health Organization, along with the Ministry of Health, were giving out Homapaks containing treated mosquito nets and anti-malarial drugs to pregnant mothers. Food was given by the World Food Programme (WFP), and clean water in the form of boreholes was provided by the Lutheran World Federation, an international organization working in the district. Nearly all camps had boreholes as the source of water and this has indeed been essential to people's health standards.

Local community contribution

The community fully participated in all the training workshops, which were conducted in the local language by trained camp leaders. Although the pregnant women were given mosquito nets, many of them did not use them, giving the reason that they would be suffocated. On the other hand, most people on the drugs that were given never completed the full course of medication, leading to resistance in the disease-causing organisms and hence 'drug resistance.' It emerged that some people preferred fetching their drinking water from the unprotected springs, claiming that this natural water has all the minerals flowing freely in it, unlike the borehole water. Little do they know that the human waste deposited all over the bushes runs into the springs when it rains. This was noted when most of the people from the camps confessed that, due to scarcity of pit latrines, they regularly visited the bushes to deposit their waste. However, even the few pit latrines seen in the camps were in very bad shape and usually overflowed when it rained.

On talking to local leaders, it was suggested that if land is available, they could mobilize families to construct pit latrines which were practical and affordable. However, this would involve having the landowners' permission. Two families said that they were very willing to construct pit latrines, but the landowners only leased them a small piece of land on which to construct a shelter for accommodation and nothing else.

The main social activity among the adults in the camps is drinking alcohol. People start drinking as early as 0900 hours until late at night. This leads to increased promiscuity and defilement, and has increased the prevalence of sexually transmitted diseases. The only drug shop that sells condoms reported that only 3 per cent of the total population in camps uses condoms. Most people cannot afford them and others feel that wearing condoms may introduce other diseases to them. So the Directorate of Health Services under the Ministry of Health is setting up committees in camps to educate the population about the dangers of unprotected sex and excessive drinking. Raymond Okello, the district health inspector, said that sex-related cases have slowly but steadily been dropping after the establishment of health committees. He said changing attitudes, especially among rural illiterate people, is an uphill task that takes a lot of patience.

The information acquired through the various training projects for disaster risk reduction and management led to the introduction of the Ministry of Disaster Preparedness in Uganda. Through this ministry, with the help of UN agencies, community leaders have tried their best to educate people on disaster preparedness and hence to reduce deaths by some of the diseases commonly manifested in IDP camps.

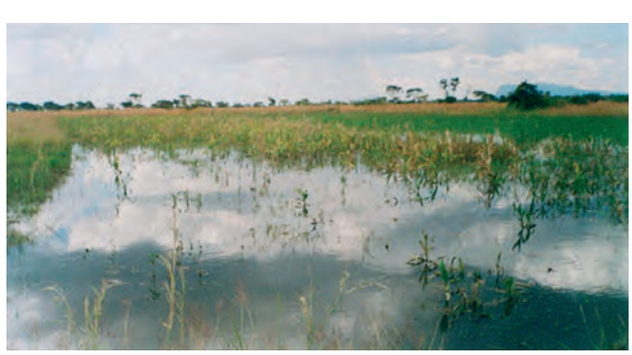


Photo: Peter Magelah

An unprotected spring, another source of water

Disaster risk management needs media support: InWEnt's commitment to human resources development for journalists and press relations officers

Dr Christina Kamlage and Johanna Eisele, Division for the Environment, Energy and Water, InWEnt — Capacity Building International

There is a 65 per cent chance that rainfall will be at lower levels and later than normal during the next planting season. For small-scale farmers in the heart of Mozambique, such information is of high importance. If they knew what to expect from the weather, they could choose seeds and fields accordingly. Otherwise, famine is looming — one of the most common hazards in this disaster-prone Southern African country.

"Our seasonal weather forecasts have become quite reliable," says Moisés Nenessene from the government meteorological service in Beira, Mozambique's second largest city. "But most people misunderstand their meaning because they don't know how to correctly interpret a probability." When they hear a low rainfall forecast, some farmers take it for granted that the next rainy season will be short and dry. But, says Moisés Nenessene, this is not what the weather service wants to say: "A chance of 65 per cent means that a farmer should only plant 65 per cent of his crops in expectation of a dry season. The remaining 35 per cent should be chosen for either normal or wet weather."

Photo: InWEnt - Capacity Building International

Journalists and press relations officers are important target groups for InWEnt's DRM human resources development programmes

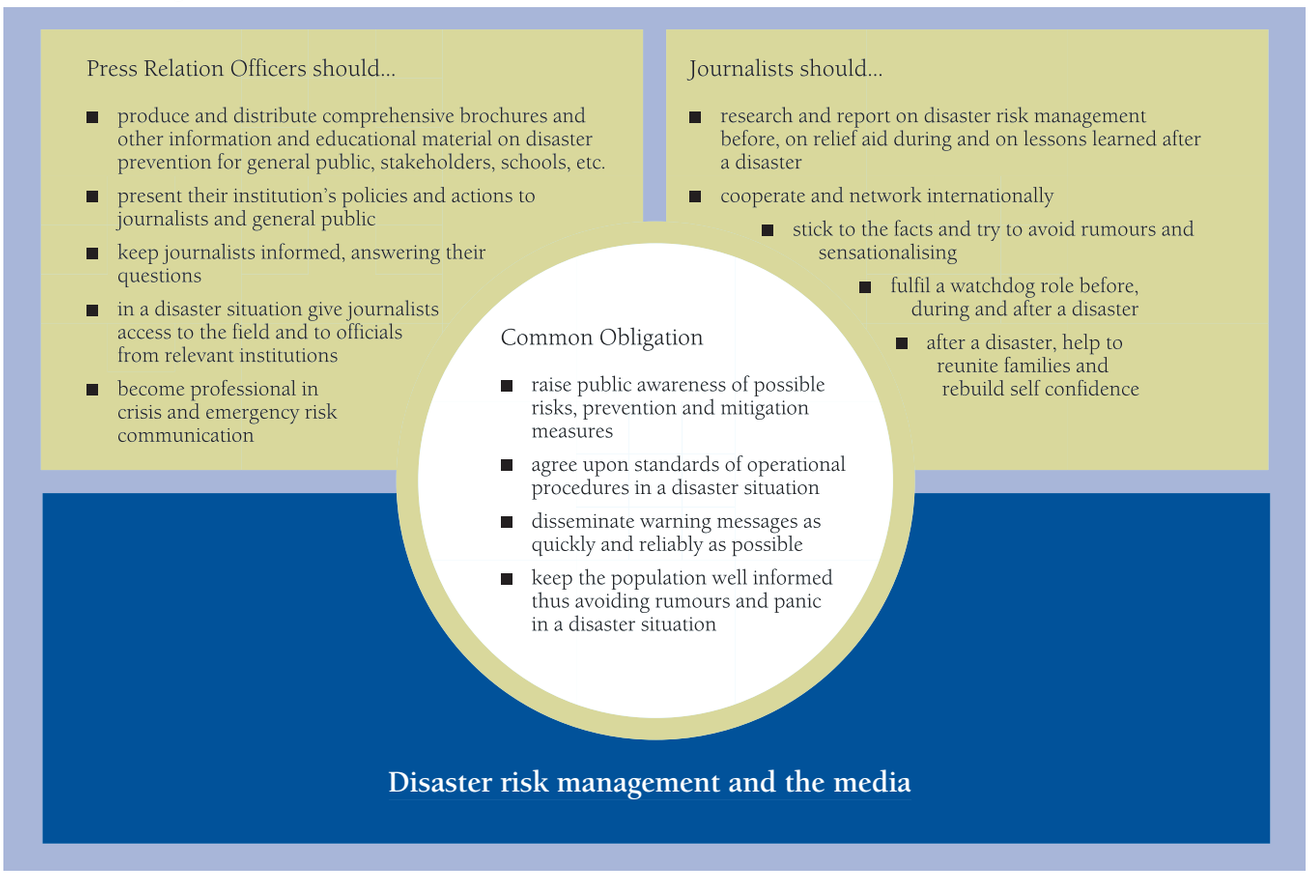
With the legacy of a 20-year-long civil war, most Mozambiquan farmers have little or no school education. In rural areas there are no newspapers, and very few people have access to TV. The only way they could be informed about the concept and meaning of a probability is via the radio. "However," adds Moisés Nenessene, "most journalists don't understand the concept either."

Mass media has a very important role to play in disaster risk management (DRM). But in many cases — and not only in Mozambique — newspapers, TV and radio stations don't live up to the challenge. This is why InWEnt — Capacity Building International[1] has included journalists and press relations officers as important target groups in its human resources development programmes for DRM in Southern Africa, Afghanistan and Indonesia.

Sensitization and networking of journalists in Southern Africa

At the end of a workshop in Nairobi, initiated by UN/ISDR together with InWEnt, 18 journalists from eight African countries unanimously adopted the following statement: "We recognize the ongoing global efforts made towards disaster risk reduction. We believe the initiative is crucial for sustainable development. We promise to work hand in glove with the UN/ISDR secretariat and African governments to achieve the ultimate goals. We call upon all journalists worldwide to join this effort." The journalists had spent the past four days exchanging their experiences, identifying knowledge gaps and receiving information from experts on DRM.

"Disasters are not only events striking at a particular time, but the result of various processes involving hazards, vulnerability, governance, etc.," says international journalist Alain Valency, who edits the UN/ISDR newsletter, *Disaster reduction in Africa*. During the workshop, he observed: "Journalists should therefore shift from an 'event' to a 'process' approach, from 'sensationalism' to a more responsible 'contextual' journalism that allows the question of why disasters occur and how their impacts could be reduced."



Source: InWEnt – Capacity Building International, 2006

Clearly, a disaster is not a single event to be reported on, but rather an ongoing process that needs to be accompanied by media coverage well before, during and after the event.

Reporting before, during and after a disaster

Before a disaster happens the role of the media in DRM is mostly educational. Which prevention measures exist? How can communities prepare themselves? How does the national early warning system work? How can official announcements be correctly interpreted? These are some of the issues requiring media attention, the aim always being a high public awareness of possible risks and mitigation measures.

An ongoing disaster with its human tragedy, grief, despair, destruction and dramatic rescue operations always makes for a gripping story. However, journalists should avoid the temptation to sensationalize their observations. Disaster reporting should adhere strictly to the facts. Lack of credible information and rumours can seriously increase people's insecurity, exacerbate fear and frustration, and even trigger social, religious and political conflict. Access to the field and to officials from relevant government institutions and relief organizations is therefore of great importance for journalists. Media workers should plan their logistics well ahead.

In the aftermath of a disaster, the media can play an important role in reuniting families and helping to rebuild self-confidence among the population. Relevant information and even entertaining radio programmes can support communities in their efforts to return to normal life. With hindsight, there will always be positive and negative lessons to learn from a disaster situation. Both should be thoroughly reported in order to be better prepared for the next one.

Before, during and after a disaster, mass media also has an important watchdog role to fulfil. Does the legal and administrative framework meet the specific needs of DRM? Are communities well prepared by government? Have lessons from previous disasters been taken seriously? Is there any evidence of mismanagement or corruption? Are there examples of 'good governance'? All these are typical journalistic questions, and they also apply when reporting on DRM.

The 'big' national media and small regional and local papers and radio stations are of similar relevance. "They play an important role in increasing knowledge and awareness among the threatened population," says Torsten Wegner, project coordinator for InWEnt in Mozambique. "We should therefore strongly involve local media."

Since many disasters are spread across national borders, international media cooperation can also be very helpful. A Journalists in Africa for Disaster Risk Reduction network was formed by participants of the Nairobi conference, and is open to all interested media practitioners from the region. Media from different countries can exchange reports on best practice examples of DRM and cooperate in early warning and mobilizing international help. Media institutions could even become directly involved as project partners in human resources development.

InWEnt's efforts to reach out to Mozambiquan journalists and media have led to a total of five media-related workshops involving 228 participants. As a result, newspaper coverage of disaster related issues increased sharply from 20 to 61 articles per year

Photo: InWEnt - Capacity Building International

Journalists at the workshop in Nairobi, initiated by UN/ISDR and InWEnt

between 2002 and 2005. An additional number of more than 25 TV broadcasts has been counted.

A magazine on project activities in Afghanistan

In Mozambique and some other Southern African countries the media landscape is quite ample, including written press, radio and TV broadcasting, both private and government-owned. This is not the case in many other disaster-prone countries. In Afghanistan, InWEnt has not yet included direct media activities in its ongoing human resources development activities. However, DRM issues have been presented to the public in a pashto-language magazine, edited by InWEnt's local project coordinator Nadjib Yussufi in cooperation with the Afghan Department of Disaster Preparedness. Seven editions of the magazine have been published so far. "It includes information on our workshops and seminars as well as reports on natural hazards and prevention measures, written by experts from Afghanistan and abroad," says Yussufi.

Separate training of journalists and press relations officers

Indonesia, another country with many InWEnt activities in the field of human resources development for DRM, has a very vivid media industry. The public can choose from 11 national and 34 local TV stations, 1,200 radio stations, 176 newspapers with a circulation of almost five million daily copies, plus hundreds of weekly papers and magazines. Most media concerns belong to big publishing houses and there is heavy competition between them. This puts pressure on the journalists to always come up with a sensational story. Journalist organizations lament a lack of in-depth, background and investigative reporting.

The Capacity and Institutional Development in Disaster Risk Management (CID) project is a joint effort by InWEnt, the Ministry of Research and Technology (RISTEK), the Secretariat of the National Coordination Board for Disaster and Internally Displaced People Management (BAKORNAS) and the Ministry of Home Affairs in cooperation with German companies GTZ and BGR. The project will devote a special focus to media related activities, following a planning workshop held in Jakarta and attended by journalists and press relation officers working in the field of DRM.

Training for journalists will include workshops on research, writing skills and the ethics of disaster reporting. The CID project will also work towards agreed standards of operational procedures for communications between government institutions and the media in a disaster situation. Special focus will be given to the watchdog role of journalism.

Dialogue and training workshops will also be offered to press relations officers — as separate events, not together with journalists. The two groups have different roles to play. Press relations officers are the 'voice' of their institutions, trying to communicate their policies and activities to the public. The role of journalists, however, is not to just interpret and hand on this information to readers, listeners or viewers, but also to question and verify the facts, to find opposing views, to look at the issue from various angles and to find out about the effects of such policy and action on the people in the street.

Crisis and emergency risk communication for press relations officers in Indonesia

Training for press relations officers will focus on creative communication tools, and especially on crisis and emergency risk communication. This is a set of methods used in order to provide all necessary information during an emergency situation — be it an early warning, an evacuation order or general disaster information — as clearly, accurately and concisely as possible. If the affected population feels itself well informed, rumours and panic can be avoided. Since press relations officers do not usually have direct access to the general public, they need to rely on journalists to spread their important messages. In a disaster situation, press relations officers and journalists need to work hand in hand. This requires trust and a good working relationship between the two groups, which need to be established well ahead of an actual emergency. At all times, press relations officers need to keep journalists well informed, providing them with all necessary data, relevant quotes and access to the field.

Apart from the actual crisis situation, press relations officers' skills in the field of public awareness raising and sensitization will be enhanced by the joint development of comprehensive manuals, brochures and information material. Activities will focus mainly on the national level and on two priority areas — one being a rural and remote island, the other one an urban area in Central Java. In order to spread training competence, participants of training activities at national level will become trainers in the priority areas.

Support for journalists' watchdog role

Proper disaster risk management is not possible without media support. However, there is no way to force journalists into the issue. They need to be attracted by providing them with well-prepared, relevant information and by giving them the opportunity to see how DRM works in practice. It does not make sense to hide potential problems from them. By reporting on the weak points of disaster preparedness, media publications contribute to awareness-raising, not only in the general public but also among stakeholders and political decision makers, thus increasing the relevance of DRM institutions. Journalists have a watchdog role to play and it is a good idea to support them in it.

Sensitization and awareness-raising on DRM issues is not a singular event. It needs to be a permanent process involving policy makers, stakeholders, experts, press relations officers and journalists. They all have different roles to play, but in an actual disaster situation they need to work hand in hand as well as possible. The sooner this is addressed the better.

Crafting cross-cultural risk communication strategies

Suzanne L. Frew, Cross-cultural Risk Communications Consultant, The Frew Group

While teaching a disaster risk communications class at the Asian Disaster Preparedness Center in Thailand, a group of public and private mitigation projects managers from around the world shared stories of the challenges they faced in their high risk communities. Repeatedly, they described cultural roadblocks, successful and unsuccessful attempts to encourage the implementation of innovative risk reduction approaches, and the need for personalized, innovative approaches to communicate natural hazard risks and promote unfamiliar mitigation techniques. The class of experienced professionals told a universal story of how high-risk communities differ dramatically in cultural values, attitudes towards change, and the ability to listen, understand, personalize and implement risk reduction messages.

Since the Indian Ocean earthquake and tsunami and Hurricane Katrina's devastation of New Orleans and surrounding communities, risk communicators and mitigation project managers have begun to more clearly realize the critical roles played by culture, psychology, spiritual traditions and individualized communication approaches in the implementation of disaster reduction practices. The two disasters have underscored the need to build a cultural context for communities at risk and customize outreach campaigns and risk communication messages rather than depending on a prescribed 'one size fits all' approach. For the United States, the devastation of New Orleans and the extensive loss of life among the hardest to reach populations demonstrated this overlooked need in one of the nation's greatest natural disasters.

The need to embrace effective cross-cultural communication increases as the informed debate on the role of risk reduction in community development and socio-economic sustainability creates new discourse, institutional practices and policies. Just as feminist scholars are now more readily being listened to as they address key concerns pertinent to the role of gender in risk reduction and disaster recovery, so equal consideration should be given to addressing a sustainable policy targeted at effective, cross-cultural communication practices combating discrimination and social exclusion.

A global communication challenge

Internationally, limited resources are directed towards public awareness efforts and outreach campaigns in each stage of emergency management — be it preparedness and mitigation, response, short-term recovery, or in the long-term rebuilding of infrastructure, economy and a return to quality of life. Yet risk communication techniques significantly influence the success rate for implementation of disaster reduction practices and decision-making processes in pre-disaster and post-disaster environments.

Men, women and children in Galle, Aceh, New Orleans and other, more recently disaster-impacted areas such as Pakistan, now struggle to understand and accept hazard mitigation strategies being introduced in the rebuilding process. Impacted residents, business owners and officials are being asked to utilize alternative building construction techniques, relocate homes and change lifestyles; to live in a different relationship to the land and the sea; and to implement controversial land use solutions. Communication strategists assisting in implementing these risk reduction practices now have an opportunity to increase the chance of success by embracing the use of traditional and non-traditional techniques that penetrate the psyche of the impacted community and build upon their psychology, behaviours, beliefs and decision-making practices.

In New Orleans, the struggle for coherent, culturally appropriate shared communication continues. In Sri Lanka, long-time warring political factions, militant extremes, multiple spiritual traditions, languages and traditions highlight the need for communication outreach that reflects the divergent communities while at the same time rebuilds a nation.

Cross-cultural communication theory

Over recent years I have used theoretical frameworks from the field of cross-cultural communications to help craft risk communication messages in Southeast Asia and the US. Two approaches in particular have been useful. K. Hagerman's Iceberg of Communication demonstrates how the tip of an iceberg — that which one sees above the waterline — is what we readily see in another person, such as ethnicity, clothing and music. Below the waterline, out of sight, are

Photo: Suzanne L. Frew, 2004

A makeshift home altar after the Indian Ocean tsunami reflects the critical role of spiritual traditions to disaster recovery

the more complex values such as time, religious beliefs, taboos and traditions. At the deepest level exist values such as criteria for good and evil, individual worth, and attitudes toward life and death — cultural values that profoundly impact decision-making and motivate willingness to change.

A second cross-cultural model is a value continuum of 'high and low context' societies, made known by Robert Kohls. For example, a member of a high context society often accepts fate and acts in a traditional and formal manner, whereas his or her counterpart in a low context society more readily believes in controlling the environment, and acts in a progressive and informal manner.

These and other cross-cultural communication theories have been successfully used for a long time in other professions outside of emergency management. In teaching public health officials, I find these concepts are readily accepted and used to analyse needed approaches for entire communities as well as individual patients. By focusing on these tools we as emergency managers can develop informative cultural profiles of our communities that allow us to identify the characteristics that describe the community, or a subculture or community within that community. By understanding the psychology and conditions of our target audience in that community (e.g. business owner or student, traditional or progressive values, first or fourth generation) we can craft a customized outreach approach based on those we wish to reach and not on ourselves as communicators.

Case example

The City of New Orleans has developed into a case study for the need for effective risk communications. Having previously served as a public information officer for the Federal Emergency Management Agency, the challenges of working with multiple levels of government in a multi-cultural environment, prior to and after an event, are all too familiar. In Katrina, the world not only watched the events created by wind and water and failed levies, but also the failure during response to use effective risk communications to safeguard the lives of those at highest risk. A previous exercise, expressed concern by the professional community, and a report by a group of public and private professionals examining the social science research needs for forecast and warning systems, documented the area's unique outreach challenges.

While participating in the Katrina humanitarian response effort as part of the IBM Crisis Response Team, I had the opportunity to work with disaster responders working with individuals living on society's edge who found their lifeline through faith-based and other non-governmental organizations. Months later, while participating in ongoing rebuilding efforts with the Bring New Orleans Back Commission and other initiatives, an issue clearly repeated was the deeply-rooted cross-cultural, cross-sector communication needs, challenges and opportunities.

New Orleans, a multi-cultural society now in the process of reinventing itself, struggles as a splintered transitional community, such as those normally experienced in geographical areas where immigrants and ethnic minorities are forced to build new political and social frameworks. City-wide infrastructure and neighbourhood planning efforts require customized, cross-cultural risk communication outreach to effectively build coalitions, create community vision, share resources, and integrate hazard reduction practices in land use planning. Individual neighbourhoods, such as the hard-hit Ninth Ward, as well as local business and industry and other stakeholders, need not only to be reached, but also to be understood, honoured and reflected in an understandable communications framework that supports risk reduction policy implementation.

Many influences shape our worldview and provide reasons for our actions. But whoever we are, man or woman, young or old, Muslim or Christian, landowner or migrant labourer, first generation or fifth, we share a common role as one of society's members. And as part of civil society we all deserve to be informed, included, and understood. Communicating across cultures builds a stronger, more inclusive bridge to safety and risk reduction.

Photo: Suzanne L. Frew, 2005

Effectively communicating loss reduction methods as well as evacuation notices to vulnerable populations will save lives and property

Concern's approach to disaster risk reduction in the haor communities of north-east Bangladesh

Peter Crichton, Emergency Preparedness Co-ordinator, Concern Worldwide, Dublin and Pankaj Kumar, Technical Advisor, Concern Worldwide, Bangladesh

Concern is an international humanitarian organization dedicated to the reduction of suffering and working towards the ultimate elimination of extreme poverty in the world's poorest countries. Concern implements both emergency and long-term development interventions with poor communities in 30 of the world's least developed countries. Regular and cyclical natural disasters, coupled with poor governance, inappropriate policy environment and conflict are common characteristics of these countries, and frequently interact to create disasters with multiple causes and effects.

Concern sees disaster risk reduction (DRR) measures as a key requirement to protect the lives and assets of the communities with whom it works and to underpin the sustainability of its long-term development programmes. The organizational *Strategic Plan for 2006-2011* has highlighted the centrality of DRR to Concern's mission to contribute to the eradication of poverty. In its country programmes, Concern has begun to mainstream DRR within contextual analysis and programming. By June 2006, as part of an ongoing mainstreaming process, the Concern Emergency Unit had delivered DRR awareness and planning workshops in 14 country programmes, targeting the staff of both Concern and its partner organizations.

Photo: Pankaj Kumar

Floods in haor areas regularly impact lives, livelihoods and assets

In 2005, Concern's Emergency Unit prepared its *Approaches to DRR* paper where, reflecting the reality of the countries in which the organization works, a broad view of hazards was taken. The study explicitly recognizes conflict, poor policies, poor governance and the impacts of climate change as threats to the communities with whom Concern works, and therefore as potential areas of focus for its DRR interventions. Concern's approach towards DRR is conceptually grounded in its analysis of livelihoods, and provides a link between its humanitarian and long-term development work.

The experiences of Concern, its partners and vulnerable communities in the haor region of Bangladesh have seen the development of a DRR strategy, built on the lessons learnt from previous responses to disasters in this area.

The haor area

Concern's programmes in Bangladesh focus on areas where a substantial percentage of the population lives in absolute poverty. One such area is the haor, a low-lying area in the north-east of the country that floods annually during the monsoon season, when rainwater originating in the hills of India pours into Bangladesh, forming huge water bodies. Water depths averaging over two metres inundate agricultural lands for up to seven months between April and October. In order to avoid flooding, villages are located on higher land within the flood plain. Such land, however, is scarce — villages tend to be densely populated and widely scattered. The limited road system has high maintenance costs associated with the flooding, and other means of communication are equally weak. Commonly, the only means of transport is by boat or, in the dry season, by foot.

During the past few decades, the lives and livelihoods of haor people have been regularly threatened by rising levels of seasonal floodwaters and storm-generated waves. This combination of annual floods and waves is eroding village and homestead lands, and has occasionally destroyed entire villages.

At the onset of the monsoon season, rural households try to protect their homestead lands by erecting reed matting (*motha*) walls tied with bamboo and fortified with *challa* grass (*Hematheria protensa*). The annual cost of making these defences is between EUR25 and EUR60, and 16-20 days of labour for each household.

Photo: Pankaj Kumar

Though often futile, rural households protect their homestead lands by erecting reed sheeting tied with bamboo and fortified with challa grass

The majority of household income is derived from the single rice crop grown annually. This is commonly produced on a share-cropping basis, and rent for the land accounts for a substantial part of this income. Flash floods occur regularly at the end of the dry season (most recently in 2004) and can lead to losses of the rice crop and other vital assets including seeds and livestock. There are few other crops grown in the area and alternate work is limited to migrational labour and working as day labourers for the large companies that control the fishing industry in the haor areas.

The paucity of basic services and absence of accountability of public service providers further compounds the hardship in the haor area. Government resource allocation for poverty alleviation does not consider the special needs of this remote and geographically distinctive area. Despite its uniqueness, there is no specific government policy to address the problems of the haor. The same building designs, codes and allocations that apply to mainland areas apply equally to haor areas.

Concern and the haor area

In recognition of these challenges, Concern has been working with haor communities since 1988, initially implementing an emergency response project and then moving in 1992 to the establishment of long-term development programmes which included a number of disaster preparedness and mitigation activities.

These activities included providing training to community groups and local government officials in disaster contingency planning, the principles of relief distribution and first aid. Other measures included the construction of raised earth platforms as flood shelters where people could take refuge with their domestic animals, crops and other assets in the event of flooding. Flood and wave protection measures such as brick walls and gabion structures were constructed around village perimeters. Individual homesteads, plinths, tube wells, sanitation units, and even entire villages were raised above flooding levels, and saplings were planted along the slopes of villages to reduce wave-induced soil erosion.

These interventions have helped protect and restore the livelihoods and assets of the haor community and provided them with an opportunity to engage in alternative income-generating activities such as poultry rearing and kitchen gardening. Construction of the physical protection measures provided local employment opportunities and an added benefit of the flood shelters is that, during times of normal water levels, they can be used for drying crops and as a space for social activities. Improved access to better water and sanitation facilities has reduced the prevalence of water-borne diseases during the rainy season.

Lessons learned and the way forward

In 2005 Concern, utilizing tools and methodologies developed in its *Approaches to DRR*, undertook a further comprehensive risk analysis to identify hazards which are more likely to occur, and to understand the specific vulnerabilities of individual communities to their impact. Building on previous actions, specific mitigation, preparedness and advocacy measures were identified. Implementation of these through local non-governmental organizations (NGOs) and disaster management committees will increase the ability of communities to withstand, respond to, and recover from the impact of hazards.

Care was taken to ensure that these measures complemented the recently established national framework on disaster management and recognized that local government institutions in Bangladesh have the mandate to coordinate and implement risk reduction activities. It is clear that Concern has a role in making linkages between macro-level policy and micro-level activities, particularly in articulating the vulnerabilities of poor communities.

Mitigation measures

The risk assessment in 2005 revealed that while some of the mitigation measures introduced performed well, a number of them required reassessment in order to better reduce the vulnerability of communities:

Flood protection measures — Haor villages have various physical flood protection measures in place which were constructed by the communities themselves, Concern, other NGOs, and government agencies. These include brick protection walls, concrete blocks, gabion structures and plantations. They have not all proved to be equally effective or durable, and a cost-to-

benefit analysis is to be commissioned to identify the most appropriate technology to be used in future interventions.

Flood shelters — The requirements and standards for the use of flood shelters during disasters need to be assessed, particularly in relation to the use of their facilities, such as water and sanitation.

Agriculture cropping patterns — The reliance upon a single rice crop is contributing to the vulnerability of the communities. The use of short maturation rice varieties that will be ready for harvesting earlier in the dry season and lessen the exposure of the crop to flash floods is to be explored. Additionally, Concern will explore with the communities the possibilities for crop diversification including winter vegetables and spices.

Tree plantations — Two local tree varieties *(koroch — Pongamia pinnata* and *hijol — Barringtonia acutangula)* were originally chosen as being suitable for the area and, though slow-growing, served their function reasonably well as a protective measure against wave erosion. In the light of experience in Bangladesh and elsewhere, it was decided to review the appropriateness of other species for the area that are multi-purpose, for example providing poles, firewood and animal fodder, and that have faster growth rates and good soil protection properties.

Preparedness activities

Capacity building — Concern, working with relevant government bodies, will facilitate the reactivation and capacity building of local disaster management committees in raising awareness of their roles and responsibilities. The organization will also assist in the preparation of risk reduction plans and their subsequent implementation. These include the preparation of contingency plans for severe disasters such as search and rescue and the pre-identification of safe areas within and adjacent to the haor communities.

Emergency response — Despite DRR becoming more central to development planning over the past few years, there is evidence to suggest that there will be a higher incidence of disasters in the future. Concern will continue to strengthen communities, local NGOs and government bodies to make speedy and appropriate emergency responses when communities' capacities are overwhelmed. The purpose of these interventions will be primarily to alleviate suffering and save lives by meeting immediate short-term needs for food, shelter, health, water and sanitation. Concern has initiated a programme with its own staff and its partners to develop a common understanding of the principal codes and standards that inform good humanitarian programming. Central to this is the need for a strong emergency response capacity allied with transparency in targeting and accountability both to affected communities and donors.

Concern Bangladesh has demonstrated over the past years that there is sufficient capacity between the programme team and partners to achieve appropriate and timely responses to disasters. If required, this capacity can be augmented by additional emergency support that exists within the organisation.

Early warning systems — It is widely recognized that early warning systems have played a crucial role in reducing the impact of hazards on communities. Bangladesh has an existing early warning system in place that can give 72 hours' warning of flash floods, but these warnings are not well communicated to vulnerable communities and do not always allow sufficient time for appropriate action to be taken. Concern will help develop the linkages between this higher level warning system and communities potentially at risk, and will support the establishment of a haor community-based flash flood warning system that will give up to six days' warning, allowing the safeguarding of harvests, livestock and other assets.

Advocacy issues

The risk assessment carried out during 2005 identified a wide range of advocacy issues, including the early allocation of government funds for risk reduction, standard relief packages, strengthening of embankments prior to floods, river dredging, and the establishment of specific building regulations for haor areas.

These and other issues will be prioritized by disaster management committees through the process of micro-to-macro linkages and by association with the national Comprehensive Disaster Management Programme, existing national networks and coordination groups. Concern will facilitate the development of a concerted and broad-based strategy for advocating these issues on both local and national levels.

Photo: Pankaj Kumar

Brick walls introduced by Concern to protect soil from erosion during floods have proved very effective

Photo: Pankaj Kumar

Concrete blocks have been introduced as a flood protection measure by local government authorities

Managing disasters: the Orissa experience

N. Sanyal, Managing Director, Orissa State Disaster Mitigation Authority
Rajiv Bhawan, Bhubaneswar, Orissa, India

Disasters have affected human populations, causing considerable damage to their social and economic support systems from time immemorial. All these years of suffering seem not to have resulted in an effective mechanism of disaster mitigation for vast segments of population, particularly for people living in developing countries. Economic limitations, the socio-political system and administrative/regulatory framework prevailing in a geographical entity often determine the impact of disasters on people.

Economists all over the world agree that democracy is the best form of hunger prevention mechanism. But experience shows that no amount of economic stability supported by democratic set-up alone can protect a population from the vagaries of nature and their after-effects. We need not go through the horror of the 1999 super cyclone, the killer tsunami of 2004 and the dreaded Hurricane Katrina of 2005 to understand disasters and their effects. Rather, one thing that emerges distinctly from all these tribulations is that perpetual preparedness is the key to limiting the impact of disasters.

Profile of Orissa

Orissa is a state on the eastern seaboard of India, located between 17°49' and 22°36' north latitude and between 81°36' and 87°18' east longitude. It spreads over an area of 155,707 sq km and is broadly divided into four geographical regions: Northern Plateau, Central River Basins, Eastern Hills and Coastal Plains. It has a 480 km long coastline. Its population was 36,706,920 as per the 2001 census. Administratively, the state is divided into 30 districts, 58 sub-divisions, 314 blocks (administrative units in descending order of geographical area and population) and 103 urban local bodies. The average density of population comes to 236 per sq km with significantly higher density in coastal areas compared to the interior parts.

Photo: OSDMA

A school-cum-shelter

Vulnerability

Orissa is vulnerable to multiple disasters. Due to its sub-tropical littoral location, the state is prone to tropical cyclones, storm surges and tsunamis. Its densely populated coastal plains are the alluvial deposits of its river systems. The rivers in these areas with a heavy load of silt have very little carrying capacity, resulting in frequent floods that are only compounded by breached embankments. Though a large part of the state comes under Earthquake Risk Zone-II (Low Damage Risk Zone), the Brahmani Mahanadi graben and their deltaic areas come under Earthquake Risk Zone-III (Moderate Damage Risk Zone) covering 43 out of the 103 urban local bodies of the state. Besides these natural hazards, human-induced disasters such as accidents, stampede and fire, vector-borne disasters such as epidemics, animal diseases and pest attacks, and industrial/chemical disasters add to human suffering.

Orissa State Disaster Mitigation Authority

The 1999 super cyclone affected 14 out of the 30 districts of Orissa, with the loss of 8,962 precious human lives and about 450 thousand cattle heads. Two million houses and 1.84 million hectares of crop area were damaged, and transport, telecom and power systems were paralysed — the entire coastal tract was devastated. The politico-administrative system and the economy of the state pointed to a significant gap in the whole process of handling disasters and their aftermaths. The vulnerability of the state, its people and their inadequate preparedness level called for a new approach to disaster management. A consensus evolved to create a separate organization to meet the challenges of disaster preparedness and management through integrated policy enunciation, holistic planning, infrastructure development and multi-stakeholder coordination. The Orissa State Disaster Mitigation Authority (OSDMA) was thus set up in December 1999. OSDMA has focused its attention on certain areas of disaster management in a systematic manner based on past experiences, especially those during and after the super cyclone. It can legitimately claim that some headway has been achieved.

Preparedness

Shelters — The colossal loss of human lives and livestock, which affected a large part of the rural economy, was caused mainly due to a lack of strong houses. The brick wall and RCC roof houses, however imperfectly engineered, were found to have withstood the forces of cyclonic wind and swirling waters. With a view to providing safe shelters to vulnerable people, it was decided to construct multipurpose cyclone shelters (MCS) in the 10 km belt from the coastline, where the maximum impact of a cyclone is generally felt. Ninety-five such MCS have been constructed along the coast with the dual purpose of providing shelter to the vulnerable populace during disasters and using the buildings for other community related purposes during normal times.

The stilted structures provide accommodation facilities on the first floor, while the ground floor allows storm surge to flow through. In the absence of such surges, the ground floor can also provide shelter to domestic animals. These shelters have been constructed with both technology and usability in mind; there are separate halls for men and women with the provision of facilities like toilets, water supply, electricity, and ramps for the old and the disabled.

To create a sense of ownership among the members of the community, Cyclone Shelter Management and Maintenance Committees comprising local government officials, public representatives and village people have been formed to manage and maintain the shelters. Besides the 95 buildings constructed by OSDMA, the Red Cross and several non-governmental organizations (NGOs) have constructed 29 shelters and are presently constructing a further 30 or so. About 8,000 school buildings have been constructed, which can also serve as shelters in the event of a disaster

Communication — One bitter experience of the super cyclone was the disruption of all traditional communication links such as telephone, telegraph, fax and e-mail. Precious response time was lost due to the collapse of communication networks. To overcome the problem, a fully dedicated civil VHF wireless network was established, with 402 base stations covering all district and block headquarters as well as some key and vulnerable locations. This provides an alternative communication medium that the district administration can use in the event of a disaster. In addition, the telecommunication network has been upgraded and satellite phones have been provided to district collectors and other key disaster managers, to enable them to establish contact in the event of failure of all other means of communication. Efforts are also underway to promote ham radio among youth clubs in vulnerable areas.

Photo: OSDMA

Boulder-crate technology reinforces an embankment

Search and rescue — The search and rescue equipment available in the state and the level of training given to people to handle emergencies were found to be grossly inadequate to cope with the situation in the post-super cyclone period. Relief material could not be transported to the affected areas because the roads were damaged, blocked and washed away. Help was sought from the neighboring states at great loss of vital response time. Against this background, Orissa Disaster Rapid Action Force (ODRAF) units were created to provide search and rescue assistance to the administration in the aftermath of a disaster. The units are manned by Orissa State Armed Police personnel. Modern search and rescue equipment and high-level skills training have been provided to these units. Five such units are located at strategic locations in the state. Besides the ODRAF units, the fire service wing of the state is being built up as a second line of response to meet any possible eventuality.

Capacity building

The Disaster Risk Management (DRM) programme is a large-scale national initiative covering 17 states. Its aim is to create awareness on disaster preparedness at different levels, beginning with the community and up to the state level. It is being implemented in 23,263 villages and 3,210 gram panchayats (village governments) of 155 disaster-prone blocks spread over the 16 districts of Orissa. Under the programme, disaster management plans are prepared at village, gram panchayat, district and state level. Disaster management committees and task forces are established and trained to discharge different duties in the event of a disaster.

Urban Earthquake Vulnerability Reduction is a programme being implemented in three cities of Orissa that come under the Moderate Damage Risk Zone. City-level and ward-level disaster management plans are being prepared under the programme. Awareness generation activities involving community members, public representatives, engineers, community leaders and masons are also being devised and implemented.

Two programmes, the National Programme for Capacity Building of Engineers in Earthquake Risk Management and National Programme for Capacity Building of Architects in Earthquake Risk Management, are being implemented to train engineers and architects in the design and construction of earthquake-resistant buildings.

As a part of the national initiative, the state is in the process of formulating a techno-legal regime for the construction of disaster-resilient buildings. A high-level committee is examining the recommendations of the National Expert Committee (set up by the Government of India) on town and country planning regulations, land-use zoning regulations, development control regulations and building standards regulations for incorporation in the state.

Capacity building measures were taken up for training of government officials, people's representatives, NGO functionaries, professionals like engineers and architects, and community members. In addition, public awareness campaigns through electronic and print media, publications, films and

community interaction have been taken up. These awareness generation initiatives have helped communities and disaster managers at different levels in broadening their information base.

For effective disaster management, emergency operation centres (EOC) have been set up at the state capital and at district headquarters. The Government of India has formulated the National Emergency Communication Plan for data, audio and video connectivity with a triple redundancy to connect national, state and district EOCs. The police network, the National Informatics Centre Network and the Virtual Private Network for Disaster Management are the three major networks that will be extended to all district EOCs for data, audio and video connectivity in a time-bound manner.

A state of the art state EOC has been set up at the state capital, and hazard-resistant buildings are being constructed to house district EOCs. Emergency and modern communication equipment like computers, fax, VHF systems, lifebuoys, lifejackets, generator sets, etc. have been provided to the EOCs.

Key policy initiatives

The most important development in the field of disaster management has been the enactment of the National Disaster Management Act, 2005. This is now being considered for adaptation in the state with modifications to suit local requirements. The National Disaster Management Act provides for the creation of disaster management authorities at four levels: national, state, district and local authority (gram panchayat and urban local body).

Executive committees will implement the decisions of the disaster management authorities at different levels, and advisory committees will provide expert opinion to the relevant authorities for effective disaster management. According to the National Disaster Management Act, every ministry or department is required to prepare a disaster management plan in tandem with the developmental plan of the department.

In Orissa, OSDMA has facilitated the formulation of state disaster management policy, plan, hazard analysis and identification, etc. Five sub-groups were set up to prepare reports on different types of hazards, and 31 types of disaster were identified under these groups. The state government has already approved the state disaster management policy.

Photo: OSDMA

An ODRAF crane

The major principles of disaster management policy include:

- Shift from relief and welfare to rights and entitlement
- Integrate disaster management into development policy and planning
- Legislation to provide statutory backing to essential disaster management functions
- Community-based disaster preparedness
- Using people's indigenous knowledge and culture in decentralizing disaster management
- Ensuring humanitarian assistance to disaster victims
- Capacity building at all levels
- Making disaster management part of the education curriculum.

The state disaster management plan incorporates guidelines for government departments for initiating their action plans for management of disasters.

Preparedness through coordination among stakeholders

Disasters in the recent past have shown one thing very clearly: that administration cannot operate in isolation. Other stakeholders like NGOs, community-based organizations and external agencies have a role to play in disaster management. In the best interest of the people, coordination among the major players in the field ought to be maintained. OSDMA has been acting as the state level coordinator involving NGOs working in the field of disaster management. The Social Capital Restoration Programme has been implemented, to involve NGOs in awareness generation, capacity building and livelihood support activities in the post-super cyclone period.

Reconstruction

Reconstruction had been a routine follow-up action of the administration in the aftermath of every disaster. But reconstruction took on a whole new dimension after the 1999 super cyclone, when the concepts of disaster-resilient construction, quality monitoring through external agencies and adoption of high technology for disaster-resistant infrastructure came into play. River training works, saline embankments and the dredging of riverbeds were among the activities taken up under various infrastructure reconstruction projects.

Pitching of river embankments by boulder-crate technology was also adopted at many vulnerable places. 602 reconstruction projects, involving 141 road works, 345 irrigation works, 19 piped water supply and 63 rural water supply works, 34 cyclone shelter projects comprising 37 shelters, and one package under the Agricultural Promotion and Investment Corporation of Orissa Limited, comprising 500 agro service centres at a total approximate cost of INR270 crore (USD60 million) were taken up. Apart from two cyclone shelters, which are underway, all the projects have been completed.

Humankind faces disasters, learns from its mistakes and builds an environment to mitigate the effect of future catastrophes. Natural hazards cannot be wished away. By enhancing and strengthening the capacities of people, hazards can be prevented from turning into disasters. Preparedness holds the key to disaster management at all levels: individual, family, community, state, national and international.

Mitigating Madhubani's menace

Kennedy Dhanabalan, Director, Development Education and Capacity Building and Esther Ghosh, Officer, Disaster Management Unit, Evangelical Fellowship of India Commission on Relief

In July 2004, Bihar state in India faced its worst floods in 50 years. The water inundated over 20 districts affecting 21,251 million people in 9,360 villages.[1] The Evangelical Fellowship, India Commission on Relief (EFICOR) intervened in this flood providing relief to 21,245 families in 92 villages of Begusarai, Madhepura, Madhubani, Muzaffarpur and Samastipur districts and spending USD299,735 (INR12,888,578).

EFICOR is a relief and development agency that has been involved in managing drought, cyclone, flooding, epidemics and earthquakes through all phases of the disaster cycle in India for the past 39 years. Apart from responding to minor disasters, EFICOR has provided emergency relief to some 83,000 families, and built about 1,700 permanent houses and a few thousand temporary shelters in eight major disaster areas since 1977. EFICOR bases its relief operation on the 'Red Cross Code of Conduct' and is one of the pioneering organizations that initiated the institutionalization of the SPHERE project in India. It also organizes project management and disaster management workshops and seminars for smaller local partners.

EFICOR has been involved in four community based disaster preparedness (CBDP) projects covering about 42 villages in Orissa, Andhra Pradesh, Rajasthan and Bihar. Recently it initiated a Department for International Development (DFID)-funded two-phase project on natural disaster risk reduction in India intending to cover about 50 additional villages in Bihar, Orissa and Assam in five years.[2]

Photo: EFICOR

Resource mapping in Mushari Tola

After the flood relief operations in Bihar, EFICOR started a mitigation project in April 2005 to reduce disaster risk in Madhubani, a flood-prone district situated in the northern part of Bihar which shares its northern border with the Himalayan country of Nepal. EFICOR is involved in community based disaster risk reduction in 20 villages in Khutona, Andhrathardi and Madhepur subdivisions (blocks) which are 36 to 42 kilometres from Madhubani town, the district headquarters.

Reasons for involvement

Bihar, especially its northern districts like Madhubani, is one of the most flood-prone states of India and faces floods every year. The UNDP Disaster Risk Management Programme, which is being implemented in the 12 most disaster-prone states in India, recognizes Madhubani as one of the 125 most disaster-prone districts.[3] Here, floods normally occur in mid-July and may recur in August or September, thus July to September is considered the flood season. These floods are generally due to excessive water from Nepal being released through the rivers Kosi, Bhadrak and Ganga into India. The river Kosi and its tributaries Kamlabalan, Sugervae and Kosi flow through Madhubani district.

Not only is Madhubani one of the most flood-prone districts in the country, it is also one of the poorest and most backward districts. With a land area of 3,501 square kilometres and a population of 3.57 million, the district supports 1,020 people per square kilometre. The literacy rate in the population aged seven years and older is 42.35 per cent, with 57.26 per cent for males and 26.56 per cent for females, lower than the respective rates of the state. About 96 per cent of its population lives in rural areas and are marginal farmers or daily wage labourers.[4]

The intervention is planned to bring about natural disaster risk reduction through capacity building and community-based mitigation and preparedness. This intervention began with a participatory assessment of disaster risk, the findings of which were incorporated in the project proposal.

Participatory assessment of disaster risk

A participatory analysis of disaster risk (PADR) was undertaken in September 2004 in Samastipur and Madhubani blocks. Different participatory rural appraisal (PRA) techniques such as social mapping, resource mapping and focus group discussions were used to analyse the kind of disaster risk the community was facing and the severity of that risk. This exercise showed that the area faces frequent flooding, besides fire, earthquakes and

droughts. It also helped EFICOR to finalize Madhubani block as the area of intervention. PADR helped the community to analyse the 'elements' at risk due to disasters and what contributed to that element being at risk — if crops were the element at risk, then analysis showed that factors such as land tenancy, cropping season, forming embankments along the river, and the unpredictable course of the rivers made those crops vulnerable to destruction.

Such analysis showed which factors could be addressed by the community itself, and helped to identify the external inputs needed from the Government or other agencies and what advocacy measures were called for. It was also instrumental in initiating a change in the attitude of the community towards disaster and its management. Instead of thinking individualistically, people could now think about how the community as a whole might benefit. For example, instead of seeking to get hand pumps installed near their houses, they now saw how strategically locating the hand pumps could help larger populations during the floods. They could also identify their capacities, which gave them a feeling of empowerment through the awareness that they need not be helplessly vulnerable to floods.

Capacity building and training

Capacity building was done through the formation and training of a village-level disaster management committee (DMC) and task force. The village communities, in informal village meetings, chose literate or semi-literate people who were knowledgeable, respected and acceptable to most in the community as members of the DMC. The DMC also includes government representatives — 'ward members' — from the *Gram Sabha* (Village Assembly) and members from the women's self-help group. Each ten-member DMC has about 50 per cent female participation and meets once a month. The 20 DMCs were trained in concepts of disaster management and mitigation and its need, good practices in mitigation, the role of the DMC, the need and purpose of the task force, and various skills necessary for the functioning of a DMC. Once trained, the committee serves as a decision-making and advisory body on disaster management issues in the community.

Across the three blocks, 460 youths have been trained as task force members. Each village has a task force, with members taking specific responsibilities such as warning, rescue, first aid, shelter preparation and relief management. Though each group has specified roles, each member of the task force is trained in all aspects. This task force passes its skills to other members of the community through mock drills.

Small farmers with their own land have been enabled to form a farmers' group, and 354 such farmers were trained on subjects such as varieties and methods of cultivation suitable for flood prone areas, the benefits and use of organic fertilizer and pesticides, and the ill effects of long-term use of chemical fertilizers.

Mitigation measures

The absence of certain structural assets also contributes to some elements being at risk. EFICOR addressed the following elements through the structural mitigation measures given.

Drinking water — Non-availability of safe drinking water during floods is a major issue. The consumption of contaminated water results in a high rate of diarrhoea, dysentery and cholera; and children often succumb to these diseases, as evident from the district's infant mortality rate of 65. Raised tube wells provided a simple solution — 12 old tube wells were raised and 18 new raised tube wells were installed. The height of the raised platform took into account the highest flood level in that area.

Photo: EFICOR

Mock drill by a village task force

Communication — Means of communication, which are already very poor, are completely cut off when water inundates the area. Many people are stranded in these remote villages and suffer due to lack of basic amenities like water, food, sanitation facilities, medical aid, etc. Therefore, ten locally constructed wooden boats were provided to evacuate stranded people to safer locations and 20 kaccha (unmetalled) roads — including minor roads — were constructed to enable quick evacuation to safer sites. Since the boats were locally made, the local artisans were able to benefit. The community took the contract for constructing the roads, and this infused much needed cash into the community.

Land and agriculture — Land and agriculture is the element impacted the most, and this has long-ranging impact on the social fabric. Though most of the community does not own land, this is an agrarian society in which most work as tenants or labourers on the landlord's fields. Once agriculture is affected, people have no other means to sustain themselves — men migrate to other states in large numbers, leaving behind the women, children and the aged.

The migration and absence of the working population contributes to economic and social regression. To address this, 680 small and marginal farmers were assisted with late-variety and improved-variety wheat and sugar cane seeds. The introduction of late-variety wheat will allow farmers to sow wheat, which is the second crop, a month later than the normal variety, without losing the crop if flooding forces them to sow it late, as is the case with the variety currently used. Sugar cane is a flood resistant crop, but its cultivation had been stopped in this area for over a decade due to the closure of sugar mills. The new government has reopened the mills, and so the cultivation of sugar has been reintroduced to enable farmers to benefit from this opportunity.

Frequent heavy floods erode these lands, as well as filling large tracts of agricultural land with sand, making it unsuitable for cultivation for many years. Trees act as a good breakwater, weakening the force of the deluge and preventing it from entering wider

expanses of land. Tree plantation has been taken up in these villages to create such natural breakwaters, and about 7,500 horticultural and commercial value trees have been planted. Each family was given two fruit saplings and made responsible for nurturing them, so as to own the venture. The commercially valuable trees can be sold and income earned, on condition that the family replaces the cut tree. Further, to prevent floodwater from logging in the villages, 13 culverts have been constructed to provide an outlet.

Shelter — Most people live in mud houses, which become damaged due to standing floodwater, forcing displacement and evacuation to safer sites. People are forced to live on embankments and have to keep moving from one higher ground to another; some are even forced to live in trees for a few days. Lack of proper living conditions invariably leads to ill health. To enable communities to live in temporary shelters on dry land, two existing evacuation centres were repaired and three new ones were constructed in villages where such shelters did not exist. These five sites have also been linked with an evacuation route to allow quicker access to them. In some villages, existing houses were strengthened with bamboo reinforcement and other houses were raised above the highest flood level, making them less vulnerable to inundation. So far, 402 houses have been made safe through such means.

Preparedness

Early warning systems — Flooding in these parts usually occurs when Nepal releases its excess water into India. Before doing so the Nepal Government warns the Indian Government, and this warning is immediately passed down to the block level. The Block Office (BO) then informs the ward members in the village through the head of the Panchayat (the government body elected at village level). When the information reaches the state headquarters at Patna, a radio warning is sounded out through the All India Radio Station at medium wave frequency 612. This radio warning system is being strengthened among the communities through awareness programmes.

Task force group formation and training — Each village has formed a task force of about 20-30 youths, depending on the size of the village. Each task force conducts mock drills with other members of the community once every three months, to create village flood preparedness.

Disaster Mitigation Fund — The structural assets created to mitigate the impact of floods will, in the course of time, go through wear and tear. In order to maintain these structures, the community has created a Disaster Mitigation Fund, which will also be used for relief operations. Presently, 14 DMCs are collecting INR1-5 per family each month towards the fund. Ten DMCs have opened bank accounts for the fund. In total, approximately USD814 (INR35,000) has been deposited over a period of ten months.

Community participation

Community participation, and not just involvement, is essential to owning and sustaining a community-based initiative. This project sought to ensure ownership through participation that is evident in the various stages of the project cycle.

The community participated in the initial planning through a PADR process and baseline survey, giving their time and suggestions. The community selected the DMC members, who have been involved in decision making and monitoring throughout the project. The DMC takes decisions such as the type and site of mitigation structures, beneficiaries for the shelter and agriculture inputs, and percentage of community contribution.

Community contribution is another aspect of these initiatives which shows how much the community owns the project. In Hanuman Nagar village the community constructed the road, contributing 50 per cent of the labour cost, which was calculated at the Government-approved minimum wage rate. Gandherian Museri Tola provides a further example of community initiative. Here, the community collected INR10 from each worker to purchase a piece of land within the evacuation site. It is also planned with the community to raise some of the existing tube wells using contributions of INR5-10 from each family.

Linkages

Linking the community with the Government has allowed them to seek and access various schemes and benefits. The village of Rakhwari Museritola has been able to gain funds through the Indira Awas Yogna — the government housing policy; and farmers are being linked to the Agriculture Technology Management Association for training in improved agriculture techniques for sugar cane and wheat cultivation. Ghonghoria and Gandherian villages were successful in obtaining land from the Panchayat for use as evacuation sites; the DMC in Hanuman Nagar filed an application with the Block Development Office (BDO) for providing a bridge to allow connectivity and easy escape; and some women's groups sought finances from the BDO towards agriculture and livestock rearing.

Future plans

The project has now been running for one year. In subsequent years, the plan is to create seed banks, provide livelihood assistance to landless farmers through the provision of livestock, encourage insurance of self and livelihood assets through awareness creation and linking with insurance providers, and campaign with the state government for community-friendly evacuation sites and raised tube wells.[5]

Photo: EFICOR

Raised tube wells

The tsunami hazard map — its role in tsunami preparedness for individuals and communities

Satoru Tsukamoto, Senior Engineer, Disaster Management Group, Kokusai Kogyo Co., Ltd.

The Japanese archipelago is one of the most vulnerable countries in the world to tsunamis. A number of monuments and archives have recorded earthquake-caused tsunamis in different areas in the country since the 7th century. The most recent massive tsunami occurred in 1993 due to the earthquake in Southwest Hokkaido, northern Japan, which hit the small island of Okushiri killing more than 200 people.

Tsunami countermeasures, however, did not fully commence until the Meiji Sanriku Earthquake Tsunami in 1896, which caused as many as 22,000 deaths. The traditional countermeasure of that time was to carry out total relocation of settlements from the affected area. This gradually changed to constructed hardware measures such as embankments and seawalls. It is, however, not practical to build a structure that blocks the explosive and destructive power of a tsunami, as its height can be 20-30 metres, as observed in the cases of former tsunamis. Furthermore, any structure would be subject to deterioration and damage by earthquakes or floods, and would necessitate huge and continuous financial input for operation and maintenance.

Accordingly, approaches that heavily emphasize lifesaving rather than countering tsunamis have become popular in recent years to supplement the limitations of physical countermeasures. One such approach was the development of a tsunami warning system. Due to technical innovations in weather observation and analysis, the Japan Meteorological Agency now announces a tsunami forecast within three minutes of an earthquake occurring, delivering the information to municipalities and residents by radio transmission and mass media.

If the forecast urges or instructs evacuation, information about which areas are particularly at risk, which areas are safe, and which routes should be taken must be given in advance to the residents. For this purpose, the preparation of demonstrative tsunami hazard maps began in the late 1980s. Today, there are tsunami hazard maps for more than 700 coastal areas, or 40 per cent of the total coastal area vulnerable to tsunamis.

Hazard map preparation, however, does not ensure prompt and safe evacuation on its own. Kokusai Kogyo, which has been engaged in a number of hazard mapmaking services with its outstanding specialist measurement techniques, is attempting to bridge the gap between hazard maps and evacuation. There follow two examples of this work.

Computer graphic technology to make hazards visible

As paper-based, simple two-dimensional maps, conventional hazard maps are not persuasive enough to encourage residents to prepare for future tsunamis. The question is how to let people know the real tsunami hazards and how to foster their 'self-help' ability, which is required for proper evacuation. To answer this question, Kokusai Kogyo worked on dynamically visualizing the propagating tsunami and expanding the inundated area, as part of its hazard mapmaking work for Iwate Prefecture, which experienced the Meiji Sanriku Earthquake Tsunami.

Using its high-resolution special measurement techniques, an airborne laser profiler[1] and the elaborate analysis of tsunami phenomena, Kokusai Kogyo simulated the 1896 Meiji Sanriku Earthquake Tsunami every second for 40 minutes, assuming that all the existing anti-tsunami infrastructure worked as designed. Three-dimensional images were displayed via satellite using computer graphic technology. Images were developed for 13 coastal areas.[2]

The Taro area, in the Iwate Prefecture, is particularly famous for its tsunami history. After the Meiji Sanriku Earthquake Tsunami, it was again affected by a tsunami in 1933. This area alone lost nearly 1,000 residents, and community relocation was planned. The community leader at that time, however, resisted by stressing the importance of making the community resistant to tsunamis, and multiple approaches including the construction of seawalls and the improvement of evacuation roads were brought forward.

Due to the time lapse and the fact that Taro was not seriously affected by the tsunami caused by the Chile earthquake in 1960 as a result of such efforts, the people who had past experience of tsunami damage became older and the handing down of experience became difficult. The decreasing number of participants in the tsunami evacuation drills that had been carried out every year since 1934 illustrated this, and a decline in people's awareness was anticipated.

The computer graphic image clearly visualizes the immense power of the tsunami as it climbed over the seawalls developed over four decades. The image is often utilized in community workshop and school classes, and it is expected that individual preparedness for tsunamis and resolutions to prevent the recurrence of the tragedy will be stimulated by this dynamic image.

Hazard map application for tsunami resistant communities

The preparation and dissemination of tsunami hazard maps should be merely a starting point. In one case, the map served as the foundation for community development toward 'evacuation for all.'

In the tsunami hazard map preparation work for Wakayama Prefecture, south of Osaka City, which is as active as Iwate

Photo: Kokusai Kogyo

The tsunami destroyed houses and caused oil leaks and fire in the Aonae area of Okushiri Island, northeastern Japan Sea

Prefecture in disaster management, Kokusai Kogyo promoted the incorporation of tsunami countermeasures into community development based on the hazard map. For example, recognizing that evacuation areas were on elevated land, evacuation routes were identified on the hazard map and investigated to see whether they could be used as pathways in actual emergencies. Consequently, stonewalls were removed, steep cliffs were protected with retaining walls, and lighting facilities were installed in case people have to evacuate at night. The routes were equipped with rails to cater for the aging of the local population, and the bridges on the routes were reinforced to be quakeproof. For the prompt evacuation of not only the residents but also of tourists, signposts were placed to point out the evacuation routes. Even though the evacuation routes are developed, there are still areas where it will take time for people to evacuate in the event of tsunami risk. In such areas, public buildings such as schools, community halls and hospitals were reinforced and designated as evacuation shelters. In addition, an 'evacuation tower' was strategically positioned.

The southern part of the Wakayama coastal region is close to the Nankai Trough, which has been the epicentre of severe earthquakes and tsunamis every 100 to 150 years. It is estimated that a tsunami caused by the next large earthquake will arrive at the southern coastal area within ten minutes. For

Photo: Kokusai Kogyo

A solar-powered signpost indicating a tsunami evacuation route

Photo: Kokusai Kogyo

A newly constructed town centre tsunami evacuation tower

prompt and efficient evacuation, it is important to be prepared to help vulnerable groups including the elderly, women and children, who tend to fall behind. Therefore, a list of those who need help with evacuation is prepared and updated, and an evacuation assistance plan is formulated for each community. Specifically, the elderly are encouraged to take a walk along the evacuation route as part of their daily exercise routine, and school children have a social studies class to learn about disaster management.

Furthermore, community workshops on tsunami hazard maps were carried out, as once hazard maps are distributed by the governmental authority to the residents, this could result in a passive attitude among residents and poor consciousness as evacuees. In the workshops, participants living in a neighbourhood work together to locate their houses, the houses of those who need assistance with evacuation, the nearest evacuation area and evacuation routes on a large-scale blank map using the hazard map. This activity can develop each individual's ability to behave appropriately in the event of a tsunami, but will also promote risk communication in the community, improving hazard management at the community level.

In Wakayama Prefecture, the hazard map will be further utilized in various aspects of community development to facilitate the roles of local government and individual residents in disaster management.

A tool to save human lives

Tsunamis do not occur often, but when they do they can cause catastrophic disaster, as recognized by many people as a result of the 2004 Indian Ocean tsunami disaster. Although earthquakes can happen unpredictably, it may still be possible to evacuate from earthquake-caused tsunamis prior to their arrival, and save human lives if the earthquake centre is at some distance. Kokusai Kogyo is determined to continue making a steady effort to strengthen its technologies and promote the advanced application of tsunami hazard maps.

Photo: Kokusai Kogyo

A community workshop using a hazard map

Early warning systems for natural disasters in Korea

Dugkeun Park, PhD, Senior Analyst
The National Emergency Management Agency, Seoul, Korea

From 1995 to 2004 in Korea, an annual average of 131 people lost their lives, mostly because of floods and landslides, to typhoons and torrential rains in the summer. Various systematic multi-hazard warning systems have been proposed and established to protect people's lives and minimize damage to critical infrastructures in different areas.

From conventional, commercial electronic display boards to cutting-edge information technologies, six different early warning systems now operate against natural disasters in Korea: the Cell Broadcasting Service (CBS) mobile phone message system, automatic verbal notification system, automatic rainfall warning system, disaster notification board system, TV disaster warning broadcasting systems, and radio disaster warning broadcasting system using the radio data system (RDS).

The CBS mobile phone disaster message notification system broadcasts disaster information to mobile phone users with a special receivable ID at the base station transceiver subsystem. Unlike the short message service, which is a point-to-point individual transmission, the CBS system can transmit messages nationwide or to local areas, simultaneously or independently.

Photo: NEMA

Observation tower

Serviceable telecoms companies and targeted areas were selected in November 2004, after which users' responses were analysed and an interactive system was set up in Korea's National Emergency Management Agency (NEMA) in 2006. So far, the system has broadcast 57 warnings to more than 19 million mobile phone users — that is, 39 for heavy snows and roadblocks, nine for wildfires, three for tsunamis, three for gusts and heavy rains, and three for drought and yellow dusts.

This system has several advantages. Information reception is possible via an equipped CBS module without additional hardware, so nationwide broadcasting is possible. This system is suitable for real-time warning services because multi-user transmissions are available simultaneously by broadcasting characteristics. The service cost is low, independent of the number of users. Users can easily select, confirm, and delete information.

This system, however, has some weaknesses. For a start, it is terminal-oriented — without a mobile terminal or CBS module, information cannot be received. If the terminal is turned off, no information is available even with a CBS module. The reception rate is another problem. The disaster information is not available in radio-dark areas and there is no automatic confirmation method to check whether or not users have received disaster information.

The second system for early warning is the automatic verbal notification system. Automatic voice notification equipment located at the local disaster management headquarters can issue warnings using fixed or mobile telephones, village broadcast amplifiers and any available communication tools when inundation and other disasters are imminent.

When rain precipitation, river level, or any emergency data in a specific area are analysed, persons to be informed are chosen and a disaster warning is issued using 32 exclusive emergency communication networks. The system database covers more than 550,000 people such as emergency managers and local residents in 234 central and regional districts.

For an effective response, call sequencing has been set up. The first call goes to the village amplifier in a disaster-prone area, so that people in the vicinity can obtain general information about the imminent disaster situation. A second call goes to the village chief, who can personally deliver the information and encourage people to evacuate to a safe place. The final call goes to the related public organizations and officers in the targeted area.

The third system is for localized rainfall warning. After a one-night flash flood killed 95 campers and hikers in the Jiri National Park in 1998, the local observatory system needed to be expanded to monitor local torrential rains which cannot be easily observed

Photo: NEMA

An electronic bulletin board and warning siren

at regional level. The automatic rainfall warning system can measure rainfall in the upper stream, analyse discharge and velocity of river flow in a specific basin and calculate the water level downstream. When the water level exceeds certain criteria, early warnings and evacuation orders can be issued.

When rainfall is actually measured in the observation station in the upper stream, which is powered by batteries and sunlight, the runoff and time of concentration can be determined using a computer program verifying various parameters. The velocity of flow is also determined using the computer program for multi-dimensional display or by Manning's formula for a simple profile. Since hazard criteria are known by actual tests based on velocity and water level, a dangerous water level can be detected. The amount of rainfall accumulating in 20 minutes is used to determine whether warning and evacuation orders need to be issued using the alarm station. The control station and field display post also help to organize the system and inform people about it.

This localized rainfall warning system is one of the most effective early warning systems in Korea. It is an actual-input based early warning system using real-time monitoring. The Korean Government established 136 systems, investing more than USD60 million between 1996 and 2003. An additional 125 systems will be completed by 2009 at a cost of about USD40 million.

The fourth system uses electronic bulletin boards exclusively to display disaster information and warnngs. This disaster notification board system is 1.2 metres high and half a metre wide and can display a maximum of 20 words. It can be attached to buildings, or can stand alone with a five-metre-high support. Currently, 299 systems are installed in disaster-prone areas such as beaches, mountain areas, public parks and lowlands.

As soon as disaster information becomes available through the Korea Meteorological Administration, NEMA and local headquarters select a standard message and activate the system using the Internet.

The fifth early warning system is the TV disaster warning broadcasting system, which is based on automatic TV turn-on/off functions. Since night time is most vulnerable to disasters, these systems enable TV systems to turn on or even change the channel with automatic volume-up so people receive urgent disaster information even if they are sleeping or watching other channels. This system broadcasts urgent disaster information as sound or screen messages using the broadcasting station's equipment and a special receiver connected to the home TV set. The Korea Broadcasting System (KBS) is the primary service responsible for broadcasting disaster information. Currently 3,997 TV sets with special receivers are in operation at central and local disaster management headquarters, at each of the administrative offices, and at related organizations. These are to be expanded for the general public.

Similar to the TV disaster warning broadcasting system, the sixth early warning system that the Korean Government is focusing on is the radio disaster warning broadcasting system using RDS. This system is based on technology that can automatically turn a radio on or off, and can activate Agora's amplifying speaker systems. The system can be applied to any facility that has internal speaker systems, such as a movie theatre or shopping centre. KBS is also responsible for broadcasting specific disaster information.

The system does not interfere with the existing FM signals, but it requires an RDS encoder to be installed. The system consists of three main sub-systems, i.e. control, transmission, and warning broadcasting panels. These panels should have an emergency power supply and be resistant to lightning damage. Also, the system is capable of various warning durations and messages. During Typhoon Maemi in 2003, radio disaster warning broadcasting systems using RDS in five areas were activated, and disseminated the appropriate disaster information.

These six systems, in operation in Korea, represent good practice in effective community-based early warning. An annual review process by NEMA guarantees the appropriateness of these systems' configurations, costs, and positions, while updated information for each system is continually evaluated. Details of how to quantify warning and evacuation criteria for automatic rainfall warning systems or other early warning systems, however, need to be reviewed and updated based on continuous validation processes including technical assessment. Also, budget allocation and privacy protection are issues to be tackled for the successful implementation of these early warning systems in Korea.

Disaster risk management in Tajikistan: a Focus approach

Hadi Husani, Executive Officer, Focus Humanitarian Assistance, USA

The Republic of Tajikistan is the smallest and southernmost republic of the former Soviet Union. A landlocked country with a total land area of 143,000 square kilometres, it shares borders with Uzbekistan to the west and north; the Kyrgyz Republic to the northeast; China to the east and Afghanistan to the south. More than 93 per cent of the territory of Tajikistan is mountainous and only 7 per cent of the land is arable. Over 72 per cent of the population lives in rural areas.

Tajikistan, one of the countries with the fastest-growing population rate in the former Soviet Union, presently has a population of just over 6 million, with a little more than 10 per cent of the total population residing in its capital, Dushanbe. The country gained its independence on 9 September 1991. Since then, Tajikistan has had to deal with the dual challenges of a collapsed state-centric political and economic system along with a brutal civil war which lasted approximately five years. This has been a challenging period of transition that has included the abrupt discontinuation of universal social benefits provided by the Soviet Union, a high level of unemployment with approximately 80 per cent of the population living below the poverty level, and national and regional tensions. It is only since the signing of the Peace Accords in 1997 and with the ensuing relative political, economic, and social stability that the country has been able to fully concentrate on addressing issues regarding its long-term development.

Tajikistan: highly vulnerable to natural hazards

The designation of the International Decade for Natural Disaster Reduction in 1989 was critical in highlighting the significant increase in disaster-related loss of life and livelihoods in recent years. It is estimated that the number of people affected by natural disasters was three times higher in the 1990s than in the 1970s and economic losses were five times higher. Moreover, it is expected that this trend will increase during the 21st century with issues such as population expansion, displacement, and environmental degradation all contributing to the increased vulnerability of populations and infrastructure. Natural disasters affect all regions and countries, but it is clear that when such disasters occur in developing or transition countries, they serve to undo development gains and add further burdens on weak systems which do not have adequate capacity to respond effectively. The end result is further economic and often social and political instability.

Due to its geography and climate, Tajikistan is prone to a number of natural hazards. According to an Asian Disaster Reduction Centre report, Tajikistan has experienced three of the ten most severe disasters between 1975 and 2000, according to the ratio of amount of damage to GDP. In fact, in the span of two years, 1992-1993, Tajikistan experienced two floods and one landslide which together resulted in almost 1,600 deaths and more than 100,000 people affected.

In addition to these hazards, Tajikistan is located in one of the most seismically active zones of Central Asia and the world in general. In the 20th century alone, Tajikistan experienced a number of major earthquakes which resulted in substantial loss of life and damage to social and economic infrastructure. The combined intensity and location of an earthquake in the Western Pamir mountains in 1911 resulted in a massive landslide covering the village of Usoi, backing up the Murghab river, creating Lake Sarez and the world's highest natural dam. Similarly, the Khait earthquake in 1949 created a landslide which moved at a catastrophic speed and buried under it several villages, costing 28,000 lives. Most recently, in 1989 an earthquake 30 km from Dushanbe, although measuring only 5.3 on the Richter scale, caused a massive landslide which resulted in 274 deaths and left more than 30,000 homeless. In addition to these high magnitude earthquakes Tajikistan experiences a number of earthquakes of a lesser magnitude, which may be more isolated in their impact but still serve to disrupt the lives and livelihoods of thousands.

In recent years, the cultivation of more marginal lands and increased migration to urban areas, due to the economic pressures in the post-independence era, have created conditions

Photo: Hadi Husani

Tajikistan has experienced a number of major earthquakes resulting in loss of life and damage to infrastructure

which multiply the likelihood and impact of natural hazards, increasing the overall percentage of population at risk.

Addressing areas at risk

The Government of Tajikistan has actively engaged the international community in developing partnerships to address natural hazard risk. Using the example of Lake Sarez, in 1999 at the request of the Government, a consortium was created to study the risk faced by Tajikistan of an outbreak flood from the lake. Representatives from the Ministry of Emergency Situations and Civil Defence (MoESCD), the World Bank, the Aga Khan Development Network (AKDN), Focus Humanitarian Assistance (FOCUS), USAID and the Government of Switzerland conducted an assessment of the lake to identify potential long-term risk reduction options.

The resulting initiative, named the Lake Sarez Risk Mitigation Project (LSRMP), focused on the installation of early warning systems coupled with community emergency preparedness to decrease the risk to those most vulnerable within the immediate impact zone. FOCUS worked with communities to develop systems of stockpiles and safe havens, along with community based response and search and rescue teams.

In addressing the risk to communities at risk from Lake Sarez, it was observed that numerous local hazards such as mudslides, rock falls and flooding posed a significant immediate risk, which was reduced using similar interventions. To this end, working with the MoESCD and the international community, FOCUS developed a longer-term approach to addressing the hazards posed to communities in the high mountain environments of the Pamirs.

FOCUS' strategic approach

Established in 1994, FOCUS is an international group of agencies engaged in Europe, North America and South and Central Asia with a specialization in disaster preparedness, mitigation and prevention, as well as disaster response.

Taking the Pamir Mountains, and specifically the Gorno Badakshan Oblast (GBAO) as the subject for an integrated risk reduction approach, FOCUS has engaged in a long-term plan to build the disaster resilience of communities through an approach that encompasses risk assessment and modelling, scenario planning and a series of interventions targeted to limit the impact of disasters.

Public, private, community partnerships

Over the years the FOCUS programme has expanded tremendously, numbering the following among its achievements:

- Development of an emergency communication system utilizing solar powered CODAN radios
- Over 200 structural mitigation initiatives
- Risk assessments in over three-quarters of the at-risk communities across GBAO
- A vibrant disaster management GIS and risk model tied to a joint Government and FOCUS incident reporting system.

With an emphasis on community empowerment, FOCUS's approach has been to engage communities in the assessment process along with national technical experts. These joint assessments conducted with the communities result in the design of risk reduction initiatives championed by communities. They include the development of emergency committees and funds, the design and prioritization of disaster mitigation initiatives, three-way agreements on the use and maintenance of communication systems and early warning systems between FOCUS, MoESCD and the community, and numerous other preparedness measures such as the development of stockpiles and safe havens.

Results and impact

As measured by the FOCUS risk model, there has been a reduction in risk of over 20 per cent to the highest risk communities in GBAO over the past four years. Where in 1997 it could take as long as two weeks to receive information in the centre about potential emergencies, it now takes hours. Where once communities looked to the state for every mechanism of emergency support, most now have village disaster plans and committees that work with state agencies as distinct civil society organizations. The lessons of the west have been incorporated into Tajikistan and as the road to development continues, communities are ensured of a more secure future.

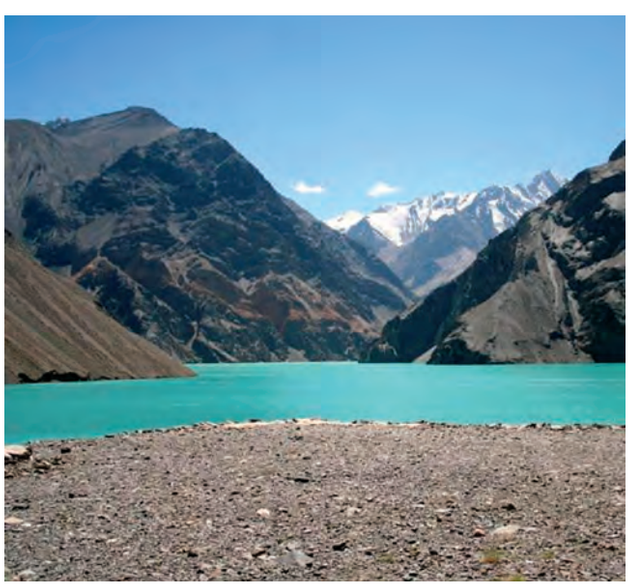


Photo: Hadi Husani

Lake Sarez has been the focus of studies to identify potential long-term risk reduction options

Photo: Hadi Husani

Tajikistan is located in one of the most seismically active zones of Central Asia

The healing community: the importance of community-based interventions

Magda Rooze, Ariëlle de Ruyter, Dean Ajdukovic, Nienke Fundter and Jorn Hövels,
Stichting Impact, Dutch Knowledge and Advice Centre for post-disaster psychosocial care

On the morning of 26 December 2004, a large earthquake occurred under the sea northwest of the island of Sumatra. It caused an enormous rift 1.2 kilometres long in the earth's crust and a tsunami of massive proportions. The tsunami was devastating, especially on the coasts of Sumatra, Thailand, Sri Lanka and India: about 300,000 people were killed or went missing. Other people were injured and entire communities were destroyed.

Community-based interventions

For those who survived, the consequences of the disaster were severe. Many of them lost relatives, friends or acquaintances and most experienced the local events as very shocking, often with far-reaching psychological consequences.

Many victims continue to complain about ongoing (or even worsening) psychological and physical problems long after a disaster. This can partly be explained as the normal course of personal problems related to disasters in general: after the initial and immediate stage of a disaster, a second stage called the 'honeymoon' stage will follow, usually creating a strong bond between victims and non-victims — existing hierarchical structures make way for a sense of being among fellow sufferers, and for massive aid. As a result, victims feel unconditionally supported by the community — a feeling fuelled by the media and the authorities, who in most cases promise to take all necessary measures.

Photo: www.anp-photo.nl / Barbara Walton

Community-based interventions can involve every level of the community

But after a few weeks, a third stage of the disaster will inevitably follow, the 'disillusionment' stage: as people return to 'business as usual,' those victims who still appeal for help or understanding run the risk of being considered complainers by the people around them, as if they were out to profit from the situation instead of repairing the damage and coping with events emotionally. Proper care must be focused especially on minimizing negative effects on the victims' ability to recover. Psychosocial aid focused on strengthening the supporting communal bonds can play an essential role here.

People affected by major disasters typically suffer a whole range of losses, while at the same time natural social networks and other support mechanisms are wiped out. As existential needs are met by the provision of food, water and shelter, and as safety is ensured, psychological defences may drop, and awe of the reality may be so overwhelming that individuals become numb and feel powerless. At this point, leadership in providing social care is essential. The key objective is the re-establishment of meaningful patterns of interaction in the community which, after massive trauma, is the vehicle for reconstructing a sense of life purpose. The extent to which people get support from others (family, neighbours, authorities, aid organizations) is crucial for their empowerment, mastering the hardship and overcoming post-traumatic symptoms. This is because one of the main healing functions of a community is to contain and support both family systems and individual members.[1]

Psychosocial aftercare in the Netherlands

The consequences for Dutch survivors of the tsunami disaster were also severe. Psychological consequences for the survivors came to light very soon after the disaster. Victims became tense, jumpy and easily irritated. They suffered from insomnia or nightmares or felt intensely sad. They had trouble shaking themselves free from memories of the tsunami and were not able to take up their daily responsibilities. There was therefore a requirement for help in the Netherlands too.

The objective of Impact, the Dutch Knowledge and Advice Centre for post-disaster psychosocial care, is the advancement of high

quality and well organized post-disaster psychosocial care. Firstly, this requires proper coordination of the tasks and activities of existing aid organizations, so that the aid on offer matches the victims' need for help as far as possible. The Knowledge and Advice Centre combines existing practical and scientific experience, makes it understandable, provides expertise and improves cooperation between all the parties and organizations involved. After the tsunami disaster, it focused mainly on community-based interventions — those that depend on the supporting role of the community in helping victims to cope with their experiences.

Impact undertook three important tasks, which are discussed in detail below:

1. Impact gave advice about a remembrance event
2. Impact foresaw a gap in Dutch aid structures and contributed to the foundation of the national *Informatie- en Verwijscentrum* (IVC - Centre for Information and Referrals)
3. Impact ensured the recognition of victims by cooperating in the publication of two books.

Remembrance event

Memorial meetings are important since they enable people to express their feelings of loss and mourning. This breaks through the victims' isolation and creates a sense of recognition between different groups. For this reason, the Dutch Government organized a memorial gathering on 25 January 2005. Impact advised the ministry about the format and organization of this meeting. Adult and child victims were present. After the meeting, the Queen and the Prime Minister talked with the victims in person.

In organizing a memorial event for victims, several crucial elements must not be overlooked:

Appearance — Who is the memorial event for? Is it for the dignitaries in attendance or the victims themselves? Preferably, the victims should be involved as much as possible in the meeting and should be given the opportunity to do the talking themselves.

Timing — To many victims, a memorial meeting feels like a transition ritual, or closure. It may be better for victims whose relatives are still missing not to attend this 'closing' event. If victims are involved in the preparations, they can be asked if they would appreciate a meeting.

Speech — Experiences, feelings and memories are usually very personal, so it is better not to have the speakers say things on behalf of all the victims, but only on their own behalf.

Supervision — Strong emotions can be channelled by having aid workers sit among the victims, perhaps incognito. In this way, the group of victims will be 'diluted' and there will be enough room, if necessary, to provide emotional support.

Dignitaries — If the dignitaries are provided with information in advance, they will be able to answer the victims' questions. Additionally, it is appropriate for the dignitaries to be present at the event before the victims arrive.

Media — If there is much media attention, it is a good idea to give television cameras and other press an inconspicuous place.

All victims and aid workers were very positive about the Dutch memorial gathering of 25 January 2005. The atmosphere was calm and conversations were started easily. Many emotions surfaced, grief above all others. Victims said they felt stronger as a result of the meeting, and many were encouraged by the Queen's attention.

There is still room for improvement: a lot of children attended the meeting, and more activities could have been organized for them, such as being able to draw pictures, light candles, release balloons or write in a book.

The idea of one-stop shopping: founding the IVC

In order to coordinate Dutch aid at a national level the Ministry of Health, Welfare and Sports tasked Impact with setting up a national Information and Referral Centre (IVC). The IVC — which started on 18 March 2005 — is a centralized virtual service desk. All the existing aid organizations and aid workers are brought together here under a single telephone number and a single website. The centre provides general information about the psychosocial consequences of disasters and the kinds of professional aid available. Specific referral to appropriate aid is possible for those directly involved. In addition, victims and aid workers can ask questions through the website and by telephone.

The IVC Website contains the following elements:

- Information for those directly and indirectly involved and for aid workers
- A list of available national care for victims and aid workers
- Digital links to information about authorities and organizations that were involved in the disaster, can offer help, or can make a referral
- A *Frequently Asked Questions* list
- A feature allowing questions to be submitted in writing.

However, the IVC also plays an active role in which its tasks are:

- Approaching and keeping in touch with all victims
- Collecting and answering victims' questions
- Monitoring victims' state of health
- Advising on the right kind of aid at the right moment.

After the acute stage — in which the victims were looked after — Impact started an investigation into available care in the Netherlands and the anticipated care requirement. The IVC was then founded using research data and information from the aid organizations within Impact's network. After this, the focus turned

Image: Johannes Calvijn School Gouda, Roos en Annemiek

The tsunami destroyed everything, no one, including animals, was safe. Everyone had to flee

to communications — the knowledge and advice centre sent a letter about the foundation of the IVC to all victims, sent press releases to all national newspapers, magazines and internal ministry magazines, and contacted all authorities and covering organizations involved. In addition, a logo and corporate identity were developed, a free telephone number was published and the website was opened.[2] The IVC could be reached every day by telephone, e-mail and via the website.

The IVC was visited frequently during the initial months, with most victims asking about the alternatives for assistance — for example, Dutch people who had been involved, had returned home or moved elsewhere, but had not yet found a new GP; or Dutch people living in an Asian region where there was no psychological help available. Other victims who registered were those for whom existing aid had offered little help because of serious and persistent psychological complaints. Some victims had been travelling alone and had missed out on social support or a reference framework. And there were people who had serious complaints but had not dared to ask for help, believing that other victims with bigger problems were more entitled to assistance.

Most victims were in need of someone who would listen to them; complaints were defined, recognized and acknowledged. Psychological education played an important role — it was explained to victims how psychological complaints arise, how natural recovery can be improved, what aid is appropriate and where proper aid can be obtained. Sometimes there were consultations with a GP about a suitable referral, which was also discussed with aid organizations, and inquiries were made about waiting periods and submission procedures. All those involved were called back once or several times to check the course of the referral and to solve any related problems.

Photo: www.anp-photo.nl/ Matt Hotton

Community-based intervention supports disaster-stricken communities using their own strengths

In the initial stage, victims needed to be approached actively in order to prevent them falling through the net and missing out on help. Unfortunately, this was not possible — for legal reasons, the IVC could not use the database of victims, although this database was available at the Ministry of Foreign Affairs. Such legal impediments need to be resolved in advance.

Two books published to help victims

During the coping process, Dutch victims were constantly asking themselves, "How could this happen? What is the point of it? Why was I affected?" It is important for the victims' coping process that they can comprehend the events themselves; by placing a shocking incident in a meaningful context, they may be able to get hold of their daily lives again. If they cannot, they will be overwhelmed sooner or later by feelings of fragmentation and uselessness. They will run the risk of becoming passive spectators of the disaster instead of someone who is coping actively.

***Over leven* (book, 'Living and surviving')**

On the initiative of the Ministry of Health, Welfare and Sports, Impact joined forces with the *Tsunami International Survey on Emotional Impact (www.tisei.org)*, the University Medical Centre in Utrecht, the Psychotrauma Centre for children and adolescents at the Wilhelmina Children's Hospital and the Central Military Hospital to publish a book, *Over leven (Living and surviving)* around the first anniversary of the tsunami. Victims cooperated in producing the book, which acts as a sounding board and reference framework for them.

Coping is the central theme of the book, which is based on interviews in which victims — fathers, mothers, children, loved ones, backpackers, aid workers and journalists — tell their own stories and provide insights into how they have coped. On 21 December 2005, the first copies of the book were handed to the victims who had been interviewed. Impact then sent copies to the Dutch victims. Judging by the grateful responses, the publication seems to have filled an essential need.

Many children were also victims of the tsunami disaster, and an essential part of their coping process is having a parent or carer with whom they feel safe and to whom they can express themselves. However, if their parents witnessed the disaster or were victims themselves, then their ability to act as a pillar of emotional strength could be temporarily lowered. In order to improve the children's coping process, the author Hijltje Vink wrote the children's book *Die dag toen de tsunami kwam (The day the tsunami came)* for the Siam Care, World Concern and Canada Fund foundations. This illustrated book has been published in many languages including Dutch, English and Thai. In the stricken countries, it is being used together with a workbook and a manual to help many children cope with the trauma they have suffered.

Further examples

Community-based psychosocial interventions can range from simple to sophisticated, and can be provided by people who have any experience in dealing with others (such as teachers, spiritual leaders, youth activists). Among the priority activities are those that help re-establish basic social structures and strengthen community coherence by organizing schooling, providing skills training for adolescents and adults who have lost income, ensuring early family reunion and through initiatives that re-establish mutually supportive relationships (i.e. youths, women, the elderly, single parent groups and home visits).

Photo: www.anp-photo.nl / Tony Ashby

Religious leaders play an important role in community-based interventions

Establishing meaningful activities for adults, together with opportunities for developing a new livelihood, are important provisions that have strong healing effects. While such interventions need to be organized, they do not require expertise in mental health assistance, and are of great value to most of the affected population. The following list illustrates a range of community-based interventions which can be implemented with very little experience in the area of mental health, or made more sophisticated as local capacities are enhanced:

- Dissemination of information (e.g. about legal status, missing family members, community development plans, access to material provisions)
- Psychoeducation about 'normal reactions to abnormal situations' for specific groups of beneficiaries (e.g. adolescents, children, the elderly, parents, teachers, volunteer helpers, veterans)
- Establishing mutual support groups with similar interests, backgrounds or experiences (e.g. survivors of family losses, families with missing family members)
- Informal, recreational and creative activities using local tradition, customs and culture
- Advising the community authorities on mental health issues in the community
- Briefings for the media and dissemination of basic knowledge about the normality of people's behaviour in difficult circumstances (e.g. using radio contact shows, writing articles for local newspapers, printing and disseminating leaflets)
- Support and consultation by mental health providers to staff in community institutions (e.g. schools, community clinics, churches, youth clubs) to help re-establish their normal routines and help them provide new kinds of support
- In-service training of local care providers in order to build sustainable capacities
- Identification and referral of highly affected individuals, families and groups that are displaying disturbing psychological difficulties (e.g. chronic psychiatric patients, dysfunctional trauma victims).[3]

After a disaster, community-based interventions assume a central role focused on strengthening resilience and getting the immediate medium-term and long-term care up and running. The majority of these interventions are organized with relatively simple resources yet still reach a long way. In countries with close communities in particular, aid must aim to support these communities and to use their strengths. Only a very small proportion of the victims will then need specialist forms of aid.

The challenge now is to share the experience thus obtained between countries that possess more resources and developing countries. A valuable point in the favour of developing countries in this context is that they often have more closely knit social structures than more developed countries.

Words are better silent at times,
So we can feel what is
In the depth of our heart;
The pain, the grief, the loss,
The love
Which lets us know
That the connected love in our heart
Is forever,
Tangible
As the quiet peace.

In remembrance of Henk Janssen, Tsunami victim
Written by his wife, Jannie van der Tuin

The development of bamboo houses in earthquake prone rural areas, Yunnan, China

Dr Hongzhou Lai, Recovery and Reconstruction Management Office, National Disaster Reduction Center of China

According to the relevant data shown by the International Network for Bamboo and Rattan (INBAR), more than 1 billion people lives in houses made of bamboo; the global annual trade volume of bamboo and rattan is about USD1.4 billion. Bamboo has a long and well-established tradition as a building material throughout the world's tropical and subtropical regions. Even now, bamboo houses are common in the rural areas of South China, Southeast Asia and Latin America. Bamboo is widely used for many forms of construction, in particular for dwelling houses in rural areas. It is a renewable and versatile resource, characterized by high strength and light weight, and it can be easily processed by simple tools. Bamboo constructions are quite easy to build, particularly resistant to earthquakes and readily repairable after a disaster. With the advantages of flexibility, endurance and light weight, bamboo is quite suitable for use in building seismic-resistant constructions.

Bamboo houses can provide shelter for earthquake victims

China is a country afflicted severely by earthquake disasters with a high frequency of occurrences, vast affected territories and grave losses. Since 1949, earthquakes in China have killed nearly 300,000 people, injured and disabled nearly 1 million people and destroyed more than 10 million houses. Yunnan Province is located in Southwest China, a fierce collision zone for the Indian Ocean tectonic plate and the Europe-Asia tectonic plate. Yunnan Province frequently suffers severe earthquakes, which often result in grave loss of life and property. A large number of dwelling houses have been destroyed and damaged due to earthquakes in Yunnan. Thus, lots of dwelling houses will be reconstructed or repaired to resettle victims by local governments in the post-disaster period. Often, there is insufficient consideration of disaster reduction in reconstruction projects, due to limited reconstruction funds, and the newly built houses are probably still vulnerable to earthquakes, especially in rural areas.

In the aftermath of a severe earthquake, local governments often find it difficult to provide enough safe shelters to resettle the victims. The central government might dispatch some tents to local governments to alleviate this problem, but the transportation of tents takes a lot of time. Sometimes it is difficult for the tents to reach disaster-hit areas in time, due to road damage and rugged landforms. Local governments need an effective and efficient resolution project.

Yunnan Province is a region of undeveloped, ethnic minorities habitat and also a region prone to earthquakes. Abundant bamboo resources are distributed in this region, and bamboo is used as a major building material by local residents, especially ethnic minorities. Bamboo can be used as a better quakeproof material due to its toughness and light weight. Because of its cheap price and short growth period, bamboo is widely used to build and reinforce dwelling houses in earthquake prone areas so as to improve the earthquake resistance of local dwelling houses.

In order to improve the effectiveness and efficiency of local government emergency relief systems, the Recovery and Reconstruction Management Office — the key management unit on the recovery and reconstruction work at the national level — proposes a research project aimed at facilitating the development and construction of bamboo dwelling houses and bamboo shelters in the earthquake-prone rural areas of Yunnan. This project is funded by the ProVention Consortium's programme for Applied Grants for Disaster Risk Reduction. The Asian Disaster Preparedness Center is responsible for managing the grant and the research progress of project. Through this project, we will carry out some on-site surveys and complete a research report, then deliver it to the local governmental stakeholders and community leaders in earthquake-prone areas of Yunnan. We will encourage and guide them to build more seismic-resistant bamboo dwelling houses in the post-disaster reconstruction period and bamboo shelters in the pre-disaster period as a part of disaster preparedness efforts, so as to provide victims with enough safe shelters to protect themselves from the aftershock, and reduce the loss of life and property to a minimum.

Bamboo houses will benefit earthquake-prone rural areas in Yunnan

In this research project, the Xishuangbanna region is taken as a research model area. It is located in the southern part of Yunnan with a rich bamboo resource and a high frequency of earthquakes. Bamboo houses (also called pile-supported houses) are the main type of dwelling houses in Dai People's village in Xishuangbanna. The bamboo house, an embodiment of bamboo culture among ethnic minorities in Yunnan, has distinctive ethnic characteristics and has recorded the vicissitudes of history and culture. The culture of bamboo building has survived and thrived through historical changes.

Since the economic prosperity and improved living conditions of the 1980s, people have wanted better living environments and better dwelling houses. Some Dai people's new-built houses have gradually lost their traditional characteristics — some new houses are made of iron-cement and bricks, with no traditional bamboo materials. The quantity of bamboo houses is decreasing. More importantly, the bamboo house as a traditional culture of ethnic minorities is gradually declining. But local residents are now beginning to renew the tradition of bamboo houses. The bamboo house

as a traditional architecture has many undeniable merits and the advantages are quite remarkable.

With the protection of the seismic-resistant bamboo houses, more people will survive in the event of an earthquake. Local governments should build more bamboo public shelters in Xishuangbanna. In peaceful times, these can be rented to tourists and travellers so that they can experience the area's traditional ethnic cultures. Once an earthquake occurs, these shelters will be used only to displace and resettle the victims. In term of the official data, there are a total of 104 renowned scenic spots in Xishuangbanna, 83 of which are located in the villages of ethnic minorities. The construction of bamboo houses would help to create better landscapes, enhance the service condition of tourism and attract more tourists, so as to benefit the village's economy and the villagers' incomes. Therefore, bamboo houses can not only facilitate the development of tourism and increase the financial income of local governments, but can also provide local government with an effective and available emergency resource for resettling victims affected by earthquakes. Local government economic and social development plans should prioritise projects for the construction of bamboo shelters in the interests of disaster preparedness and community-based disaster risk reduction efforts.

Local governments also have the responsibility to encourage and guide local residents to build more bamboo dwelling houses in the post-disaster reconstruction period. On one hand this will help to protect the residents themselves from earthquakes; on the other it will retain the area's traditional landscapes and the culture of bamboo houses. Combining government efforts with residents' participation will accelerate the achievement of the goal of community-based disaster risk reduction. However, in order to improve the reliability of bamboo houses, some effort should be directed toward the key fields of preservation, jointing, structural design and codification. So, in the process of implementation of the project, local governments should provide scientific architectural designs and technical guidance to local residents, and establish a project management system to facilitate the building at the community level.

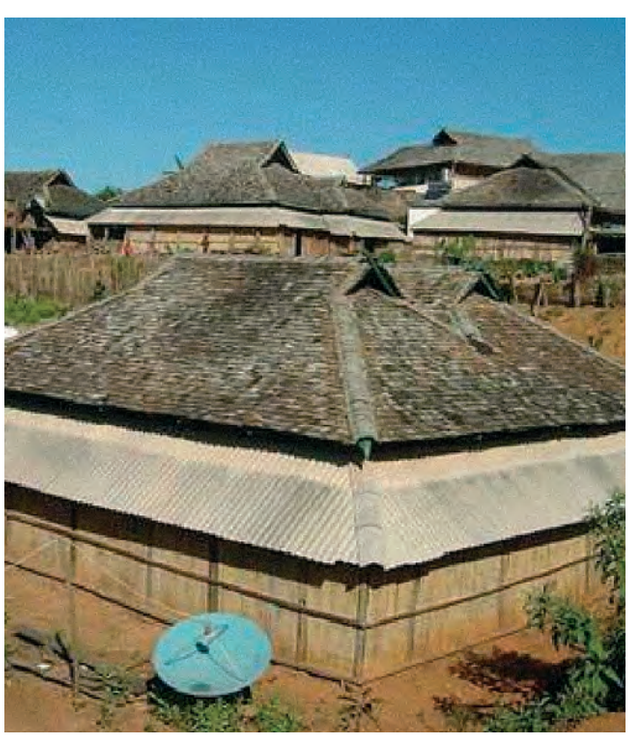


Photo: Dr Hongzhou Lai

The new-built bamboo dwelling houses in Dai People's village, Yunnan

Bamboo houses help protect ecological resources

Bamboo is widely recognized as one of the most important non-timber forest resources. The forest area on the Earth has gradually decreased in recent decades, particularly in the tropics. This has focused world attention on the need to identify a substitute material, which should be renewable, environmentally friendly and widely available. Globally, the area of tropical forest has decreased $2.4x10^7$ hectares per year since 1988, while the bamboo forest area has expanded and reached $2.2x10^7$ hectares. In view of its rapid growth, a ready adaptability to most climatic and edaphic conditions and properties superior to most juvenile fast-growing wood, bamboo emerges as a very suitable alternative.

This is particularly the case in the geographic environment and climate conditions of Yunnan Province, which produce many and varied bamboo resources for wide distribution. There are 230 species in 28 genera of bamboo in Yunnan. The number of genera is 40 per cent of the world's total, 70 per cent of the total genera in China. The number of species represents 20 per cent of the world's bamboo species and 50 per cent of those in China. Yunnan was named as the 'Bamboo Kingdom' for its rich variety and source of bamboo. Therefore, there are enough accessible bamboo resources available to build bamboo dwelling houses and bamboo shelters in Yunnan.

The outline of the 11th Five Year Plan constituted by the Chinese Government takes the forest covering percentage as a key index of economic and social development, and points out that this percentage will increase from 18.2 per cent in 2005 to 20 per cent in 2010. During the 11th Five Years, China will further enlarge the strength of forest planting, returning land for farming to forestry and strictly restraining deforestation to ensure the realization of this goal. As a better resource, bamboo materials have the beneficial characteristics of cheap prices and short growth periods. So, it is key to promoting the regional economic and social development of poor areas in Southwest China, by intensifying technical innovation and scientific research in the application field of bamboo materials, and creating potential economic, social and ecological benefits. Therefore, the development and construction of bamboo houses in Yunnan not only protects the local residents from earthquake disasters, but also promotes economic development in bamboo areas where people are living on low incomes, and saves forest resources to protect the ecological environment as a wood substitute.[1]

Photo: Dr Hongzhou Lai

The seismic-resistant structure in the bamboo dwelling houses of Dai People, Yunnan

Risk resilient communities: the Aga Khan Development Network in northern Pakistan

Asif Merchant, CEO, and Khizer F. Omer, Manager Planning and Evaluation,
Aga Khan Planning and Building Service, Pakistan
Karim Nayani, Nusrat Nasab and Samina Sardar, FOCUS Pakistan

THE NORTHERN PARTS of Pakistan are among the most isolated areas of the western end of the Himalayas, surrounded by high mountain passes. The area's remote human communities reside in narrow valleys dominated by mountains and rivers. Ethnic diversity of these areas is unique, and many of the passes are migration routes between central Asia and the Indian sub-continent. The construction of the Karakoram Highway has opened the area to outside influences.

Pakistan's northern regions are disaster prone, falling in a seismically unstable zone at the point of confluence of the Indian and the Eurasian plates. These regions are regularly impacted by natural disaster events such as earthquakes, floods, landslides and droughts. Degradation of natural resources, especially the loss of foliage and vegetation, has caused land degradation and soil destabilization. Earthquakes have resulted in the destruction of houses, infrastructure, facilities and property, as well as creating economic and social hardship.

The Northern Areas and Chitral (NA/C) portion of northern Pakistan encompasses two of the country's poorest regions — 50 per cent or more of its overall population of approximately 1.2 million lives below the poverty line. Cultivated land per capita is only 33 per cent (0.11 hectares per person) of the national average, with per capita income being 56 per cent of the national average. Only 5 per cent of the available land in NA/C is suitable for human settlement, the rest occupied by high mountains. Due to the extreme climate, winter temperatures in most areas fall to as low as minus 15 degrees Celsius.

Photo: AKPBSP

General view of northern Pakistan

Understandably, thus, the region has poor housing conditions. Over 80 per cent of all houses are made of mud, or of dry masonry for wall construction. All houses have wooden roofs with a heavy layer of mud for insulation. These houses are a death trap in the event of an earthquake, as demonstrated by the earthquake in nearby Kashmir on 8 October 2005.

The Aga Khan Development Network (AKDN), through its various development agencies and affiliate bodies, has been working for the social, economic and environmental uplift of the NA/C communities for decades. Recognizing the connection between poverty, high seismic risk and poor housing construction, habitat risk management has always been essential to the AKDN development process, with physical development undertaken to minimize risks associated with natural disasters.

As part of the AKDN, the Aga Khan Planning and Building Service, Pakistan, (AKPBSP) undertakes initiatives to develop built infrastructure and promotes indigenous construction technology in these areas. AKPBSP assists organizations and institutions to improve communities' built environment and living conditions through applied research and implementation; improved technological products and tools; and institutional capacity building.

Focus Humanitarian Assistance (FOCUS) is a crisis response agency affiliated with the AKDN. FOCUS provides disaster risk management and emergency humanitarian assistance for vulnerable communities in the developing world, and has units in Canada, Europe, India, Pakistan, Afghanistan and the USA. Through its Prevention, Mitigation and Preparedness (PMP) programme, FOCUS Pakistan builds communities' capacity to reduce their vulnerability to natural and man-made disasters; prevent disasters where possible; reduce the harmful effects of disaster; and assist communities and institutions in preparing for effective disaster response.

Public buildings – schools and health centres

The Kashmir earthquake killed approximately 83,000 people, including about 18,000 children who died in schools when the school buildings collapsed (around 5,300 schools — 66 per cent of all schools in the affected area — collapsed during the earthquake). Yet another 15,000 or so children perished when around 400,000 housing units collapsed during the earthquake. The earthquake also destroyed 420 health facilities (74 per cent of the total health facil-

ities in the area), paralysing the entire healthcare delivery system and increasing the difficulty of relief and rescue efforts.

Education and health are cornerstones of AKDN's socio-economic development efforts. AKDN recognized, early on, the importance of constructing health and education infrastructure facilities to appropriate seismic resistant standards, and was constructing hospitals, health, and education facilities to such standards as early as 1983.

The region's education has traditionally been provided primarily by the Government using a system of free primary, middle and, more recently, high schools. However, in the 1950s, there were not enough government schools, especially for girls, in the region. In the early 1950s, His Highness Sir Sultan Mahomed Shah Aga Khan III, then Imam of the region's Ismaili Muslims, began constructing additional 'Diamond Jubilee' girls' schools. With stone walls and corrugated iron roofing on timber trusses, these schools were often built by the communities themselves on community-donated land, with some financial support from the Imam.

In 1984, it was realized that these school buildings were not strong enough to resist earthquakes. Thus started the Self-Help School Construction Programme (SHSCP), initially supported by the Aga Khan Foundation, Pakistan, (AKFP) and later funded by other international donor agencies. The primary objective for the SHSCP was to develop a system that could improve the educational environment for girls in NA/C, particularly within the 100 or so Aga Khan Education Service, Pakistan (AKESP) schools that were then housed in temporary accommodation. In the event of an earthquake, the earthquake-resistant schools were to provide temporary shelter to those whose houses were destroyed.

The school design had to respond to the hilly and narrow terrain with the limitation that many sites were inaccessible by modern transport, and to cope with long cold winters as well as heat and solar radiation during the summer. Local skills were used maximally to reduce costs and to enhance ownership by the community, which was to maintain the building as its asset once the construction was over. Therefore, the buildings also had to be low maintenance so as not to overtax the community's resources.

The prototype design consisted of 13 rooms, built in four phases to provide three, six, ten and then thirteen rooms as the school grew through primary, middle, secondary and then high school levels. Village communities contributed free unskilled labour, sand, aggregate and gravel, while the SHSCP paid for the skilled labour and all non-indigenous materials.

Responsive design solution

The result was a single-storey building with concrete, hollow-block, un-plastered walls made onsite using locally available sand and gravel. The building was shaped like an eight-cornered star: a core, comprising five classrooms and an administrative office was built first, with 'corner' rooms added incrementally as the need arose. The design avoided the need for shuttering in vertical elements, and reinforcement was embedded in the hollow blocks, making the school easy to build by semi-trained craftsmen. The roof was also of pre-cast concrete, though it did require some cast-in-situ concrete work with shuttering. The buildings were designed to withstand seismic loads according to the then existing US building classification codes.

In 1990, it became clear that the school design used too much flat land, and that the cast-in-situ concrete elements required complex skills. A research and development exercise tested several alternatives and a revised design — maintaining its concrete, hollow-block walls — added the option of a soil-stabilized block wall. The roof was fully pre-cast, requiring no cast-in-situ concrete work. The footprint of each four-classroom block was considerably smaller and each block could be built on a different slope. The seismic requirements were upgraded to the revised and updated US building classification codes.

Further design development exercises in 1996 and 2003 resulted in revisions including a double-storey option to further reduce the footprint, and random rubble stone walls with metal roofs to cater for varying constraints in different villages. Seismic resistance, however, remains a key design parameter. To date, over 800 classrooms have been built in over 250 villages providing safe schools to over 25,000 students in the NA/C region. The ongoing programme has been recognized by UN-HABITAT as good practice in human settlements.

Similar to the SHSCP, the Aga Khan Health Service, Pakistan (AKHSP) and AKPBSP in 1993 initiated a Health Centre Construction Programme (HCCP) on self-help construction concepts. The health facilities' buildings consisted of a consultant room, a procedure room, a ward, and nurses' accommodation. Successive improvements have increased the design's cost-

Photo: AKPBSP

Seismic resisitant Aga Khan Girls Academy, Hunza, Northern Areas

Photo: AKPBSP

A typical seismic-resistant rural health centre

effectiveness, durability, and responsiveness to local needs. Almost 40 such facilities have been built to date, with German and British support.

Training to build seismically safe buildings

Wood has traditionally been used for building reinforcement in northern Pakistan. This has lessened over recent decades as forests have diminished and more cement, steel and bricks are being used for local construction. This has made the local houses unsafe and non-durable, as craftsmen lack the skills to properly use modern materials and the resulting elaborate, high-maintenance structures are vulnerable to earthquake risks. To address these issues, AKPBSP initiated two programmes in 1988:

- The Mobile Training Course (MTC) for semi-skilled adults
- The Basic Engineering Course (BEC) for schoolchildren.

The 5-6 week long MTC takes place in villages, with hands-on training in the form of constructing an actual building. At the end of each MTC, a toolkit and a manual are given to the village organization to be loaned free of charge. Enhancing the community participatory approach, the course deals with topics including site selection and planning for construction, house orientation, and building materials.

The BEC aims at creating awareness among schoolchildren about improving and maintaining the quality of the environment. Manuals are carefully conceptualized to be accessible to children of various age groups, and are continually upgraded, while an inbuilt monitoring system charts the success of the course.

The popularity of the MTC/BEC is clear from its social acceptability and increasing enrolments. Its value is also evident in the improved shelter construction in NA/C. Through community effort, trained people also help unskilled neighbours, and there is a marked improvement in living standards. Over 3,000 craftsmen and children have benefited form MTC and BEC courses. A recent internal evaluation found that over 70 per cent of MTC participants have been able to significantly improve their earnings because of the course.

Housing and construction improvement

Private dwellings in northern Pakistan are often found in clusters, combined to form communities or villages. There are three distinct types of house: Bipush or Kho houses, plain area houses, and terraced area houses. The houses are mostly made of timber columns and beams with non-load-bearing infill walls of stone, and mud-reinforced walls with horizontally placed timber logs. Most houses are highly vulnerable to the impacts of natural disasters, such as high-intensity earthquakes. The problem has been exacerbated by the extensive use of wood for traditional house construction, heating and cooking, which has caused excessive degradation to vegetative cover. In addition, most community buildings, schools and other public buildings in the valleys are non-engineered structures.

AKPBSP develops, manufactures and delivers affordable, regionally appropriate home improvement products which provide practical solutions to issues including seismic resistant, energy efficient house construction and insulation. These products and techniques include lighter bow-string and composite beams for reducing timber use in roof construction, HDGI wire wall reinforcement (earthquake resistant) to replace timber wall reinforcement and reinforced concrete columns, and proper foundation techniques to improve load bearing capacity. These techniques, on average, cost only 5-10 per cent more then traditional construction, but are more seismically resistant, less damaging to the environment, and easy to build as they optimize traditional skills.

Non-masoned houses depend on good stone construction with adequate tie-stones, roof diaphragms, minimum openings, low wall constructions and short wall lengths for earthquake resistance. Nevertheless, even the best-constructed non-masoned houses will fail in a major earthquake. HDGI wire is provided in the shape of a long, ladder-like mesh that can be produced locally. It is applied horizontally between courses of stone or mud block, binding the two faces of the wall and providing longitudinal reinforcement. The technique is equally applicable to dry-stone masonry using stabilized mortar only; mud walls and adobe construction; and in masoned construction with either stone or cement blocks.

Through in-house research, AKPBSP has developed, tested and applied over 60 different interventions to improve living conditions in NA/C, from portable shelving and food storage containers to energy-efficient and thermal-efficient house construction techniques, solar products, double-glazed and roof hatch windows, and water heating facilities. Over 12,500 products have been installed in 5,000 households, benefiting over 43,000 people across 100 villages and reducing annual household biomass consumption by up to 60 per cent in the region. The ongoing programme has been recognized by UN-HABITAT as good practice, and by the UNDP Small Grants Programme as best practice in human and environment development.

Community preparedness

FOCUS' Community Based Disaster Risk Management (CBDRM) project aims to build the knowledge and skills that will enable communities to survive and recover from natural and man-made disasters. Community involvement and social cohesiveness are key to the success of the project at the local level.

CBDRM has been designed for both urban and rural communities to enhance local awareness and understanding of hazards and

Photo: FOCUS

Training volunteers for post-disaster rescue work

disasters and, most importantly, to impart skills and knowledge required to enable sustainable responses to disaster by local communities. Whether a disaster is major or minor, it is these people who suffer most. Coping and survival strategies enable them to respond to the situation long before outside help arrives from the government or non-governmental organizations (NGOs). Communities wish to protect themselves through community-based disaster preparedness and mitigation.

The following is a list of key elements of CBDRM, derived from FOCUS' experience in the NA/C:

- *Community participation* — Community members are the main actors and propellers; while sustaining the CBDRM process, they directly share the benefits of disaster preparedness, mitigation and development.
- *Priority for vulnerable groups* — Subsistence farmers, children, women, elderly and indigenous people are the most vulnerable in rural areas.
- *Hazard vulnerability capacity risk assessment* — Risk reduction measures are community-specific and are identified after an analysis of the community's disaster risk.
- *Recognition of existing coping mechanisms and capacities* — CBDRM builds upon and strengthens existing coping strategies and capacities, such as cooperation, community/people's organizations, volunteerism and local knowledge and resources.
- *Capacity building* — FOCUS has trained over 25,000 community volunteers to use local resources to respond to and manage different types of disaster.
- *Provision of stockpiles* — FOCUS has also provided stockpiles at community and regional levels to support community response efforts.
- *Acceptance and recognition* — The ownership of the CBDRM remains with the community and is therefore easily accepted and recognized within it.

AKDN-AJK earthquake response

The Kashmir earthquake in 2005 was the worst to have affected South Asia over the past 100 years. With a magnitude of 7.6 on the Richter scale, its epicentre was about 95 km northwest of Islamabad in Pakistan-administered Azad Jammu and Kashmir (AJK). This major quake was followed by many aftershocks of severe intensity for many days.

The earthquake covered approximately 30,000 square kilometres, causing massive destruction in nine districts of Pakistan, in the Northwest Frontier Province (NWFP) and AJK. Apart from the dead, severely disabled or injured, the earthquake left over 2.8 million people without shelter, assets and livelihood.

Immediately after the earthquake, AKDN was able to mobilize its resources, initially for relief, and then for the reconstruction phase. FOCUS' experience with search and rescue and its relationship with RAPID-UK was used to mobilize the first international search and rescue effort. Its trained team and logistical support were extensively used for distributing relief goods and tents. AKPBSP installed water supply and sanitation facilities in camps and villages and constructed temporary shelters before the winter onslaught. Other agencies, such as AKHSP, AKFP, and the Aga Khan University Hospital (AKUH) also provided extensive services. The AKPBSP and FOCUS relief-phase experiences were shared with the local communities, NGOs and the Government, where AKPBSP house construction techniques have been incorporated in official infrastructure reconstruction guidelines.

AKDN is now undertaking a multi-input programme in an entire valley of the Kashmir, covering over 25,000 people. Inputs include water and sanitation, housing, education, health, livelihood, other critical infrastructure and disaster preparedness, to be supplemented by the construction of two schools in NWFP.

The AKDN organizations' experiences reveal several key lessons:

- Disaster preparedness is a long process, as infrastructure and facilities are built over a long period, and needs to be part of the development attitude incorporated in all approaches and programmes
- While constructing safer public buildings is important, most damage is done by houses falling down and this sector cannot be ignored
- Underdeveloped and poor communities require programmes and technologies specifically developed for their circumstances and with their continuous input, in order to make them sustainable, affordable and socially acceptable
- Technological solutions need to be supplemented by preparedness activities such as training for relief work
- AKDN experiences in Pakistan affirm the effectiveness of involving communities in disaster preparedness and mitigation. While communities have built on local coping strategies and capacities to reduce some vulnerability, many necessary structural mitigation measures involve large capital outlay
- Vulnerability is a complex web of conditions, factors and processes, which can only be reduced through complementary and concerted action among multiple stakeholders from various disciplines.

AKDN has been working on various aspects of disaster risk reduction in northern Pakistan for decades with a multi-faceted approach that is unique in Pakistan and has been of considerable assistance to the Government and other agencies, especially in responding to the Kashmir earthquake. AKDN has promoted its experiences and techniques at various forums in Pakistan and has campaigned extensively for a national earthquake preparedness programme. However, much still needs to be done, especially in the housing sector. This clearly underlines the huge task involved in making communities resilient to earthquake risks, and the urgency of starting such work wherever there is risk.

Photo: AKPBSP

Water supply installed by AKPBSP in Kashmir

Post-disaster assessment of building damage

Arghya Sinha Roy, Supriya Prabhu Mehta, K Iftekhar Ahmed, NMSI Arambepola,
Asian Disaster Preparedness Center

Building damage assessment forms a key component of overall disaster impact and reconstruction needs assessment. By summarizing the types of building damage assessment commonly used in the Asian region following a disaster, a conceptual framework of key considerations in building damage assessment can be developed.

While disasters widely impact various aspects of human lives, their impact on buildings is especially catastrophic since vulnerable populations are rendered homeless or compelled to live in uninhabitable and unsafe homes, with livelihoods impaired due to the destruction of workplaces. Disasters such as earthquakes, cyclones and tsunamis, and sometimes long-duration flooding, severely impact the housing sector in the Asian region, where a large proportion of housing is semi-engineered at best.

Some of the recent disasters in the region have impacted the housing sector quite significantly. On average, 1 per cent of India's housing stock is lost annually due to disasters.[1] In the recent 2005 Kashmir earthquake, more than 200,000 housing units in the districts of Azad Kashmir and the Northwestern Frontier Province (NWFP) in Pakistan were damaged or destroyed. This damage has a huge direct impact on the community and settlement as a whole in terms of the safety of inhabitants, security of the population, and indirect effects on the economy of the settlement. Hence it is an absolute must to carry out damage assessment of buildings with a scientific approach, immediately after a disaster.

Purpose of building damage assessment

Building damage assessment is conducted in the post-disaster context, typically by qualified, trained and authorized personnel. It serves several important purposes.

The most immediate function is that of determining the structure's safety for continued habitation or use by communities. This is an essential function particularly to quell apprehension among the affected population about the safety of their houses, especially in the context of geological hazards such as earthquakes which can have large-scale structural impacts followed by recurrent aftershocks.

Building damage assessment is also essential in providing an overall assessment of the quantum of damage and for estimating the expected cost of disaster impacts in terms of value of replacement. This kind of assessment serves as a decision support tool for rehabilitation and reconstruction policies.

In the longer term, a database of comprehensive building damage assessment can also be analyzed to identify typical hazard- and location-specific building failures, which can be used to identify future risk reduction measures. This assessment would help in learning lessons from gaps in:

- Building construction practices
- Limitations of building materials used
- Compliance with construction standards and zoning regulations
- Guidance for the framing of long-term policies and practices for hazard-resilient building construction.

Types of building damage assessment

Depending on the purpose of the building damage assessment, identified by the user, the assessment methodology differs slightly in process, scope and in the human resources requirement, which may be broadly categorized as follows:

- Rapid safety assessment
- Detailed building damage assessment and categorization
- Engineering evaluation.[2]

Rapid safety assessment is undertaken to identify and label buildings that cannot be occupied (labelled "unsafe"), those that can be reoccupied safely ("safe"), those that may be entered very briefly after taking certain precautions ("restricted use") and those whose perimeters might be unsafe due to falling hazards or chemical or other contamination ("area unsafe"). Rapid assessment also provides insights, based on rapid reconnaissance, into the extent of impact, to estimate the expected number of households needing refuge centres for displaced people and temporary housing requirements. Rapid safety assessment, as its title suggests, is undertaken in a very short time frame and therefore does not yield adequate information to guide decisions on the strengthening, retrofitting or demolition of a building. It is not intended to estimate the loss of private property, or to estimate the cost needed for strengthening, retrofitting or demolition. The Applied Technology Council's *ATC-20: Post-earthquake Safety Evaluation of Buildings* is an internationally recognized tool for this process.

Detailed building damage assessment and categorization involves an assessment of individual structural and non-structural members within a building to provide a composite category of damage, which represents the severity of impact. This category may be represented by a numerical degree between 0 and 5, or a qualitative category (such as 'minor', 'moderate' and 'extensive' or others) may be provided. This categorization has been used in past instances for determining the extent of financial or material assistance that households may be entitled to in the post-disaster reconstruction phase. Based on this detailed assessment, a more accurate cost estimate

for repair and retrofitting of overall building stock is possible. If this assessment follows an initial round of rapid assessment, it can also provide a more conclusive evaluation of structural safety. Unlike the rapid assessment, the procedure for detailed assessment varies for different kinds of construction and building types.

Engineering evaluation of buildings is required to determine the structural adequacy and integrity or distress of a structure or selected elements prior to undertaking retrofitting, strengthening or repair. The decision to conduct an engineering evaluation is mostly the responsibility of the building owner, due to the cost and time involved in the process.

Structural elements to be considered for building damage assessment

It must be recognized that different natural hazards have a differential impact on structures. Cyclones, with their high-speed winds, impact lighter elements of a structure such as the roof (especially if pitched), wall cladding and openings, while the heavy rains and floods that often accompany cyclones affect the foundation. Cyclones also often render the surrounding area unsafe by uprooting power supply lines and trees.

In floods the level of physical vulnerability of a structure depends on its capacity to withstand the prolonged inundation, and pressure from water in case of flash flooding. Building damage assessments following floods must integrate an assessment of components such as the building's foundation (or in case of some flood-prone areas the stilts that prop the structure) and walls. Floods are also accompanied by secondary hazards such as ground settlement.

In the event of earthquakes, every structural and non-structural element needs to be examined carefully for damage. Damage to vertical load-carrying elements such as columns and walls due to the ground shaking is often the most dangerous, since this may cause building collapse. Hence, particularly in the case of earthquakes, columns need to be critically examined for vertical, diagonal and cross cracks (wide or hairline width). In some cases, there may be uneven settling of ground due to liquefaction, which can severely impact the structure.

Policy and institutional considerations in damage assessment

While building damage assessment is undertaken after most major disasters, not many countries have taken the necessary measures for institutionalizing a scientific and consistent approach toward building damage assessment in Asia. Gujarat state in India is one of the few pioneers in having initiated the process of developing and institutionalizing a methodology for damage and loss assessment.

Having the necessary human and material resources pre-identified, trained and ready for deployment at any time is essential for an effective and efficient damage assessment system. Since building damage assessment requires expertise in structural and civil engineering, it is often useful to establish and maintain contact with local engineering chapters or associations, which can provide volunteers for undertaking such an exercise when required.

As stated, one of the key functions of building damage assessment is to point towards appropriate future policy with a view to risk reduction. In many Asian countries, building codes are available, but are either not mandatory or not complied with. Assessment including engineering evaluation can ascertain the exact elements of the construction that did not comply with building codes, consequently causing structural failure and damage to the building. For example, corner reinforcement of buildings in an earthquake-prone region may be specified in the code, but might be frequently ignored, resulting in cracking or collapse at the corners of buildings in an earthquake.

Building codes tend to be exhaustive; therefore, such assessment based on identification of typical failures would indicate precisely which aspects of the code should be emphasized in future construction policy to avoid repetition of similar failures. Justification for the enforcement of such policy could draw upon the findings of the damage assessment. It could also form the basis for public awareness, skills development and capacity building of professionals and construction workers, and spontaneous compliance with codes, leading to the mainstreaming of hitherto neglected aspects of the building codes.

A similar scenario applies in the case of building regulations. Even though, unlike building codes, these are mandatory, the vast majority of owner-built constructions pay little heed to such regulations. Enforcement is often lax and subverted by corrupt dealings between building owners and authorities. A clear, scientifically-driven damage assessment can be a powerful tool toward reversing this process by demonstrating the adverse consequences of overlooking or avoiding building regulations. Additionally, where adequate building regulations have not been in place, the assessment would provide directions for formulating relevant regulations based on the nature of damages, and where applicable, be a basis for revising existing regulations.

Similarly, existing land use plans are often not followed properly — for example, an area demarcated for agricultural use might be used for housing by building unauthorized settlements. When a flood occurs in such an area, the property damage and economic loss might be significant compared to what it would have been if this was an agricultural area — benefits might even have been gained in terms of crop irrigation. In such cases, damage assessment may allow revision and reorganization, or the formulation of new land use plans based on its findings and future risk reduction considerations. At a more refined level, it may demonstrate the risk and possible futility of settlement in areas earmarked hazardous through hazard-zoning. Such hazard-zoning, not only on the macro-national level, but also micro-zoning within cities, exists in some Asian countries. However, people are often unaware of the risk of living in areas zoned as hazardous until a disaster does strike. An opportune moment then arises to build awareness for more selective settlement patterns and policies, facilitated by and demonstrated through the findings of a damage assessment.

Photo: Mr. N.M.S.I Arambepola

Building damage assessment may be used to identify immediate damage and measures to prevent this in the future

Rethinking post-disaster reconstruction: rural and urban areas of Turkey

Muzaffer Baca, Vice President, International Blue Crescent Humanitarian Relief Organization
Ömer Faruk Görçün, Instructor, Anadolu Bil Professional School of Higher Education
International Blue Crescent

Developing countries such as Turkey face a variety of natural risks, leading to disasters which cause immense loss of life and property. The Marmara earthquake of 1999 exemplifies the immense scale of many such disasters, emphasizing the critical importance of effective planning and programming for post-disaster reconstruction, including not only the provision of shelter for victims, but also the rehabilitation of physiological, social and economic infrastructures.

One crucial challenge in post-disaster reconstruction is ensuring the sustainability of interventions — in many cases, reconstruction has compounded the vulnerability of settlements. Following the Marmara earthquake, steel-stake construction for apartments and reliance on modern technology for the construction of urban housing has failed to reduce vulnerability to future earthquakes, and may have increased the physical, social and economic vulnerability of local communities.[1]

Reducing vulnerability from a physical and psychological perspective

The principal causes of increasing pre- and post-disaster vulnerability are related to existing psychological, social, economic and political conditions as well as post-disaster reconstruction policies. Often, existing development processes for rural and urban settlements contribute to social and economic poverty, a market economy and an undeveloped education system. Rural and urban areas of Turkey and other developing countries present major challenges in seeking to reduce vulnerability through development of local knowledge and capacity. These include:

- Loss of material and land resources (from rural communities)
- Loss of traditional skills
- An acquired culture of external interventions
- Increasing social and economic poverty and inequity
- Weakening municipalities and city administrations.[2]

Vulnerability is a set of negative conditions within a community, which may be caused by inherent weaknesses or external threats. Knowledge and capacity result from positive conditions, representing the internal strengths and external opportunities of a community. However, vulnerability to disasters is both the cause and effect of decreasing knowledge and capacity in local administrations, and of conditions of poverty.[3]

Disaster-related damage is a complex phenomenon that might relate to one or multiple risks, affecting the whole society or sections within it. A significant aspect of the interlinkage between the vulnerability and capacities of afflicted societies is in the dynamic nature of the relationship. The negative effects of a disaster do not remain the same over time, especially after a natural risk such as an earthquake or hurricane.

On one hand, vulnerabilities can form the context for a disaster; on the other, reactions such as relief and rehabilitation processes may help to eradicate or reduce certain kinds of risk while compounding others. Certain aspects of vulnerability precede a disaster, creating a setting for it and contributing to its nature and severity. These can be reinforced and changed by post-disaster response decisions and by the overall social, economic, political and institutional context. Vulnerability to natural disasters can therefore be understood in terms of 'products' and 'processes,' existing before as well as after a disaster, with certain aspects carried forward because the underlying causes remain.

Because societies are always in transition, local knowledge and capacity are accumulative, and develop continuously in response to various situations. Internal perceptions dictate the learning processes and communication mechanisms which develop over

Photo: Muzaffer Baca, International Blue Crescent

Vulnerability is a product of immediate and long-term disaster responses

time, leading to the creation, reception and accumulation of new knowledge. There may also be hidden capacities and vulnerabilities that are not linked to a specific risk, but nevertheless characterize the society's strengths and weaknesses in general.

Moreover, in many situations, vulnerabilities and capacities may complement each other. The disaster vulnerabilities and capacities of rural communities in India and Nepal can be viewed in a time continuum as processes, which are themselves the products of social, cultural and economic transformation processes within communities. Three major factors affect the vulnerability and capacity of rural and urban societies, and also affect each other:

- The normal (under)development process
- Immediate disaster response
- Long-term disaster response.

Social, cultural and economic transformation processes within societies

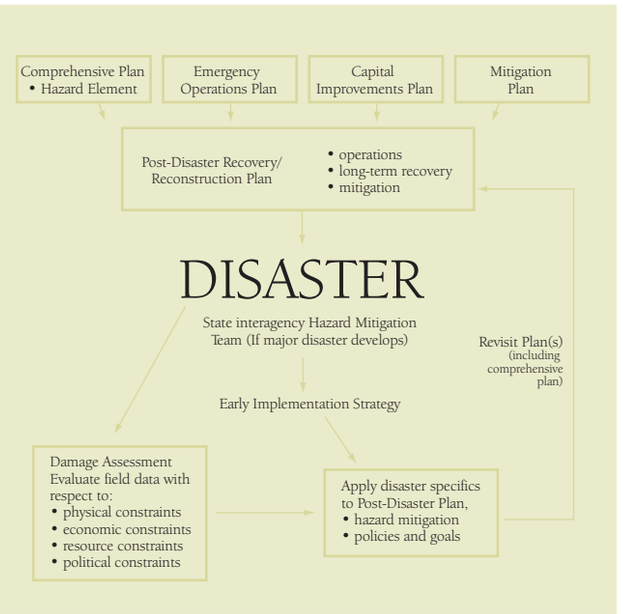
Turkey's rural and urban societies have traditionally been coherent entities with a distinct social hierarchy but well-defined roles and relationships. However, ongoing changes to these societies include those to the traditional patterns and relationships that determine their mutual support systems. These changes can help to reduce vulnerability, but some of the patterns and relationships are exploitative, and increase the vulnerability of certain groups. Moreover, these inherent transformation processes extend to changing perceptions and thought processes that favour anything which is 'modern'.

These structural changes are mainly due to the predominant forces of globalization and the changing political and economic environment, which erode the traditional systems and relationships that have defined these communities for generations. Social vulnerability in South Asian rural communities is very much linked to widening social and economic segregation, which is reinforced by the local political power structure. This has weakened collective coping and response mechanisms, leading to increased social and economic inequity, which has in turn increased the vulnerability of certain marginalized groups. The present generations of these communities are 'lost' generations — neither able to use their traditional systems, nor to adjust and benefit from modernization.

The vulnerability of Turkey's urban and rural societies is certainly a direct or indirect result of the dominant paradigm of development. In some form or other, development has implied modernization, the transformation of 'traditional' society (characterized by dependence on particular social forms and cultures, and on nature) towards 'modern' society (characterized by control over nature, individual free choice, and independence as freedom from a given social and natural reality). This paradigm also assumes that development can be created or engineered, and brought to some people by others who are more developed. Moreover, it is assumed that development is linear and predictable, with a direct line between cause and effect, input and output.

Such predominant notions of externally driven development have negative implications for rural communities. First, the agencies in charge of development perceive modernization as a panacea for developing 'backward' urban and rural societies, without comprehending local frames of reference — their worldviews, needs and priorities. The result is cultural incompatibility and non-sustainability of interventions — rural development approaches in Turkey have failed to some extent to meet basic needs or enhance capabilities. Rural communities are increasingly losing access to local resources, especially land.

Damage assessment



Source: Cecelia Rosenberg, FEMA; designed by Lisa Barton, APA

The question of choice and access to resources is fundamental in any discussion on rural poverty. Increasing poverty drives rural people to urban areas, leaving behind their skills and knowledge. However, most of them are also marginalized in urban areas. Vulnerability is a product of immediate and long-term disaster response, of external human interventions and the perceptions of decision-makers, undertaken as post-disaster decisions or actions intended to reduce vulnerability against such natural events. This is either because of erroneous official policies for relief and rehabilitation or, in many instances, emergency, relief and rehabilitation models by non-governmental organizations (NGOs). The long-term negative consequences are evident in the case of Marmara, where it is also assumed that the provision of reconstructed houses is an end product for the development of villagers and urban dwellers.

Ineffective disaster management may also be due to the overall social, economic and political context within which it takes place, and which it helps to shape. Poor policy approaches can reinforce and even increase existing resource dependencies and social inequity while overlooking local knowledge and capacities. Moreover, social participation in disaster management depends largely on the local power structure which is, ironically, reinforced by existing social segregation.

Turkey's disaster management has become a highly specialized discipline, with professionals and decision makers identifying various approaches within their own disciplinary field. For example, policy-makers perceive relocation as a safe option based on the technical criteria of seismic safety, without considering relationships to land, culture and livelihoods. Similarly, housing reconstruction is seen as a physical end product, heedless of its relation to ways of life and economic conditions. Similar issues emerge on the questions of transferring technology, which can make the structures highly earthquake-resistant but raises questions about affordability, cultural compatibility and sustainability in rural communities.

Redefining risk and disaster

Conventionally, we tend to categorize disaster in terms of phases (pre-, emergency and post-disaster) for the sake of management.

But is disaster a 'reality,' or the 'construct' that these categorizations make of it? [4, 5]

The complexity and dynamism of vulnerabilities and capacities makes 'disaster' a very loose term, with no beginning or endpoint. Disaster situations need to be viewed within a continuum, with actions during various phases impacting each other. We need to establish backward and forward linkages while deciding actions and interventions at various stages.

This further implies that disaster can only be measured for the phenomenological discussion of the nature, increase and decrease of vulnerabilities and capacities before and in response to specific natural hazards. Discussion of phases such as pre-disaster or post disaster is therefore inappropriate. Instead, shifts in the magnitude, scale and severity of vulnerabilities and capacities must be examined at various stages with reference to the hazard event that catalysed the disaster situation. These are:

- Normal situation (without the impact of natural hazard)
- Emergency situation (a few days or months after the hazard has struck)
- Transition phase from relief to recovery (a few months to a year after the event)
- Rehabilitation phase (over the years, through the rehabilitation process)
- Long-term, post-rehabilitation phase (to assess the impact of post-natural-risk interventions).[6]

This model essentially describes how vulnerability situations develop by elaborating on the causal relationships involved. However, the model is linear, and conceives disaster as an end product. If development is a fundamental context within which all the above situations interrelate and take shape on the ground, then it is either externally driven or driven by local communities. Therefore, in the disaster management cycle, development is not a phase in itself; rather it interacts and separately affects each of the above situations which are, in turn, each affected among themselves, ultimately shaping the developmental context itself.

However, disasters are very much a part of the overall risk framework. The term 'risk' is understood as the product of hazards and vulnerability. In conventional terms, the risk of a site or property is understood in relation to one hazard such as earthquake or flooding, and vulnerability is understood as the exposure of that site to that particular hazard at one particular time, mainly in physical terms.

Contrary to conventional means, the integrated method of understanding risk to a site or property may stem from exposure to one or more hazards and other determinants. A holistic understanding of risks from various hazard sources is needed, as well as an understanding of vulnerability processes while incorporating actions and strategies for specific kinds of hazard. The physical vulnerability of both movable and immovable aspects of a site or property must also be linked to those resulting from social, economic and underdevelopment processes. For example, risks to physical fabric are not only linked to structural weakness, but also to the social, political and economic context in which they are located. Local meanings and perceptions may also have a bearing.

Post-disaster reconstruction and integrated risk management

Risk management is a well-developed subject with well-defined components and universally accepted definitions. It includes proactive tools, techniques, strategies and actions for risk assessment and control at various stages with respect to a disaster situation. Therefore we need to organize the subject of risk preparedness, primarily under the universally accepted phases of risk management (risk identification and analysis, evaluation, monitoring, prevention/mitigation, disaster preparedness, emergency response, long-term recovery etc.) before addressing various types of risk. The risk management framework is a prerequisite for a disaster management framework — various activities undertaken during preparedness, response and recovery phases of a disaster must be subject to risk identification, analysis, assessment and control.

Undertaken as part of integrated risk management, risk assessment will involve integrated vulnerability analysis on one hand and integrated hazard mapping on the other. Integrated vulnerability analysis takes into consideration social, political, economic and attitudinal aspects of vulnerability alongside physical aspects of their impact on each other. Vulnerability is considered not only as a product in the form of exposure to risks at a particular time, but also as a process over time.

Damage and needs for reconstruction

Disaster assessment encompasses the survey and information collection activities that determine the effects of a disaster on the affected population, and their resulting needs. The assessment process is usually conducted at two distinct stages of a disaster.

Immediately after a disaster, a preliminary or 'rapid' assessment is conducted to obtain an early but full picture of the geographical extent of damage and the number, categories, location, and circumstances of the disaster-affected population. It provides a general picture of where people are, what condition they are in, what they are doing, their needs and resources, and what services are still available to them. It usually takes the form of a reconnaissance that can guide search-and-rescue and relief operations. Preliminary thematic maps that locate affected or damaged sites and infrastructure can then be produced. As needs change day by day in the immediate aftermath of a disaster, a series of rapid assessments may be needed. Their results provide valuable baseline data for monitoring the post-disaster situation.

At a later stage, a more detailed assessment is done to collect more specific information about the nature, location, and extent of loss and damage, and the resulting needs of affected populations. Information about damage to housing and other buildings, livelihood, agriculture and livestock, services, infrastructure and utilities is gathered and used for planning and implementing reconstruction programmes.

Specialists in each sector determine the damage. Structural or civil engineers, for example, examine the damage to housing, commercial and public buildings, physical infrastructure and utilities. Agricultural specialists determine losses to crops and forests, among others, and economists determine damages to the local economy. Many special plans developed by local governments, for example neighbourhood plans, also provide an ideal opportunity to sharpen the focus of post-disaster planning.

Neighbourhoods in hazard-prone areas, especially if they are developed with a high level of citizen participation, can raise citizens' awareness of the need for preparedness and mitigation and of more sustainable rebuilding methods. Could better storm water detention systems ease a neighbourhood flooding problem? Might fire-resistant landscaping requirements for a homeowners' asso-

Photo: Muzaffer Baca, International Blue Crescent

Participating in neighbourhood development can help raise awareness of the need for preparedness and mitigation

Photo: Muzaffer Baca, International Blue Crescent

Community ownership of preparedness measures helps to reduce vulnerability

ciation help avert disaster? Under what conditions should vulnerable historic buildings be demolished? Linking post-disaster elements with the development of neighbourhood plans presents an opportunity to nail down details of post-disaster reconstruction and mitigation that might otherwise escape notice.[7]

While damage assessment is usually done by sector specialists, it is essential that disaster-affected families participate in surveys involving their housing units. A needs assessment determines the level and types of assistance required by the affected population, their priorities, and their preferred strategies to meet these. Common needs include housing, livelihood, personal (injury, handicap, bereavement, trauma), and services (water supply and sanitation, electricity, schools, health centres). The information helps to identify and prioritize needs, leading to appropriate assistance and inputs for reconstruction in the medium and long term.

Clearly, reconstruction needs to be holistically planned — it is not merely a question of replacing damaged building stock and infrastructure, but also of reconstructing communities, ensuring equity, access to resources and equality of opportunity for the most disadvantaged members of those communities, and reducing community vulnerability to hazards.[8]

Disaster assessment methodology

Technical evaluation of structural damage — This is usually conducted through a street-by-street, house-by-house survey to determine the precise nature and extent of damage to all buildings. Damage is classified according to pre-defined categories, via direct onsite visual evaluation of building exteriors.

It is essential that the surveyor consult with each affected family to develop a reasonable consensus on the method and basis for classifying the dwelling under a given damage category.[9] It is also important to evaluate every structure within the area, even those that are not affected. This ensures that isolated, undamaged homes are identified and recorded, and helps pinpoint the specific cause of damage to those that are affected. This assessment provides the basis for the level of housing assistance allocated to affected families, who should be informed of the results as soon as possible.

Inventory of affected assets — This detailed survey of all losses (assets and income) caused by the disaster is the basis for special financial provisions given to the affected people. Categories include shops, workshops, stalls, tools and equipment, and livestock. The owners or heads of households may need to countersign the inventory to minimize the possibility of subsequent claims or disputed claims.[10]

These detailed surveys rely on interviews with a sample of the affected population and the collection of statistical information. Generally, sample surveys are used for needs assessment. There are several different sampling methods:

- Simple random sampling: Every member of the target population is equally likely to be selected, and the selection of a particular member has no effect on other selections
- Systematic random sampling: Every fifth or tenth member on a numbered list is chosen
- Stratified random sampling: The population is categorized and members from each category are selected by simple or systematic random sampling before being combined to give an overall sample
- Cluster sampling: Restricted to a limited number of geographical areas ('clusters'), from which samples are selected by simple or random sampling. Sub samples are then combined to give an overall sample.

Rethinking post-disaster reconstruction implies establishing or strengthening the management systems of tangible and intangible, 'historical' and 'living' dimensions of cultural sites and establishing systems that address risks to sites and property in an integrated manner through preparedness before, during and after disaster situations. After all, integrated risk management for a living culture is about addressing the knowledge and skills accumulated in the past, surviving in some form in the present, and with a potential for reducing disaster vulnerability and increasing capacity for the future.

It is about linking past, present and future by managing change with a proactive approach that addresses the underlying causes of a disaster in both pre- and post-disaster situations. An integrated framework for risk management addresses the larger forces that put cultural heritage at risk. Risk preparedness initiatives can be strengthened by integrating the needs of living heritage with existing disaster management systems at national and state levels. This requires re-addressing existing development policies and their impact on risks to cultural heritage.

Risks are a shared reality facing individuals, villages, districts, even regions. Responses must be multi-pronged — no single initiative can address risks to cultural heritage. Rather, there must be multiple initiatives at various administrative levels through the involvement of multiple public and private stakeholders. Dialogue, collaboration and coordination are essential to this vision.

A new understanding and approach to disaster management in Turkey

Orhan Topçu, GDEM, Turkey

TURKEY HAS ALWAYS been vulnerable to natural hazards of many kinds. Its geology, topography and meteorological conditions all contribute to this risk, where any type of disaster leads to both material damages and high physical and social vulnerability.

Even in recent decades, there has been excessive loss of life, injury and damage to property. The most recent major earthquakes, in 1999, occurred in Turkey's industrial heartland at a critical economic period for the country.

Turkey lies on several active fault lines and is mainly at risk from major earthquakes. Almost 70 per cent of the population lives in areas at risk. Earthquakes have caused irreversible damage to ancient sites and historical remains, which constitute some of the most outstanding pieces of the world's cultural heritage.

The Marmara earthquake alone caused 18,243 deaths; 48,931 injuries and 377,879 damaged houses and offices.

The Japan International Cooporation Agency (JICA) report, *Development of Disaster Management Systems and National Strategies in Turkey*[1] identifies four distinct periods:

Pre-1944: Post-event response — Turkey had no effective, systematic policies for disaster management activities (mitigation, preparedness, response and recovery).

1944-1958: Feeble countermeasures — As a result of devastating earthquakes, Turkey realized the importance of legal provisions and strategies for mitigation and preparedness activities.

1959-1999: Ministry-level responsibility for disasters and construction — Regulations had so far stipulated mitigation, preparedness, response and recovery activities only in relation to earthquakes and did not include reconstruction activities. Other natural disasters such as floods, landslides, fires etc. became prevalent. The Ministry of Reconstruction and Resettlement was created, but related laws were not successfully implemented as they were issued in the line of basic policies for proper land-use planning, building construction and building inspection regulations due to social, economical and political barriers.

Post 1999: Awakening — The huge losses from the 1999 earthquake forced the Government to send an urgent bill to Parliament, allowing it to pass whatever mechanisms were deemed necessary through the *Decree with the Force of Law*, (Law no. 4452) to aid disaster recovery. Passed just ten days after the earthquake, this law authorized the Government to issue decree laws in order to quickly address the needs caused by this catastrophe.

Within seven months of the 1999 earthquakes, the Government published seven new laws and 32 decrees to improve the national disaster management system and support the needs of earthquake stricken areas.

Recent disasters have demonstrated the importance of disaster preparedness at every level, with the main goal of reducing the loss of lives and livelihoods. However, recent experiences and further studies have proved that disaster management and creating disaster resilient societies can only be achieved by strong dedicated institutional organizations combined with a culture of information sharing, enhanced public awareness and educational capacity, and more focused risk reduction activities.

Decree Law no. 600 was passed in 2000 with the simple aim of filling the 'gap of coordination' between different actors in the multi-sectored emergency management cycle. There are a huge number of responsible organizations within different phases of the disaster management cycle. Some are only assigned duties on one level, some on multiple levels, but prior to this decree there was no overall coordinating body in the Turkish governmental system. There were some practical difficulties in coordinating different state organizations on a vertical level, so this crucial coordinating authority was assigned a new agency within the Prime Ministry.

Changes since the Marmara earthquakes

In 2000 the Turkey Emergency Management General Directorate (TEMAD) was established to foster a new understanding and approach to disaster management.[2] A comprehensive framework for emergency management in Turkey was established according to the definition below, which was added to the responsibilities of the Prime Ministry:

"To take necessary measures in order to provide effective emergency management nationwide in case of earthquakes, landslides, fires, accidents, meteorological disasters, accidents caused by nuclear and chemical substances and population movements of a scale that threatens national security, and to provide coordination between agencies that are part of emergency management, such as those that are active either in precautions before emergencies or in search and rescue operations during emergencies, or in recovery and reconstruction activities after emergencies."

The responsibilities of TEMAD are to:

- Ensure establishment of emergency management centres, determine working principles and provide coordination
- Prepare short- and long-term plans and establish data banks
- Conduct coordination of all resources, using all available sources where emergency management is introduced
- Encourage voluntary organizations and individuals and coordinate relief operations.

TEMAD is the only national body with the sole responsibility of coordinating emergency related agencies in different disciplines and sectors. The agency will become fully functional on comple-

tion of projects such as the new TEMAD centre and the development of national emergency information and communication systems.

There have also been changes to Turkey's search and rescue (SAR) structure. SAR activities are performed by the General Directorate of Civil Defence under the Turkish Ministry of Interior. This institution was set up in 1928 and reformed in 1932, attaining its characteristic shape and duties in 1959 for the purpose of civil defence. But emerging needs and global trends towards protection rather than defence prompted reorganization.

Turkey's SAR teams were located in 11 centres, each staffed with highly trained, fully equipped teams according to the needs of the area. The Turkish SAR structure is still working to establish its identity, and will eventually define its position in relation to Turkey's role in the region.

Many of Turkey's disaster-prone cities, such as Istanbul, Izmir and Sakarya are now renewing or beginning to build their disaster contingency management master plans.

Emergency communication systems have also changed. A consistent and reliable communication system is a vital tool for any emergency management situation, and the new structural approach to communication is based on the latest technologies such as satellite or wireless voice and data communications. The system has many back-ups including non-governmental organizations (NGOs) such as the Turkish radio amateurs. Two other major projects are ongoing to create a reliable nationwide crisis management data and information network.

Many international efforts are coordinated by TEMAD. Several international organizations, including JICA, the Federal Emergency Management Agency, the Swiss Development Agency and the World Bank, initiated various projects in different sectors following the Marmara earthquake. All of these efforts are integrated via the new coordinating structure, thus yielding more fruitful results and reaching their targets over a wider area.

New disaster training programmes were introduced at local and national levels, across almost all government agencies, universities, institutes, schools and private sector organizations. Mass media has been used as an effective means of promoting public awareness.

The Turkish Armed Forces also reorganized, forming special units and also restructuring all brigade-level units with the capacity to perform disaster relief operations. Natural Disaster Assistance Troops (DAFYAR) have been formed at battalion level, and are kept ready to intervene in natural disasters. These have achieved excellent results in many recent response operations.

The introduction of new building codes and inspection systems was also introduced by the Ministry of Settlement and Public Works, and a new insurance system, DASK, has been set up to provide cover against natural disasters.[3]

Since the 1999 earthquakes the number of NGOs operating in different disaster services has increased enormously. Society has filled the gap where government resources were weak. NGOs work mostly in SAR and communication activities. TEMAD is preparing programmes for encouraging and promoting more effective NGOs, media and academic society.

Today, NGOs are a key element of democratic and developed societies. Turkey has made great legal steps to enable NGOs to operate in disaster or crisis operations, in Turkey and outside it. Several Turkish NGOs have performed rescue and relief operations in many countries around the world. Between 2005 and early 2006, 1,071 waivers were issued to free NGOs from custom charges in support of humanitarian aid activities by TEMAD.

Costs of the 17 August 1999 Turkish earthquake

Costs (USD billion)	SPO State Planning Organization	World Bank	TUSIAD Turkish Industrial Business Association
Direct cost	10.0	6.6 to 10.6	3.1 to 6.5
Housing	4.0	3.5 to 5	1.1 to 3
Enterprises	4.5	2.5 to 4.5	1.1 to 2.6
Infrastructure	1.5	0.5 to 1	0.9
Indirect cost	2.8	2 to 2.5	1.8 to 2.6
Value-added loss	2.0	2 to 2.5	1.2 to 2
Emergency relief expenses	0.8	…	0.6
Total damage cost	13.0	9 to 13	5 to 9
Secondary effects			
Current account loss	2.0	…	3
Fiscal costs	2	5.9	3.6 to 4.6
Job losses in the region	…	…	20% to 50%

Source: Turkey post-earthquake report, OECD

At the national level all planning activities are orchestrated by the State Planning Organization (SPO) through five-year plans. The elements of the last seven plans relating to natural disasters were analysed. The SPO established a special commission on natural disasters after the 1999 earthquakes for the preparation of the eighth five-year development plan, and made concrete recommendations regarding legislative issues, staff and financial infrastructure, training and technical infrastructure and long-term actions.

A well-prepared system is not only based on good planning. It is also expected to be effectively informed by early warning systems and well-rehearsed national and local contingency and evacuation plans, as well as communication and coordination systems and adequate logistical infrastructures and emergency funds.

Achievements so far

This new structure has brought to Turkey more flexibility. It has been tested and proved in many recent humanitarian response operations and some major international exercises. It has brought together professionals and experts from different sectors. Its composition is based on services, professionals and related organizations in the disaster management cycle.

Professional teams for SAR, health care, communication and others are working closely together under TEMAD coordination. The Iran BAM earthquake response operation was the first success of this new multi-level approach, and the list of examples continues to grow:

- 1,550 tons of food rations were delivered to Georgia while it suffered instability
- Approximately 2,860 tons of food rations were delivered to Telafer and Fallujah
- 1,352 tons of food rations and three fully-equipped ambulances were delivered after a request from Palestine
- Two military airplanes were dispatched to Darfur, Sudan with USD500,000 of medical equipment and nutrition for children
- After the Iran BAM earthquake, TEMAD responded with medical services plus SAR teams and NGOs totalling 161 personnel.

TEMAD's duties are not limited to the region or its neighbours. One of its policies is to enhance public awareness by responding to global

Istanbul remains at risk from major earthquakes

emergencies. For example, after the Tsunami around 300 personnel from government organizations and 300 from NGOs served in the area, delivering 30 tons of nutrition during the early days of the catastrophe and USD41 million donated by Turkish people.

In the wake of Hurricane Katrina USD1.5 million was donated to the American Red Cross directly and indirectly via Turkish associations located in the US.

The Eastern earthquake is TEMAD's latest and biggest aid operation. Public donations reached more than USD200 million, and since the beginning of the operation, 25 flights, 12 ships, 66 trucks and 54,224 tons of aid have reached the area. The activities included 604 personnel with 51 SAR, 146 medical, 346 from the Turkish Red Crescent, and 61 from other professional services. Today, 102 Turkish citizens and 89 Pakistani contractors are still serving in the area.

TEMAD is now working with the UN-OCHA and other aid organizations to organize international efforts.

Shaking a megacity: Istanbul

Istanbul has experienced several devastating earthquakes, and experts believe there is around a 65 per cent probability of a major earthquake during the next 30 years.

The inevitability of a large earthquake in Istanbul keeps everybody on constant alert. The seismic risk is best illustrated by quantifying the effects of an earthquake on the physical and social environment. Two significant findings emphasize the risk in Istanbul:

- In global terms, Turkey has produced a significant volume of stock within a limited period. As a result, urban areas are predominantly low-standard, low-quality, unauthorized environments, representing large pools of risk
- The rate of urbanization is levelling and it is probable the surplus will persist.[4]

Unfortunately, in recent decades rapid and uncontrolled urbanization, poor land use planning and construction, inadequate infrastructure and services, and environmental degradation have prevented sustainable progress towards an earthquake-resilient Istanbul.

Despite this, a lot of effort has been put into Istanbul, from the highest political level to the citizen in the street. The first and most important step was the Earthquake Master Plan for Istanbul, initiated by the Istanbul Metropolitan Municipality and produced by a consortium of four leading Turkish universities. The difficulties were not limited to the city being the most populous in the country. Financial and industrial sites doubled the number of problematic areas in the event of a major earthquake.[5]

The Istanbul Earthquake Master Plan is based on three fundamental actions:

- *Contingency plan* — The principal document outlining methods for managing risks (avoidance, mitigation or sharing)
- *Local action plan* — Containing sub-project activities or implementation packages
- *Research and activity programmes* — Enabling the sustenance or completion of the first two actions.

Popular and political support for the Master Plan will be facilitated through close cooperation with NGOs, the media and the economic sector. The Istanbul Earthquake Master Plan is truly an ambitious risk management plan with few global precedents.

At this point, the UN/ISDR Hyogo Framework Dialogue Final Summary, comprising a set of simple steps, gains utmost importance as a guiding document in Istanbul's case:

1. Ensure that disaster risk reduction is a national and local priority with a strong institutional basis for implementation
2. Identify, assess and monitor disaster risks and enhance early warning
3. Use knowledge, innovation and education to build a culture of safety and resilience at all levels
4. Reduce the underlying risk factors
5. Strengthen disaster preparedness for effective response at all levels.

The Earthquake Master Plan for Istanbul comprises work in these tightly linked areas:

- Assessment of the current situation
- Seismic assessment and rehabilitation of existing buildings
- Urban planning
- Legal issues
- Financial issues
- Educational issues
- Social issues
- Risk and disaster management.

Istanbul is currently working toward a post-disaster emergency response and rescue plan, based on real risks defined by its geographical information systems (GIS), and addressing methods of response to the nearest future risk.

The city is also retrofitting the public service buildings project (pre-disaster activities). In addition, there is a growing, citizen-led post-disaster Neighbour Disaster Support Project.[6] The most critical period to save lives after a disaster is the first 72 hours, and most people are rescued by relatives and neighbours rushing for help within the first 24 hours, usually with little or no equipment and training, before the professional responders arrive.

The project's objectives are to improve the potential for neighbourhood-based rescue during the critical period by providing training, equipment, and an efficient and sustainable organizational structure; improving cooperation and coordination with professional responders; raising disaster awareness in the community, and informing civilians about disaster risks and precautions.

Earthquake probability in Istanbul in the near future

Earthquake with a magnitude of more than seven		
2000-2010	32%	+/- 12
2010-2022	50%	+/- 13
2022-2030	62%	+/- 15

Source: T. Persons (USA), A. Barka (Turkey), S. Toda (Japan)

Post-disaster activities include a disaster response station for each district project, with 250 ready-to-use containers loaded with emergency equipment, located in several secure and easy to reach points of Istanbul. In case of an emergency the equipment inside will be used by professionals or trained citizens.

Further priorities include projects for micro-zoning, early warning systems implementation, land use maps and planning activities, training and preparedness, SAR equipment, the earthquake park project, and the Istanbul Seismic Risk Mitigation and Emergency Planning project (ISMEP).

ISMEP

The ISMEP project is one of several ongoing projects aimed at mitigating Istanbul's risk of earthquake, all of which are tightly linked under the control of central government and TEMAD. The whole country is working on a better response in a systematic approach framed by the United Nations and other international organizations with the support of Turkish people and NGOs.

Within the next 10-20 years, the project aims to transform Istanbul into a city more resilient to major earthquakes. Its overall goal is to save lives and reduce the social, economic and financial impacts of a major earthquake in the region. Specifically, the aim is to improve Istanbul's preparedness for a potential earthquake by enhancing its institutional and technical capacity for disaster management and emergency response, strengthening critical public facilities and supporting measures for better enforcement of building codes and land use plans. The Istanbul Special Provincial Administration will be the responsible agency on behalf of the Republic of Turkey.

Andrew Vorkink, Country Director for Turkey, has noted that, in a world where the 1999 Marmara earthquake, the 2004 tsunami, Hurricane Katrina and the South Asian earthquake cost so much in terms of lives and livelihoods, emergency preparedness and hazard risk mitigation are essential government roles: "The good news is that in Istanbul province, both the municipality and the governorship, with the support of the central Government, have demonstrated a high level of commitment and ownership in earthquake mitigation efforts, and have initiated several valuable seismic risk assessment and planning activities," he said.

"Through the ISMEP project more will be achieved. Key public facilities will be retrofitted to resist a major earthquake; skills and technical capacities of the relevant emergency response units will be strengthened; and enforcement of building codes and land use plans will be improved. The project will retrofit around 40 hospitals and 600 schools, and several clinics, dormitories, and administrative buildings. It will also demolish and rebuild any building too weak to be retrofitted."[7]

The ISMEP project comprises three main components:
Component A: Enhancing emergency preparedness. The objective of this component is to enhance the effectiveness and capacity of Istanbul's provincial and municipal public safety organizations to prepare for, respond to and recover from significant emergencies, especially those arising from earthquakes. The component will support improvement of emergency communications systems; establishment of an emergency management information system; strengthening the institutional capacity of the Istanbul Governorship Disaster Management Centre (AYM); upgrading of emergency response capacity, and public awareness and training.

Component B: Seismic risk mitigation for public facilities. To reduce the risk of future earthquake damage to critical facilities and lifelines in order to save lives in the event of an earthquake. Key activities include the retrofitting or reconstruction of priority public facilities such as hospitals, clinics, schools, administrative buildings and infrastructure; risk assessment of lifelines and vital infrastructure; and risk assessment of cultural heritage buildings.

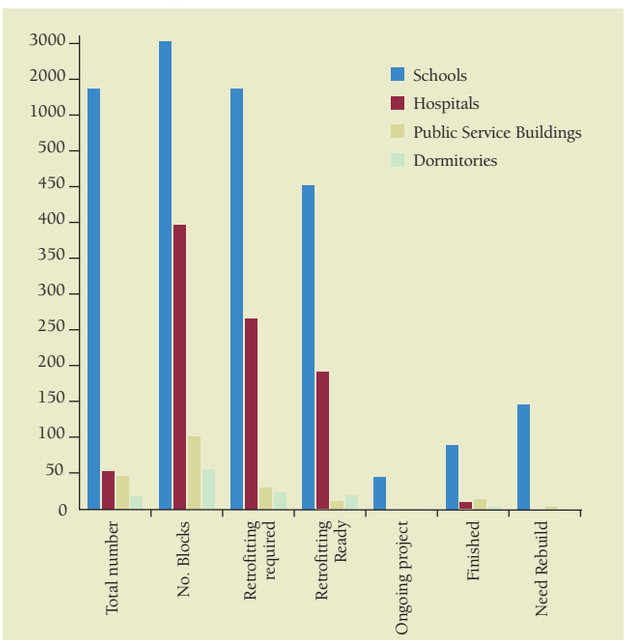
Component C: Enforcement of building codes. This component will support innovative approaches to better enforcing building codes and compliance with land use plans. Key areas of support are public awareness campaigns; further development of a regulatory framework for enforcement of building codes and land use plans; volunteer accreditation/training of engineers; streamlining of building permits issuance procedures, and promoting transparency and accountability in selected district municipalities.

Istanbul's 15 million inhabitants will benefit from mitigated risk of an earthquake and the preparation of the city and its population for a potential disaster. The city's decreased vulnerability will benefit the country in economic, financial and social terms, since major losses to the metropolis would dramatically affect Turkey as a whole.[8]

Natural or man-made disasters have similar results when it comes to effects on our daily lives. When a disaster hits an important facility, a chain reaction starts and other metropolitan systems collapse. But if a multi-dimensional and multi-sectored approach is taken to preparation activities, the result is a chain of response that eventually becomes a sustainable development.

Turkey has learned expensive lessons from the 1999 earthquakes. Disasters are not confined by national or regional borders, and countries cannot cope alone. The world is increasingly interdependent, and a spirit of partnership is needed to save human lives and protect property.

Istanbul retrofitting



Source: Istanbul Governership Emergency Crises Management Center

More to lose: reducing family vulnerability to flood and storm damage in central Vietnam 1989-2006

John Norton and Guillaume Chantry, Development Workshop

Vietnam's growth in recent years has made the country a byword for development success stories. Since the doi moi (renewal) reforms launched in the 1980s catapulted Vietnam toward a market economy and jacked up growth in domestic revenues, there has been a marked improvement in living conditions.

Despite this, some 24 per cent of the population were still living below the poverty line in 2005,[1] and as many again were 'temporarily poor,' hovering just above the poverty line and at constant risk of falling below it. Reducing the vulnerability of poor and marginal families is key to reducing poverty. And in central Vietnam, after crop losses, one of the biggest mishaps a family faces is damage to their home, or its destruction, by annual floods, storms and typhoons.

Natural disasters represent an ever-present threat. Their impact is increasing and levels of economic loss have climbed steadily.[2] Nor is it just news-breaking disasters that cause damage: every year whirlwinds, lesser storms and flash floods represent a catastrophic financial setback for poor families.

As a result of doi moi, many families living close to the poverty line have struggled to gradually replace their pre-reform precarious shelters with homes built using more durable materials. They intend these to provide security for their families and possessions and a safe base from which to work. This investment is typically by far the largest in kind and cash that a family will make. It is therefore a cruel twist of fate that house improvements are frequently and repeatedly destroyed by typhoons and floods. Paradoxically, it is these very improvements that increase family vulnerability, insofar as the cost of rebuilding is higher and — crucially — monetarized.

Since 1989, Development Workshop (DW) has observed the gradual replacement of traditional rural buildings using local materials — thatch, bamboo, wattle and daub — with new homes built with bricks, tiles, and cement, all of which are costly. Fifteen years later, commune statistics show that some 70 per cent of provincial and rural housing stock has been replaced.[3] This represents a huge domestic investment and a vastly increased exposure to economic loss. The same statistics nevertheless classify many of these more recent houses as 'semi-solid,' i.e. exposed to damage caused by even lesser disaster events. Visual assessment bears this out.

Why should such levels of damage still occur? Essentially because basic rules of disaster-resistant construction have been neglected. Many storm-resistant features of traditional housing have been forgotten due to misplaced faith in new materials, economy, or simply because the home has remained unfinished. So recovery, which had been relatively cheap, now involves the cost of buying raw materials and building components, and often of employing skilled builders.

Not surprisingly, Vietnamese preparedness policy has focused on strengthening and developing infrastructure and protecting dykes and riverbanks,[4] and the country has a long and commendable history of preparation and relief.[5] But faced with growing economic losses, a disaster management strategy that does not mobilize all potential resources to reduce risk and vulnerability is neglecting valuable opportunities. In this context, the people themselves become a key resource.

A top-down disaster risk reduction strategy does not adequately consider families and local communities as genuine partners in the disaster reduction process. DW firmly believes in maximizing potential at all levels of society. A comprehensive disaster management strategy has to involve both state and community in a partnership that makes local people genuine actors in reducing their own vulnerability to future storms and floods.

Promoting preventive strengthening

Since 1999, DW has helped communities in central Vietnam to identify local risks and take preventive action to safeguard their buildings by incorporating flood and typhoon resistant details into new and existing buildings. This approach recognizes that the

The case of Madame Phan Thi Yêm

Madame Phan Thi Yêm is a mother of five. Widowed early and with meagre savings from weaving straw hats, she was able to pay for her children's schooling. But once this and basic needs were met, she could barely afford to live in a frail bamboo shelter. Using savings scraped together and with help from neighbours, in 1974 she managed to build a cement-block house with a tin roof, but no reinforcement – only to find herself homeless in 1985 when the typhoon ripped off all the roofing and she was forced to purchase fibre-cement sheets to replace it. "That's why when I hear a typhoon warning, I'm terrified."

She heard about preventive strengthening and was understandably interested. When the village met to select beneficiaries, Madame Yêm took part and was selected for strengthening with project assistance, to which she made a small financial contribution. The project has agreed to loan her a further VND1.5 million (USD96) at an interest rate of 0.3 per cent per month. With her modest income, she can make the monthly payments of VND57,000 (USD4). Greatly moved, Madame Yêm tells us that her house is now comfortable and strong. She is grateful to the project and hopes that others like her will be able to benefit.

damage caused by floods and storms to housing and public infrastructure is usually unnecessarily high. It can be avoided at a far lower economic and social cost than that of post-disaster reconstruction. Reconstruction of a typical central Vietnam 40m² house costs USD950. But spending just 15-30 per cent of this sum spent on preventive strengthening would make the same house resistant to the effects of most floods and storms. The same applies to small communal facilities.

DW[6] has worked with poor and vulnerable communities along the storm-exposed coast of central Vietnam, encouraging families to strengthen their homes, training builders and community leaders in safe construction techniques, developing management capacity at commune leadership level, and involving children in safety and disaster prevention issues.

On a technical level, families are encouraged to apply the 'ten key points' of flood and storm resistant construction, which apply to almost any house or small public building, and to all but the frailest of homes. Each point addresses a specific risk and indicates the action required: separate the veranda roof from the main roof; use doors and shutters to seal the building; fix together all parts of the structure; firmly secure the roof covering; etc. Builders and community leaders are trained to apply the safety points to different situations as demonstrated on existing houses and small public buildings.

Participating in preventive strengthening

If individual families are to strengthen their homes, technical solutions have to be compatible with local house styles, in order to develop acceptance. Each house is surveyed, followed by a discussion of its weaknesses, a suggested work programme and costs. A contract is then drawn up with the family and the Commune Damage Prevention Committee (CDPC), detailing the work and defining the contribution of each with DW support. No two buildings have the same strengthening needs. The project typically contributes about USD150 per family. The family covers the remaining costs, sometimes by borrowing, and if necessary using hired skilled labour. The CDPC can help families with difficulties, for example those headed by widows. All but the very poorest families contribute both in kind and financially to the cost of strengthening, and many go on to make additional improvements since they now have confidence in their home.

Early in the programme, beneficiary enthusiasm was such that families resorted to borrowing from usurious moneylenders in the absence of a credit system specifically addressing house strengthening. This caused hardship, and DW concluded that the project needed to demonstrate that credit for house strengthening can work. Credit programmes relate more commonly to income generation activities, but in DW's experience, strengthening the house is considered just as important an investment. Families have been ready to borrow sums of USD100-150 and to make regular repayments (over 18 months). Terms are tailored to means: 0.3 per cent monthly interest with flexible payment conditions, depending on the rhythm of family income. The credit system has been managed by the CDPC in collaboration with the Women's or Farmers' Union, and repayment rates are consistently good. DW wants other organizations, including banks, to note that poor people do repay loans for house strengthening, thus propagating similar credit opportunities.

Financial commitment by families is important to the success of DW's strategy: it shows the degree of their belief in the value of strengthening their homes. Women head 40 per cent of the beneficiary families. Women often make the decision on whether to borrow, and are also key actors in changing the attitude of families to make prevention a priority in housing improvement and construction.

Families also need professional skills to help in preventive strengthening. DW runs concise two-day training sessions for all construction workers in a commune. Community representatives also attend so they can explain and discuss strengthening houses and public facilities. For many, these workshops are the first time

Photo: Development Workshop

A model house travels the communes

that they can discuss local building issues with professionals. Evaluations have shown that trained builders are confident about applying the safety techniques, and ready to promote the principles of storm prevention in housing construction inside or outside the target communes.

Getting the message across

Raising awareness among diverse groups of beneficiaries is fundamental to the DW approach. The basic message — prevent storm damage — is communicated in numerous ways to different target groups (children, families, builders, village leaders, local organizations etc.). The project hammers home that prevention is important, easy and affordable; that it is cheaper than rebuilding after a disaster; and that anyone can get help and advice from the CDPC. The ideas and media used are varied and draw on culturally familiar events for adults and children, such as competitive boat races, banners and public address systems.

Much of this activity is designed to be memorable months or years later. Concerts with local musicians, singers and poets, many of whom perform their own material written for the project, convey the prevention message. A series of 'home story' sketches about a family has used different scenarios to encourage people to strengthen their homes before the storm season. Performed by commune actors and actresses, the sketches usually have a ribald subtext, as laughter helps to make the message memorable.

DW has made a particular effort to work with primary and secondary schools and kindergartens, discussing children's concerns about disasters and exploring with them what can be done. Competitions for drawings, stories and poetry are popular among children.

Developing a framework for prevention

Aside from this focus on family involvement, the social and institutional environment that supports preventive strengthening cannot be ignored. Partnerships between family groups and CDPCs have been established with DW support in each partner commune. Activities cannot be sustained without the engagement of both families and commune representatives.

Family groups are the smallest 'unit' in the programme and are central to the implementation of a family-based vulnerability reduction process. DW works at hamlet level where there is enough social and geographical proximity to allow meetings to take place easily. Families participate in making beneficiary selection a democratic process with an open vote for the family they each think is most in need. Groups of families then become a focal point for sharing information and experience.

The CDPC, set up by DW with the People's Committee in each commune, manages the project activities with support and guidance from DW. It operates the annual budget that has been agreed on by the commune and DW to cover the costs of activities retained for action, including building safe public buildings such as schools and markets, and to which the commune also contributes financially. The CDPC is also helped to organize suitable activities in the commune.

Developing family-level damage prevention action planning was a priority in 2005: the CDPC has worked alongside families and village leaders to identify risk issues ranging from typhoons to drought and disease. It assesses these against different forms of human and material vulnerability and identifies what action can be taken, with or without DW support. Each commune and hamlet has its own concerns and priorities, and the planning process has contributed to widening the expression of these.

Ensuring that damage prevention committees become part of the province disaster preparedness structures is key to longer term sustainability, and to achieve this the informal network of partner communes is being fused into a commune prevention network that will have stronger links with the districts and provinces in managing prevention activities.

DW's team has developed a programme that is changing the attitudes and practices of different stakeholders in the community, making damage prevention in housing a higher priority.

The diversity of activities has encouraged active involvement from local authorities and the population; beneficiary families are reassured by their strengthened homes; community leaders fully understand the project's aims and are engaged in the process, and they recognize that by motivating people and mobilising relatively small sums of money a great deal can be achieved to reduce vulnerability. They recognize too that with a safer home, families can turn their attention to meeting other needs with greater assurance — they have less to lose.

Photo: Development Workshop

Children on a prevention march

Photo: Development Workshop

Children take part in a prevention show

Earthquake-safer construction: developing a set of standard designs for building

Binod Shrestha, Geotechnical Engineer, National Society for Earthquake Technology, Nepal

Geography plays a key role in construction practices in Nepal. The high Himalayas, the middle hills and the Tarai region all possess different construction practices, mainly due to physical and meteorological properties governed by geography. Building practices also depend on socio-economic and political conditions: urban and rural areas of human settlement differ much in building preferences and practices. A further influence on construction culture is the availability of construction materials.

New buildings in Nepal are built by convention, rather than being specifically designed. The overall process is informal to the extent that technically ignorant owners and craftspeople often make decisions on structural elements. Even in urban areas where the building permit process is mandatory, actual incorporation of seismic safety into the project is not uniform. This has resulted in highly vulnerable buildings in Nepal, even when these are constructed using modern materials and technologies. These buildings represent high seismic hazard and low preparedness, and have resulted in a very high level of risk to human life and property. Understanding the cultural and socio-economic aspects of Nepal's non-engineered and informal building construction, the Nepal National Building Code Development Process in 1992-1994 took a pragmatic policy decision — in contrast to the conventional approach of building codes, it classified the buildings in four groups, with the aim of facilitating the incorporation of seismic safety in all classes of buildings:

- State-of-the-art
- Professional engineered
- Pre-engineered
- Non-engineered.

The aim adapted was to move gradually though these classifications, from non-engineered to pre-engineered and then engineered status. Accordingly, guidelines were developed for pre-engineered construction as well as engineered construction.

If communities are to be made safer against earthquakes, all buildings should be made earthquake resistant. To achieve this goal, all buildings need to be designed for earthquake resistance. However, this is not feasible due to the cost of design, and the lack of trained manpower for earthquake-resistant design and construction. This is a dilemma in itself, but considering the similarities between residential buildings, solutions can be developed by creating a set of standard designs, which would encompass typical architectural drawings, structural designs, a bill of quantities, specifications etc. This would assist the potential house owner to choose a suitable standard building plan from the set of designs. Such a scheme would help to move from the practice of creating non-engineered buildings to pre-engineered practice.

The current research focuses on residential buildings[1] and entails two principal objectives:

- Develop standard architectural designs and drawings of a set of typical residential buildings, of different configurations and sizes, to cater for the housing needs of people belonging to different economic strata (low to medium)
- Develop structural designs and drawings of these buildings with different structural systems that comply with the requirements of the National Building Code, including preparation of an appropriate bill of quantities and specifications.

Although residential apartment-style buildings have been constructed in Nepal, the process is still in its infancy. Generally, such buildings are designed and supervised by technicians, and are hence expected to be engineered.

A review of previous reports and articles helped to visualize the building construction scenario. Current trends in construction were discussed with stakeholders in the building construction sector. All available information was thoroughly studied, and the researcher drafted a survey format based on this, which seeks to record:

- Building typology
- Number of storeys
- Plinth area
- Building design process
- Size of column
- Maximum length of beam
- Overall building dimensions
- Plan of building.

Analysis of the survey data also considered an identification of deficiencies and positive practices in the buildings.

There is a wide variety of building typologies in Nepal. The majority of buildings in the city area are of reinforced concrete construction. Other typologies are brick in cement, brick in mud, stone in cement, stone in mud, adobe etc. Reinforced concrete, brick in cement, stone in cement and stone in mud cover most of the non-engineered building constructions on the periphery of cities and market centres, and there is a growing trend to construct as compared to the load-bearing structures. Load-bearing structures are also built significantly in urbanizing areas and low strength masonry structures are widespread in rural areas. Based on these facts, a number of standard designs was fixed for each category: reinforced cement concrete (5), brick in cement (2), stone in cement (2) and stone in mud (1).

Guidelines have been developed to incorporate seismic safety into all classes of building

The average idealized Nepalese urban building has two storeys, with a prayer room and terrace on the third floor. Generally, the plinth area is not more than 100 square metres per floor. Therefore, the study focused on those buildings that have no more than three stories and less than 100 square metres.

The adequacy of the earthquake resistant designs for the reinforced cement concrete system was checked using the software. The load-bearing structures such as brick in cement, brick in stone and even those using mud mortar, were designed and checked against the guidelines and directions of the International Association of Earthquake Engineering and the Nepal National Building Code.

The main target of this study was to build an earthquake-resistant element into current construction practices. The main focus of the project is structural rather than architectural. The problem, either in reinforced concrete systems or in load-bearing systems, is in the detailing. Detailing at the beam-column joints, lapping length and location of the bars, size of columns and size and spacing of the stirrups, are the main problematic parts in concrete frame buildings. In load-bearing structures, vertical bars at corners, horizontal bands and stitches in different levels, and the connection of wall to wall are the main issues to be addressed.

The outcomes and lesson learned from this research was discussed on an ongoing basis among the structural engineers, construction engineers and engineers of local and central government, and within the National Society for Earthquake Technology (NSET). This study and its results will also be discussed as case studies among the practising engineers and architects attending regular training programmes of NSET and its partner organizations. So far, the discussions and interactions have enabled the conclusion that the study as well as the set of designs will be beneficial to all who are directly involved in the construction industry, to house owners and even to policy-level personnel. Publication of such documents is essential, but obviously requires funds.

During the survey work, some house owners did not want to cooperate either because they misidentified the survey as a check by the municipality to see whether the house was built according to the plan in the building permit, or as a check for earthquake resistance. In the latter case, the house owner's fear was that the tenants would desert it once they know that the building would not withstand an earthquake. Security concerns were another reason for non-cooperation. Data collection is not so easy outside the valley as it is from within due to travel difficulties, technical difficulties like photocopying, and the amount of time it takes. The survey and analysis revealed a very wide diversity among the buildings on structural and other non-structural components such as sanitary accessories, flooring etc. This required a greater extent of idealization regarding the 'typical' house than what was considered in the survey design. So, the preparation of a bill of quantities and specifications is another difficult issue. It is necessary to develop about 100 standard designs for buildings in order to address all the building typologies of Nepal.

Vulnerability and risk reduction: existing non-engineered buildings in urban areas of Nepal

Hima Shrestha, Structural Engineer, National Society for Earthquake Technology, Nepal

Most of the lives lost in past earthquakes have been due to the collapse of buildings. In developing countries, these are generally non-engineered buildings constructed informally in the traditional manner with little or no intervention by engineers. Across the world, in zones of moderate to severe seismic risk, more than 90 per cent of the population still lives and works in such buildings.[1] In view of this, the safety of such structures from the fury of earthquakes is a subject of the highest priority.

In developing countries, the risk to lives is further increasing also due to rising populations, poverty, lack of awareness and a lack of the necessary skills and technology for safe construction. The scenario is the same for buildings in all parts of Nepal.

Nepal lies in a 'high' seismic zone along which the Indian plate is subducting under the Eurasian plate. Many large earthquakes have occurred consistently in the past, with Kathmandu having suffered devastation due to large earthquakes several times since 1833.

Rapid urbanization has increased the height of buildings, but not their safety

Due to the concentration of economic, political, administrative and cultural activities in Kathmandu Valley, the demand for buildings has increased tremendously, leading to unplanned development which has in turn resulted in an ever-increasing vulnerability to earthquakes. According to a study by the National Society for Earthquake Technology in Nepal under the Kathmandu Valley Earthquake Risk Management Project (KVERMP) in 1998, an earthquake measuring 9 on the Medvedev-Sponheuer-Karnik (MSK) seismic intensity scale in Kathmandu Valley today would cause over 40,000 deaths, over 95,000 injuries, leave more than 700,000 homeless, damaging 60 per cent of the existing building stock beyond repair. The main risk factors are low awareness, lack of proper knowledge and technology dissemination mechanisms, and a high population density accumulated in haphazardly constructed buildings without any consideration of earthquake risk. Despite the knowledge of historical seismicity, and continued geological researches in the Nepal Himalayas, implementation of earthquake risk management efforts is poor.

As a result of rapid urbanization and continuously rising land prices, building height has increased tremendously in recent times. Reinforced concrete framed building with masonry infill has become the most the common construction system, accounting for about 25 per cent of the buildings in urban areas of Nepal.[2] However, most of these buildings are not designed and constructed to meet the seismic requirements specified by the National Building Code. Many of them do not even meet the requirements for vertical load design. Disproportionate height and large occupancy means that most of these buildings pose significant risk in urban areas. The situation is worse in inner city areas, which have narrow streets with tall buildings on both sides.

Rescue and relief operations may encounter problems during large earthquakes. The tendency to neglect seismic design recommendations in building reconstruction, repair and refurbishment has dramatically increased the percentage of highly vulnerable structures within the existing stock. The National Building Code addresses the earthquake resistance of new constructions only — it does not advise on the seismic strengthening of existing buildings. The most recent earthquake events (Bhuj, 2001; Turkey, 1999; Iran, 2003 and Pakistan, 2005) showed that this class of building suffered catastrophic damage, causing larger-scale losses of life and property. Therefore, the seismic retrofit of these buildings is a pressing need, especially given the fact that a large earthquake is considered overdue in Nepal.

Retrofitting requires a thorough understanding of a structure's potential weaknesses

Strength assessments and computer analyses of this class of building have indicated an increased seismic risk for buildings of two or more storeys, which lack both strength and ductility. This vulnerability is partly due to irregularities in planning and elevation, non-uniform distribution of load-bearing elements, disproportionate door and window openings and, above all, poor construction practice and lack of attention to reinforcement details. Vulnerability can be significantly reduced via the seismic strengthening of these buildings.

Assessment and retrofit techniques for reinforced concrete buildings have been extensively studied and implemented in developed countries, with a clear focus on engineered constructions. Conventional techniques use braces, jacketing or infills, and more recent approaches include base-isolation and supplemental damping devices. These techniques, prevalent in developed countries, have rarely been implemented in developing countries like Nepal. Rather, the construction of the 'frame' type of buildings, as discussed above, is rapidly growing in an unplanned manner. Instead of reducing vulnerability, these structures are creating more and more risk every day. The National Building Code was recently made mandatory in three municipalities of Nepal, but is yet to be enforced practically.

New, non-engineered constructions can be made safer by cost-effective methods that can be adopted even in developing countries. Seismic vulnerability reduction requires a differential approach between residential buildings in which the safety of lives is of primary concern, and buildings that house critical or community facilities, such as hospitals and schools. These rules obviously do not aim to prevent all damage from moderate or large earthquakes, but they do help to prevent life-threatening collapses and aim to limit damage to reparable proportions. We need to be concerned about the lack of awareness regarding the availability of simple solutions and their effectiveness in achieving seismic safety as a preventive measure at minimum cost for all communities.

Improving the seismic performance of existing buildings is a more complex task. There has been very little study concerning vulnerability evaluation and practical methods for reducing vulnerability in existing non-engineered buildings. Suitable retrofitting techniques must be developed, and alternative intervention methods found. A simple, easy-to-use, efficient retrofitting scheme can be developed that can readily be adopted by local people in order to develop and enhance the safety of communities.

This requires a thorough understanding of the potential 'weak links' in the structure, based on which the designer can devise repair and strengthening measures for improving the building's response during future earthquakes. It is advisable to adopt wall jacketing for buildings of two to four storeys as a strengthening measure to improve their response in large earthquakes. Similarly, for buildings of four or more storeys, wall jacketing may not suffice and alternative measures such as the addition of reinforced concrete structural walls at appropriate locations should be adopted. These methods can significantly increase the resistance of a structure to lateral forces, although establishing a sound bond between the old and new concrete is of great importance. This can be achieved by chipping away the concrete cover of the original member and roughening its surface, by preparing the surfaces with glues (for instance, with epoxy prior to concreting), by additional welding of bend-reinforcement bars, or by reinforced concrete or steel dowels. The approximate cost of such interventions is estimated at between NP1,500 and NP4,000 (USD20 to USD60) per square metre, against NP11,000 (USD160) per square metre for new constructions. However, the actual cost for retrofitting methods depends on the number of storeys the building has, and the method of strengthening adopted, which is determined through detailed analysis and design.

Out of the various available methods, these are considered to be the most practically feasible and economically viable, and are the most widely used methods worldwide, although more expensive alternatives are also available. These options address the needs of a vast majority of Nepalese people. These simple and economic techniques can be applied on a wide scale in Nepal and other regions. What is most urgently required in the present context is to educate the general public about earthquake risk and advocate safer building practices.

Are we ready for the next big event? NASA's strategy for Earth observations and solutions for society

Stephen D. Ambrose, Program Manager for Disaster Management, Applied Sciences Program, NASA Headquarters, Washington, DC

A CATEGORY FIVE hurricane makes landfall with its eye just southwest of Galveston; a category three hurricane makes landfall in New York City; a category five hurricane strikes New Orleans. These scenes may seem far-fetched, but they are closer to reality than we think. How ready are we for the next big event?

Eight million people live in New York City alone; nearly 20 million people live in the greater metropolitan region. Many of these people live on barrier islands, coastal land, reclaimed wetlands and the landfill that makes up much of Lower Manhattan, enough people to make this a catastrophe of proportions greater than Katrina.

NASA's strategy to help the nation, and the world, prepare for such a catastrophe is nestled in its strategy for applied sciences to benefit society. Backed by years of research in climate change, solid earth and atmospheric sciences, NASA has the tools available to study the Earth's system, understand the changes, and predict future changes. NASA has taken a systems engineering approach to using its research and technology to enhance decisions support. These efforts coincide with the US Government's endeavour to develop a ten-year strategy for disaster reduction.

Members of the Office of Science Technology and Policy (OSTP) Subcommittee on Disaster Reduction (SDR) collaborated with scientists and engineers worldwide to identify a suite of 'grand challenges' for disaster reduction. This article presents six such challenges and provides a framework for prioritizing the related federal investments in science and technology. Addressing these grand challenges will improve America's capacity to prevent and recover from disasters, thus fulfilling its commitment to reducing the impacts of hazards and enhancing the safety and economic wellbeing of every individual and community. NASA plays an important role in implementing these grand challenges.

NASA has a history of earth observing satellites that have benefited the hurricane response and recovery community. The Tropical Rainfall Measuring Mission (TRMM), Terra, Aqua, and QuikScat have been around for a number of years, providing valued input to models that predict the strength and path of hurricanes and tropical storms. The US National Oceanic and Atmospheric Administration (NOAA) has stated that the Atmospheric Infrared Sounder (AIRS) instrument on Aqua alone has improved hurricane prediction significantly. The improvement in forecast skill at five days is equivalent to gaining a four- or five-hour extension of forecast capability. While this may seem small, it is quite significant when compared to the rate of general forecast improvement over the past decade. A four- to five-hour increase in forecast range normally takes between 1.5 and 2 years to achieve.

The 2005 hurricane season will long be remembered both for the record-breaking number of early storms and for the emergence of a powerful category 5 hurricane in the central Gulf of Mexico – Hurricane Katrina. This hurricane began as a tropical depression in the central Bahamas on the afternoon of 23 August 2005, before making landfall just south of Fort Lauderdale along the southeast coast of Florida on the evening of 25 August as a category 1 hurricane.

After coming ashore, Katrina cut southwestward across southern Florida. The relatively short amount of time the centre spent over land, combined with the wet marshy composition of the Florida everglades, kept Katrina from weakening all that much. As a result, Katrina quickly regained hurricane status after emerging into the Gulf of Mexico, becoming a category 1 storm on the

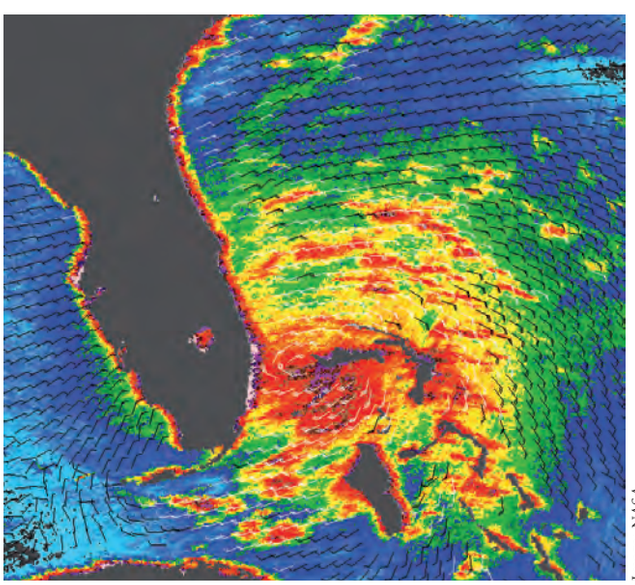
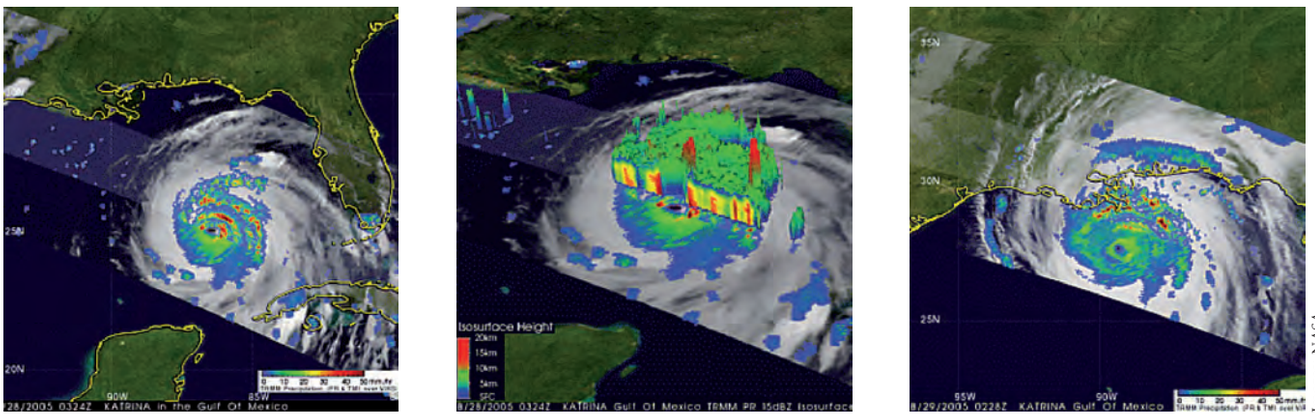


Image: NASA

Tropical Storm Katrina as observed by NASA's QuikScat satellite on 25 August 2005, at 0837 hours UTC (0437 hours in Florida). Wind speed is depicted in colour and wind direction with small barbs. White barbs point to areas of heavy rain. The highest wind speeds, shown in purple, surround the centre of the storm



Images: NASA

The first two images, taken by TRMM at 0324 hours UTC on 28 August 2005, show aerial and 3D-cutaway views of Katrina, about to become a category 4 hurricane in the central Gulf of Mexico. The third image, taken at 0229 hours UTC on 29 August, shows Katrina bearing down on the north-central Gulf Coast

morning of the 26 August. Conditions in the Gulf, however, were favourable for development and Katrina began to intensify.

By the evening of 26 August, Katrina was a category two storm as it continued to move slowly west-southwest in the southeastern Gulf of Mexico. On the morning of 27 August, Katrina became a category 3 storm with maximum sustained winds reported at 100 knots (115 mph) by the National Hurricane Center (NHC) Tropical Prediction Center (TPC). The central pressure continued to drop throughout the day, however, and the storm began to shift to a more west-northwesterly direction.

In November 1997, the TRMM satellite was launched to measure rainfall over the global tropics. However, TRMM has also shown itself to be a valuable instrument for observing tropical cyclones, revealing Katrina from varying perspectives as shown in the three images above.

The first image shows the horizontal distribution of rain intensity within Katrina as obtained from TRMM's sensors. Rain rates in the central portion of the swath are from the TRMM precipitation radar (PR), the only radar capable of measuring precipitation from space. The PR is able to provide fine resolution rainfall data and details on the storm's vertical structure. Rain rates in the outer swath are from the TRMM Microwave Imager (TMI). The rain rates are overlaid on infrared (IR) data from the TRMM Visible Infrared Scanner (VIRS). At the time of the image, Katrina was still a category 3 storm with maximum sustained winds reported at 100 knots (115 mph). TRMM reveals that Katrina has a closed eye surrounded by concentric rings of heavy rain (red areas) that are associated with outer rain bands. The intense rain near the core of the storm indicates where heat, known as latent heat, is being released into the storm. This latent heat release is what drives the storm's circulation.

In the second of the three images, the vertical height of the isosurface (15 dBZ) is determined by the height of precipitation-sized particles as measured by the TRMM PR. Two isolated tall towers (in red) are visible: one in an outer rain band and the other in the northeastern part of the eyewall. This area of deep convection in the eyewall is associated with the area of intense rainfall there. The height of the eyewall tower is 16km. Towers this tall near the core are often an indication of intensification — this was true in the case of Katrina, which became a category 4 storm soon after the image was taken.

During the early morning hours of 28 August (local time), Katrina's central pressure continued to drop, and the storm intensified into a powerful category 5 hurricane. By 1100 hours that morning, Katrina's sustained winds reached an unbelievable 175 mph! At 1755 hours UTC (1355 hours local time), a NOAA hurricane hunter aircraft measured a central pressure of 902 mb, the fourth lowest ever recorded in the Atlantic Basin. Katrina now turned more to the northwest, in response to a weakness in the subtropical ridge to the north and an approaching trough from the west.

In the third image, the centre of Katrina does not fall within the PR swath. However, the large eye of the storm is clearly visible via the TMI, by the large ring of moderate-intensity rain that is visible by the green annulus. The first outer rain bands with embedded areas of heavy rain (red areas) are already impacting the coast in southeastern Louisiana. At the time of this image, Katrina was at category 5 intensity, with maximum sustained winds measured at 140 knots (161 mph) by the NHC.

Katrina initially made landfall at 0010 hours UCT (0610 hours CDT) south of Buras, Louisiana, along the Mississippi delta as a strong category four storm. The eye eventually crossed the coastline again along the Mississippi-Louisiana border with the most dangerous part of the storm, the eastern eyewall, hitting along the same part of the Mississippi coastline that was wiped out by Hurricane Camille back in 1969.

Tropical Storm Katrina was observed by NASA's QuikScat satellite on 25 August 2005, at 0837 hours UTC (0437 hours in Florida). At this time, the storm had sustained winds of 80 kilometres per hour (50 mph; 43 knots). It did not yet appear to have reached hurricane strength.

However, the greater danger lay not with Katrina's winds, but with her rains. At this point the storm was moving slowly, at just 13 km/h (8 mph), and was expected to slow as it moved over land. The NHC warned that Katrina's heavy rains would linger longer over one area, dumping 15-25 cm (6-10 inches) of rain over Florida and the Bahamas and possibly up to 38 cm (15 inches) in some regions.

Measurements of Katrina's wind strength show sustained winds similar, but not identical, to those shown by the QuikScat observations. This is because the power of the storm makes accurate measurements difficult. The scatterometer sends pulses of microwave energy through the atmosphere to the ocean surface, and measures the energy that bounces back from the wind-roughened surface. The energy of the microwave pulses changes depending on wind speed and direction, giving scientists a way to monitor wind around the world.

Tropical cyclones (the generic term for hurricanes and typhoons) and, to a lesser extent, weaker storm systems like Katrina, are difficult to measure. To relate the radar energy return to actual wind speed, scientists compare measurements taken from buoys and other ground stations with data acquired by the satellite at the same time and place. Because the high wind speeds generated by cyclones are rare, scientists do not have the corresponding ground information to know how to translate satellite data for wind speeds above 50 knots (about 93 km/h or 58 mph). Also, the unusually heavy rain found in a cyclone distorts the microwave pulses in a number of ways, making a conversion to accurate wind speed difficult. Instead, the scatterometer provides a nice picture of the relative wind speeds within the storm and shows wind direction.

Although Katrina was a catastrophic event that we won't want to see any time soon, the forecast provided by NOAA was timely and accurate. That is why it is important to consider the social aspects of weather forecasting where a good forecast may not necessarily be enough to prevent catastrophe. It will be just as important to consider how people respond to events as well as how people prepare for events.

The future holds much for science and technology and their application to social needs. NASA's Applied Sciences programmes in Earth science are central to three important presidential initiatives, the Climate Change Science Programme (CCSP), Global Earth Observation (GEO), and the Oceans Action Plan.

In the next ten years, NASA will deploy the next generation of advanced observation and research capabilities:

- The National Polar Orbiting Operational Observing Environmental Satellite System Preparatory Project (NPP) will extend the data record of essential measurements begun by EOS and demonstrate new instruments
- The Cloudsat and CALIPSO missions will use advanced radar and laser technologies to observe three-dimensional structures of clouds and aerosols
- The Glory mission will help researchers characterize aerosol properties
- The Global Precipitation Measurement mission will extend global and more frequent coverage demonstrated by TRMM
- The Ocean Surface Topography Mission (OSTM), a joint project with France, will take the next step towards operational ocean altimetry
- The Orbiting Carbon Observatory will take the first measurements of the global distribution of carbon dioxide, a key factor linking global ocean circulation and climate change.

NASA's partnerships in global modelling and data assimilation over the next decade will shorten the distance between observations and answers regarding important questions, and continue the efforts in benchmarking the assimilation of NASA research results into policy and management decision support tools for environment, economy, safety, security, preparation and response for the next big event.

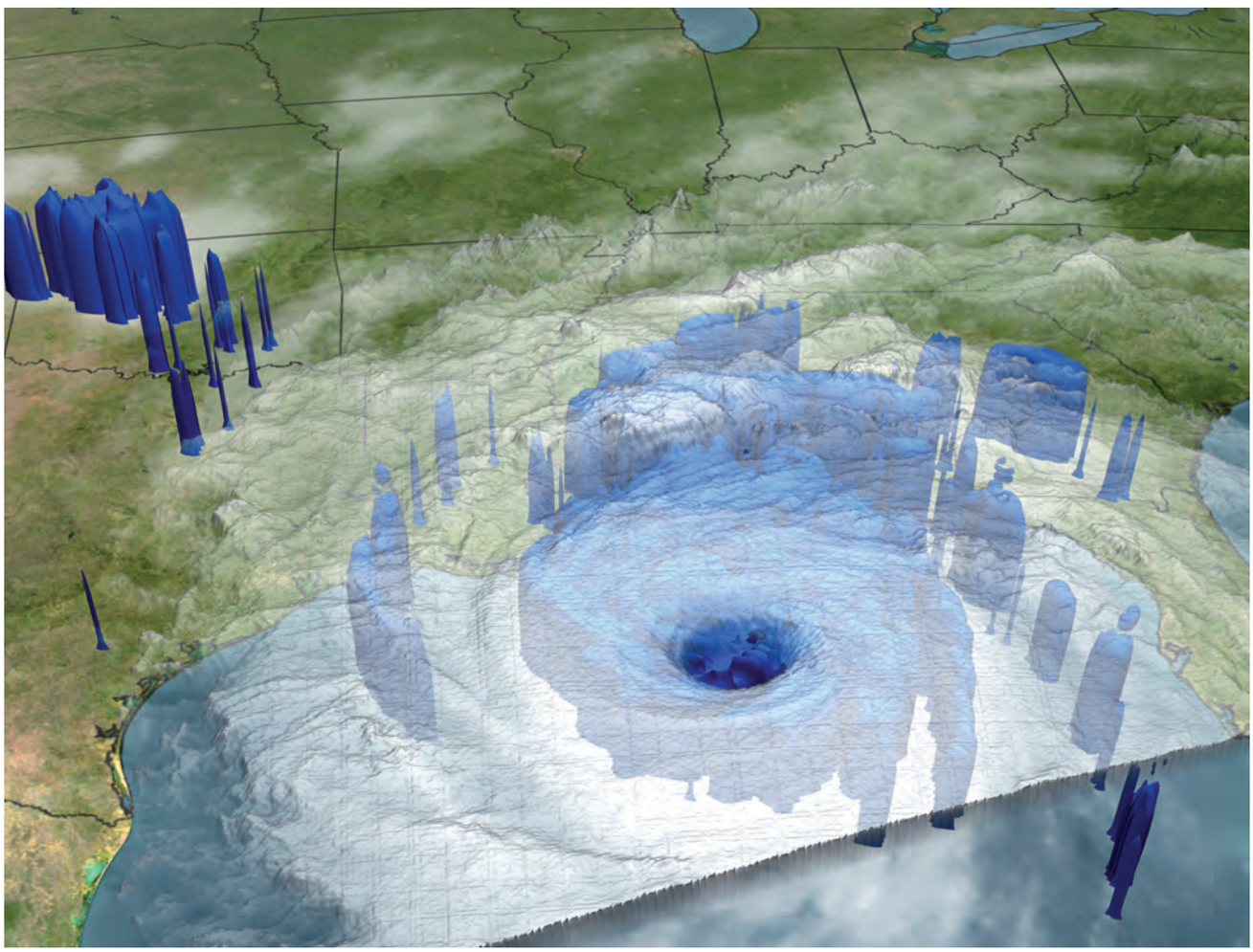


Image: NASA

TRMM image of Hurricane Katrina, 29 August 2005

Effective risk reduction through monitoring of the environment from space

Jérôme Béquignon, Programme Co-ordinator, European Space Agency

Shortly after the tsunami of 26 December 2004, the World Conference on Disaster Reduction held in Kobe, Japan, confirmed the Yokohama strategy and adopted a framework for action for 2005-2015. The Hyogo Framework for Action sets priorities, in particular to "identify, assess and monitor disaster risk" and to "use knowledge, innovation and education to build a culture of safety and resilience", to which space technologies in general and earth observation in particular should contribute. There follow some concrete examples of the implementation of such priorities, which illustrates the uses of these technologies.

Because of its sudden outset and immediate disastrous effects, and because of the extent of the affected coastlines, the Asian tsunami revealed to a wide audience how satellite data can contribute to emergency and rescue operations. Since then, space-derived information has been requested more than 36 times through the International Charter: Space and Major Disasters. Events addressed by such calls include Hurricane Katrina, the 2005 Kashmir earthquake and, most recently, the eruptive episode of the Merapi volcano and the 2006 Java earthquake, both in Indonesia. This sad list, and especially Hurricane Katrina, recalls that no nation, regardless of its state of development, can consider itself immune from or prepared enough for major disasters. In spring 2006, heavy rains in central Europe caused the rivers Elbe, Danube, Tisza and Dora to flood parts of Germany, Austria, the Czech Republic, Slovakia, Hungary and Romania. This led to four different activations of the charter, and the episode represents the largest event mapped by the charter since the Asian tsunami.

Image: SIRA through ESA 2005

A CHRIS/PROBA image of France's Var region showing fire scarring west of the town of Cogolin. Acquired 3 September 2003

The need for an accurate and up-to-date picture of the situation for the management of emergencies is widely recognized, but how does the wealth of data acquired day and night by myriads of satellites contribute to reducing risks and vulnerability? Part of the answer is provided by lessons learnt from December 2003, when the waters of the Rhone river reached red alert level for the first time, causing the failure of levees and very serious flooding in the Rhone valley, southern France.

Thanks to the mechanism of the charter, a comprehensive set of satellite imagery was acquired. In parallel, several aerial photography campaigns were launched by national and local authorities. A recent study[1] funded by the French Ministry of Ecology and Sustainable Development compared various types of satellite imagery with the aerial survey carried out by the National Geographic Institute. Flood maps prepared during the emergency had already proved to give valuable guidance to hydrologists for their field assessment work. The point was to assess whether satellite imagery could be used to characterize the flood event.

One of the most remarkable results of this study is its demonstration of the ability to detect hydrological objects equally on aerial photographs and very high-resolution satellite pictures. Beyond the simple detection of flooded areas, such objects include features such as hydrological sectors, or water retention boxes within the main waterbed, and through detailed analysis of water turbidity, water circulation currents within and between sectors. The effects of levee breaks could be observed as accurately on satellite images as on aerial photographs, despite the difference in resolution (1 metre vs. 0.3 metres). Therefore satellite images contribute to regulatory tasks such as the revision of flood atlases, and eventually to regulatory flood risk maps. It has to be noted that a similar approach was independently taken by the US administration after Hurricane Katrina.

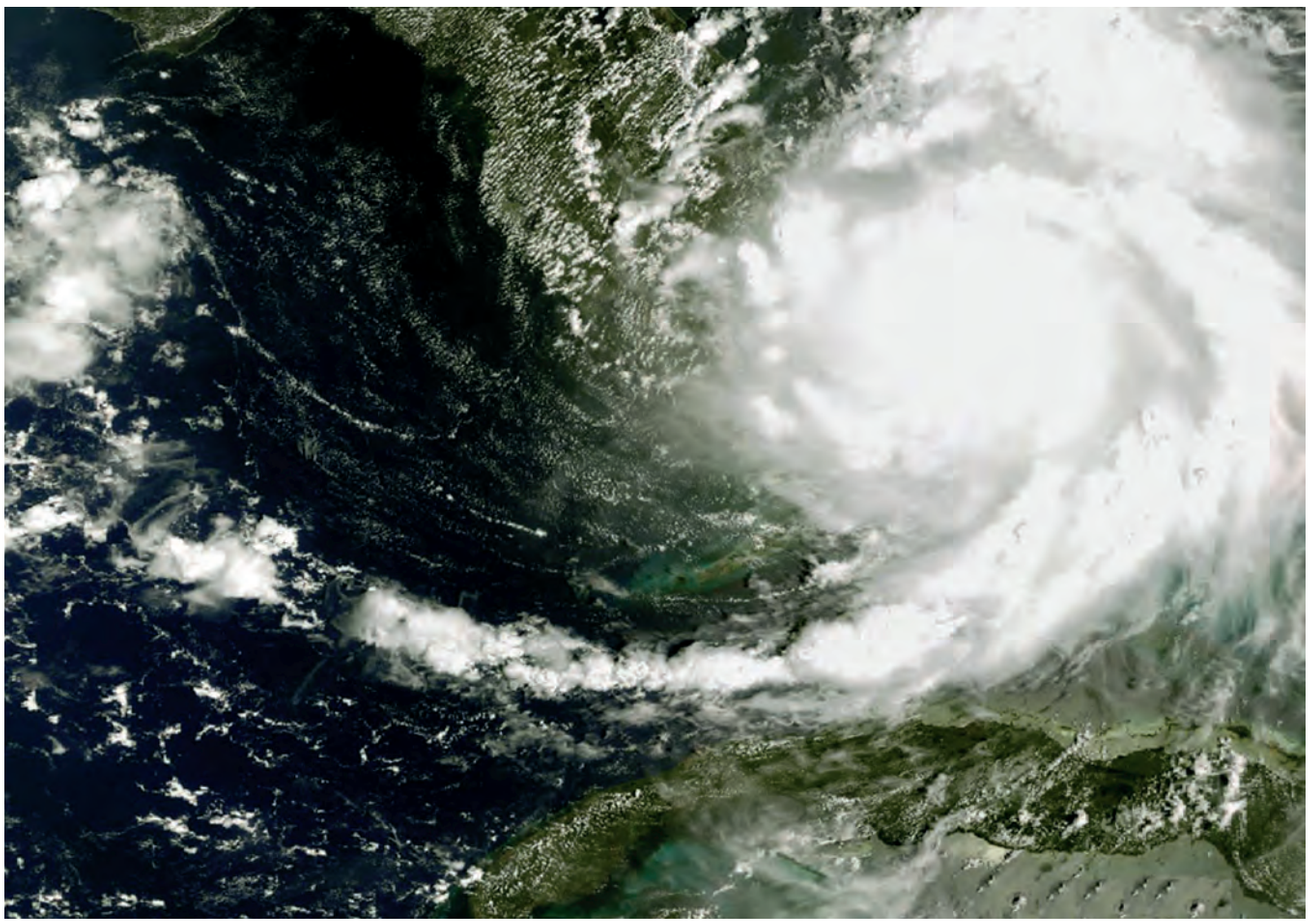


Image: ESA

Hurricane Katrina off southern Florida, seen by MERIS/ENVISAT on 25 August 2005

Another example comes from the fight against forest fires. Thanks to the Global Monitoring for Environment and Security (GMES) service elements funded by the European Space Agency, annual mapping of burnt areas derived from satellite pictures has become a standard practice in the Mediterranean basin, complementing and illustratinig fire databases maintained by fire fighters. Such a systematic annual mapping of burnt areas helps to maintain records of risk and its consequences beyond human memory.

In the long run, typical patterns such as 'fire corridors' are documented through objective data and not only the memories of witnesses. A side effect of such remote sensing data is the ability to detect scattered, newly built habitats, especially at the urban/forest boundary. While in theory, such information should be commonly available through geographic surveys and in digital format from the cadastre, in practice it is not, for a combination of reasons ranging from illegal buildings, holes in information sharing or simply gaps in updating information. This type of information on human and economic assets is indeed extremely important to minimizing vulnerability and, if needed, in efficient rescue planning. Similarly, the on-demand mapping of areas affected by fires of unusual size or impact provides an invaluable assessment tool, as evidenced by the request of the local government of New Caledonia after fires around Christmas in 2005 near its capital Nouméa.

Beside their technical specification and use in regulatory activities, such maps derived from satellite imagery carry the memory of risk to communities in a straightforward way.

For such services, demonstrated by projects like RISKEOS or RESPOND, to be brought in and accepted by those communities, continuity of observations must be guaranteed over long periods, much longer than a decade. In this respect, a decisive step was taken by the ministers of the European Space Agency's member states, when they gave the go-ahead for GMES.

The European Space Agency supervises the development and launch of the space segment of this ambitious programme, which includes a series of recurrent satellites known as Sentinels. Sentinel-1 will carry a C-band radar imager that will provide continuity in all-weather observation of floods or oil spills and repeated observation of seismogenetic areas, along the lines of ERS and ENVISAT satellites. Sentinel-2 will continue the well-known SPOT and LANDSAT multi-spectral imagers with their ability to map floods and other land events. Sentinel-3 deals with oceanography and global land cover observation, while Sentinel-4 and Sentinel-5 are dedicated to atmospheric chemistry, air quality and climate applications. Together with dual use, very high resolution satellites such as CosmoSkyMed, Pleiades and TerraSAR, built respectively by Italy, France and Germany, this programme will allow Europe to bring a substantial contribution to a Global Earth Observation System of Systems (GEOSS).

Actually, the impact of the charter on disaster response, after events like the tsunami or the Kashmir earthquake, have created expectations for easy, inexpensive access to satellite data about a disaster, even for those events which did not lead to a specific activation. After the Asian tsunami, special collections of satellite data were made widely available on an exceptional basis: one of the objectives of the GEOSS implementation plan is to render access to such data as easy as possible in a cheap and affordable way, so as to allow communities to take maximum benefit from them.

Review of UK space activities in support of disaster reduction: an update

Mark Churchyard and Ian Downey for the British National Space Centre

The UK continues to play an important international role in supporting disaster management and risk assessment activities. Policy-based drivers and the capabilities offered by advanced technology developments ensure that we must better monitor, understand and respect the environment in which we live. It is envisaged that such advancements in monitoring and understanding will enable us to better understand, predict and react to disaster phenomena and identify those activities that adversely affect our environment.

The British National Space Centre (BNSC), a partnership between UK Government departments and organizations with interests in civil space, supports many activities that help to develop systems and services directly and indirectly associated with disaster management and humanitarian aid.

International policy evolvement is based in part on enhanced technology developments and a better understanding and interpretation of the data received. Recent initiatives based on policy requirements such as Global Monitoring for Environment and Security (GMES) — a joint European Commission (EC) and European Space Agency (ESA) initiative; the Group on Earth Observation (GEO) — a politically driven international initiative; and the Galileo satellite navigation programme are all driving the development of new technology to meet new requirements. As the number of instruments and satellite missions increases we gain improved global coverage, frequency and timeliness of revisits, providing us with a continuous stream of data with which to monitor the Earth.

In January 2005 a high-level UK Natural Hazard Working Group was established, by the chief scientist in the UK at the request of the Prime Minister, to advise the Government on the mechanisms that could and should be established for the detection and early warning of global physical natural hazards. The UK working group endorsed the view expressed at the Kobe World Conference on Disaster Reduction (January 2005) that there is a clear need for a sustainable and effective global, multi-hazard early warning system, building on existing capabilities and frameworks.

BNSC assists UK organizations to collaborate internationally in many fields, and this has resulted in a major success in expanding the potential for current and future low-cost satellite missions that can provide disaster reduction services. In October 2005, a fifth spacecraft — 'Beijing-1,' the China DMC+4 enhanced micro satellite of the disaster monitoring constellation (DMC) — was launched. This satellite joins four others already in orbit and owned by Algeria, Nigeria, Turkey and the UK respectively. Together, the satellites provide the opportunity to cooperate and provide daily imaging of any part of the world when required. Currently, on-board instruments provide multi-spectral images of the ground with a resolution of 32 metres; while Beijing-1 and other, future satellites also offer 4-metres panchromatic imagery. This constellation not only provides the opportunity to supply ongoing monitoring information as problems develop, but can also provide information direct to land-based teams in a crisis situation. The DMC satellites have already been used to provide rapid response imaging data to humanitarian aid and relief organizations on more than 20 occasions since launch.

Disaster management demands frequent monitoring, as natural catastrophes can occur at any time and anywhere in the world. To help coordinate satellite mission response to such disasters, the International Charter 'Space and Major Disasters' (the Charter) was set up following the UNISPACE III conference held in Vienna, Austria in July 1999.

At the Committee on Earth Observation Satellites (CEOS) plenary meeting in London during November 2005, the UK Government (on behalf of the DMC Partnership) formally joined the world's major space agencies in adhering to the Charter, which aims to provide a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through authorized users. Each member agency has committed resources to support the provisions of the Charter and thus is helping to mitigate the effects of disasters on human life, property and the environment.

Coordination of the DMC for Charter activations and disaster response is undertaken by DMC International Imaging (DMCii), based in the UK, which also provides a specialized 24-hour emergency satellite planning service to task the Charter satellite fleet as emergency on-call officers. In joining the Charter, the DMC is already providing thorough broad daily image coverage during disasters such as Hurricane Katrina and the Indian Ocean tsunami. DMC has also supplied data in non-natural disasters for mapping applications, for example to the UN for Internally Displaced People (IDP) camp placement in Darfur, Sudan. The DMC is also used to monitor slow onset environmental disasters such as deforestation over large areas like the Amazon basin and Cameroon.

In addition, the UK designed and built the compact high resolution imaging spectrometer (CHRIS) demonstrator, which is the highest resolution hyperspectral instrument currently flying and has been operating on the ESA PROBA platform since October 2001. The CHRIS instrument is now one of ESA's third-party missions (data acquisition from external Earth observation missions) and also supports the Charter. Today, over 80 images have been supplied ranging from the tsunami to volcanic eruptions and earthquakes. The instrument was designed and built by the Sira Space Group (now part of SSTL), a British private

Image: ESA & SSTL

North Sentinel Island, taken 3 December 2005, showing the coral reef raised out of the sea after the tsunami of December 2004 (picture taken by the CHRIS instrument)

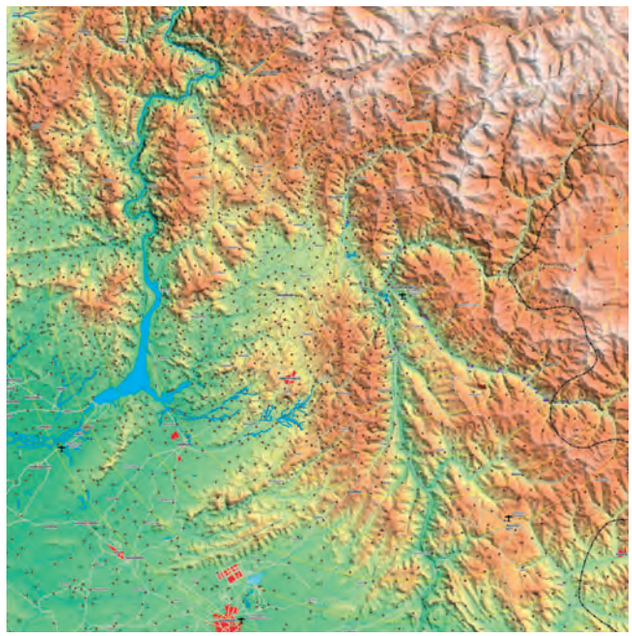


Image: Infoterra Ltd.

Map showing the extent of the potentially affected areas by the earthquake of 8 October 2005. General overview maps were found very useful due to their timely availability

sector company. The instrument has significant in-flight programmability in both the spectral and spatial domains, and this has the advantage that it can mimic other sensors, such as the SPOT and the Indian remote sensing (IRS) imagers, to provide useful comparisons.

BNSC is a partner in the joint EC/ESA GMES initiative, which has a well-established programme and action plan to develop relevant operational capabilities by 2008. GMES is driven by the information needs of Europe in the fields of environment and security. Particular emphasis is given to matters of global change, environmental stress, and natural and human-induced disasters.

Operational services are envisaged incorporating the advanced technical and operational capabilities offered by terrestrial, airborne and space-borne observation systems. Through ESA, the UK is providing the lead in two of these important GMES services: Terrafirma and Respond.

The Terrafirma initiative aims to provide a pan-European ground motion hazard information service, to be distributed throughout Europe via the national geological surveys. The service uses the recently discovered power of satellite Radar Interferometry (InSAR) technology to detect millimetric ground level displacements in order to save lives, improve safety and reduce economic loss (equivalent to approximately EUR3.5 billion annual cost for ground movement effects in Europe). Initially, the service focuses on urban subsidence, but it will eventually include earthquake zones, landslides, coastlines and floodplains. Already the service providers include 14 national geological surveys, with more surveys keen to start working on the results.

From mapping the area coverage and magnitude of ground motions following cataclysmic earthquakes, to measuring discrete subsidence displacements over several years, satellite InSAR has a wide variety of uses in ground movement surveying applications. For several years now, the NPA Group, a UK-based satellite mapping company, has been routinely detecting and mapping to sub-centimetric levels in many types of large-area ground motions using InSAR techniques. As well as heading major research projects in this field for the ESA and the EC, NPA is contracted to undertake this work, not only in the UK but throughout the world, on behalf of local government agencies, risk management companies, commercial organizations such as mining companies, and geological survey institutions.

The Respond initiative aims to support the improved deployment of humanitarian relief through better understanding of geographic information, supporting actions for both slow (e.g. famine) and rapid (e.g. earthquake) onset crises. It is providing high quality geographic information in consultation with users, working within all phases of the crisis cycle — from prevention to emergency response and from rehabilitation to the development of long-term prevention plans. Additionally, the initiative provides training and in-field support services for users, and supports forecasting and alerting services by providing maps of crisis areas.

Respond was very active during the Asian tsunami disaster and, more recently, during the series of severe earthquakes (maximum magnitude 7.6) that struck the Kashmir region in northwestern Pakistan on 8 October 2005 (see map above). The Respond consortium provided relief support to European and international aid agencies by rapidly producing thematic, crisis and damage maps based on satellite images, which were widely distributed.

The Centre for the Observation and Modelling of Earthquakes and Tectonics (COMET) is one of the Natural Environmental Research Council's (NERC) centres of excellence and was established to allow scientists to use satellite observations to model the deformation of the Earth's crust over periods ranging from days to millions of years, and over areas ranging from tens to thousands of kilometres. These models are used to study the earthquake cycle, the effect of faulting and uplift on the Earth's surface, and the physics of continental deformation. These all play an important role when quantifying seismic hazard and interpreting how past environments control the distribution of natural resources.

COMET uses various techniques, in conjunction with the data from satellites, to model earthquakes and tectonics. These

include global positioning system (GPS); InSAR; digital-elevation models and landscape evolution.

The UK also supports work within the international Integrated Global Observing Strategy (IGOS) initiative. As part of the activities of the IGOS partnership, the British Geological Survey (BGS) co-chairs an IGOS GeoHazards theme with the French Geological Survey and the ESA. This strategy for geohazards observations is focused on pre-disaster mapping, monitoring and mitigation for earthquakes, landslides, subsidence and volcanoes. Its goal is to improve global society's preparedness, so that known hazards do not turn into disasters. The IGOS GeoHazards Theme Report was published by ESA in April 2004.

ESA and the French Geological Survey are implementing the theme through a jointly established executive bureau. The UK, with the other two co-chairs, sits on the theme's steering group, alongside the United States Geologic Survey, UNESCO, ESA, NASA and JAXA for the space agencies, and representatives of the global seismic, geodetic, landslide and volcano observatory communities.

Following an international geohazards workshop held in June 2005, five working groups have been established and an active network of scientists and other interested parties is being developed, called GeoHazNet. This network will form the basis for a disaster-related Community of Practice within the GEO initiative. GeoHazNet membership will be open to individuals, projects and institutes and is being promoted via a series of regional workshops. The second main task being undertaken by those associated with the theme is the establishment of a global inventory of hazard maps and related data, again as part of the GEO work plan. The executive bureau has created a free software tool that will allow organizations to provide metadata concerning their hazard maps at minimal effort; the hazard maps themselves stay with the original organization in this distributed system. Metadata is now being populated into the system and it will then be used to identify gaps in hazard map provision, as well as forming a valuable resource for use in disaster management.

The UK has also provided an input to the UN Committee on the Peaceful Uses of Outer Space (COPUOS) action team 7, and the follow-on ad hoc group of experts on space and disaster management, which has been identifying national and international needs for space information in disaster management and humanitarian relief with the goal of recommending how to coordinate these assets globally in promoting better response to events. The action team and the ad hoc group of experts have reported their recommendations to UN-COPUOS and members are working with the UN Office for Outer Space Affairs (UN-OOSA) to review and scope an implementation pathway.

BNSC fully supports many activities in disaster reduction, and will continue to focus its support in specific areas where UK expertise and technology advancements can best be exploited to achieve pragmatic outcomes for the wider community affected by such disasters.[1]

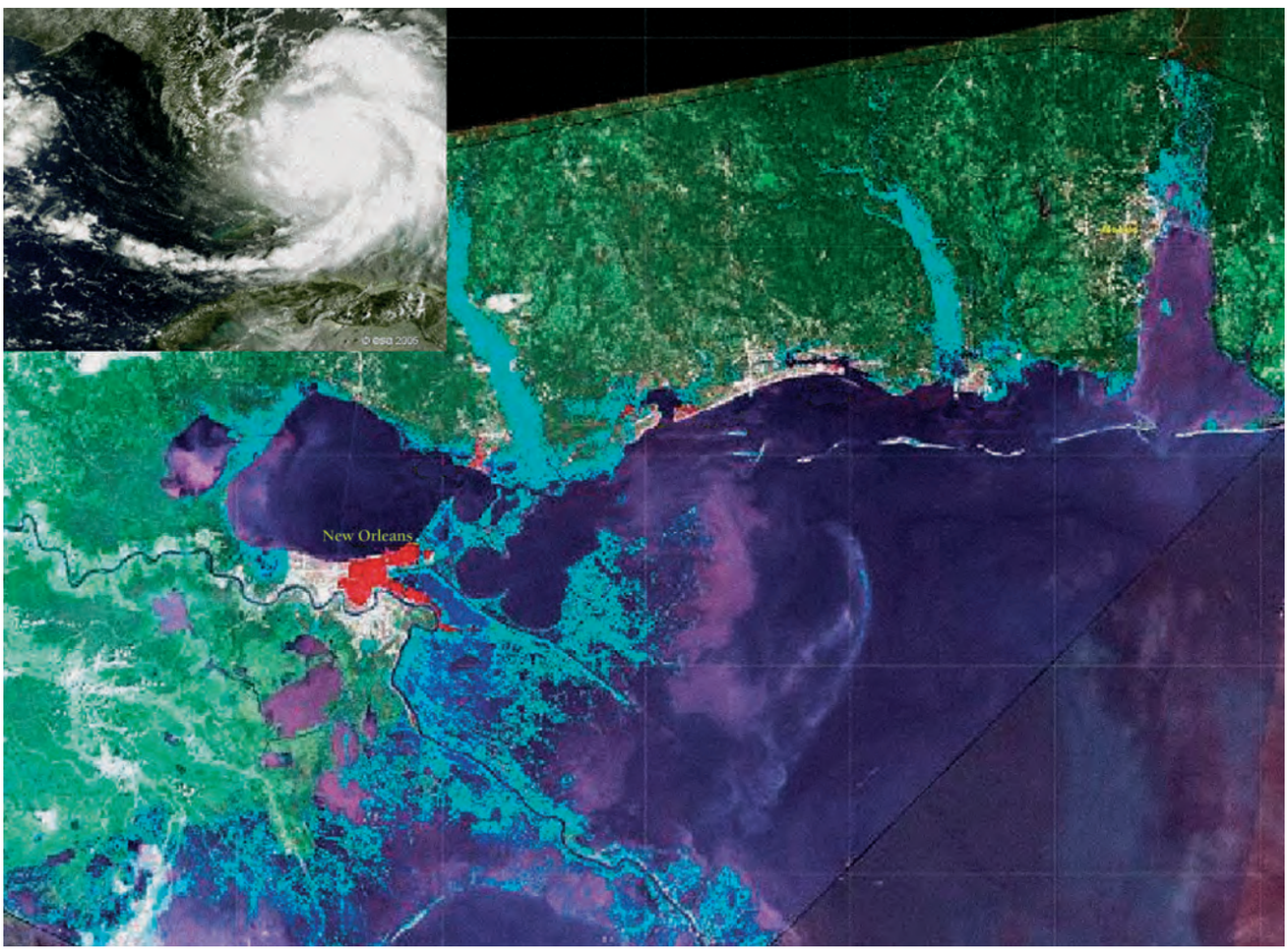


Image: DMCii; inset courtesy of ESA

Event map of New Orleans in the aftermath of Hurricane Katrina, taken from NigeriaSAT-1, part of the DMC (inset, Hurricane Katrina taken from the MERIS instrument aboard ENVISAT)

NASA's plan for sustainable development in response to WSSD goals and objectives

Shahid Habib, NASA Goddard Space Flight Center, Greenbelt, Maryland
Stephen Ambrose, NASA Headquarters, Washington, DC

When the United Nations General Assembly held the World Summit on Sustainable Development (WSSD) in Johannesberg, South Africa in September 2002, it was clear that progress in implementing sustainable development was lacking. Sustainable development, as described at the WSSD, indicated the need to implement rather than debate solutions. Instead of a political debate, the 2002 meeting turned out to be a summit of actions and results, where it was understood that there is no 'magic bullet' to solve the problems of developing countries, particularly Africa, and that practical and sustained steps are needed to address many of the world's most pressing problems for sustainability and societal benefit.

The WSSD should be used as a benchmark for governments to establish key performance indicators in committing themselves to implementing safe minimum living standards, which are necessary to ensure quality of life and environment, especially for the poor. The summit was described as a "successful effort" by United States Secretary of State Colin Powell, who said: "I think it shows that we have a shared vision of how to move forward. I think it shows that the world is committed to sustainable development." He added, however, that the real challenge lay "in the actions that need to take place in the months and years ahead".

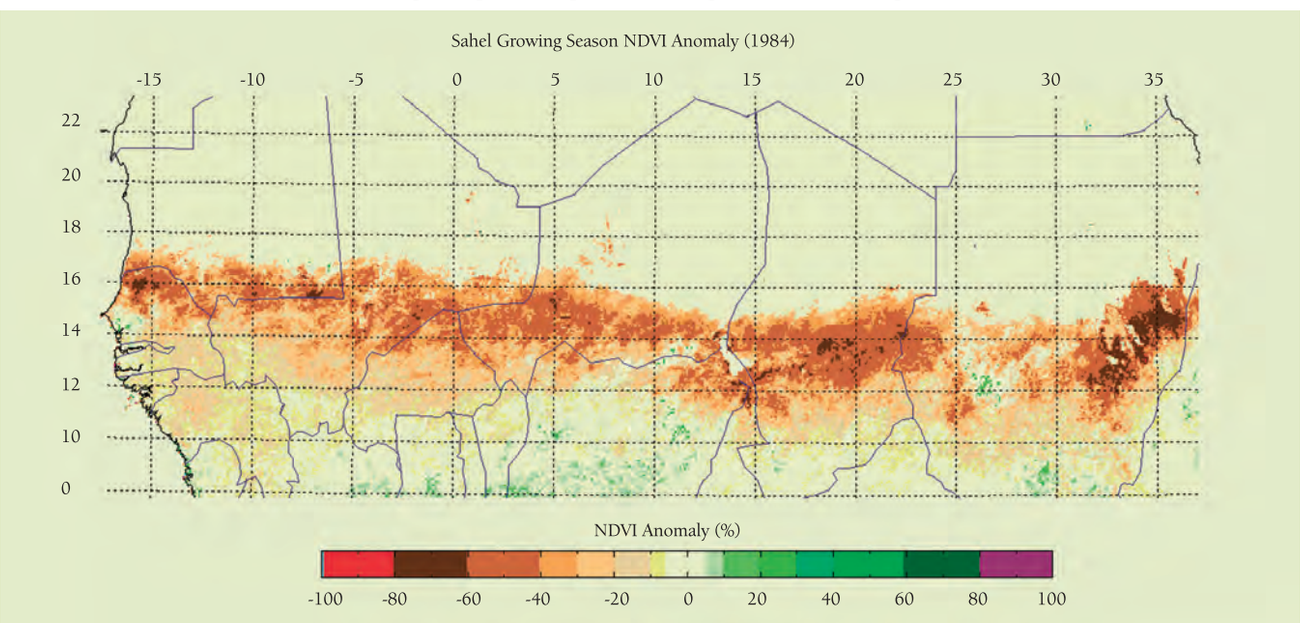
NASA is responding to this call for action by initiating a community-wide inventory of NASA research and applications that can be used by African countries and organizations to address their societal problems. There may be many such investments involving the continent of Africa, whether through validation of NASA science products or through their application in solving real-life societal problems. These are NASA investments and may be made either through the Research and Analysis (R&A) or Applied Sciences programmes as competed or earmarked grants, or independently funded from a NASA centre to a university partner.

This inventory will be used to gather information useful to the development of a comprehensive NASA programme for sustainable development where NASA investments are made efficiently for global benefit.

Background to NASA's involvement

The WSSD brought together tens of thousands of participants, including heads of state and government, national delegates

Growing season (July-October) normalized difference vegetation index (NDVI) anomaly for 1984 showing large-scale drought across the Sahel zone of Africa. Most of the region experienced persistent drought conditions throughout the 1980s



Source: Anyamba and Tucker, 2005

and leaders from non-governmental organizations (NGOs), businesses and other major groups, to focus the world's attention and direct action towards meeting difficult challenges. These include improving people's lives and conserving natural resources in a world that is growing in population, with ever-increasing demands for food, water, shelter, sanitation, energy, health services and economic security.

Partly, this effort is supported by the Committee on Earth Observation Satellites (CEOS), whose membership comprises all civil space agencies with major Earth observation capabilities, representing about 33 countries and major user organizations (WMO, UNEP, FAO, etc.). Its members include agencies from developed countries (Europe, USA, Japan, etc.) and developing countries or countries in transition (Russia, India, Brazil, South Africa, Thailand, etc.). The United States/NASA is one of the major players and contributors, supporting several CEOS activities and working groups listed in the CEOS annual report. In particular, CEOS has chartered NASA to address the WSSD issues for Africa.

There is no sustainable development without adequate information about the planet Earth as an integrated system. This is in keeping with the goals of the Global Earth Observations System of Systems (GEOSS) concept. Space observations and mathematical models provide the venue to achieve this objective. Space is not a tool only for developed countries; on the contrary, space technology serves many needs of developing countries, where access to information is often difficult or costly.

NASA and many other international space agencies fly and will continue to fly Earth observing satellites which provide important observations such as ocean colour, sea surface temperature, soil moisture, vegetation coverage, atmospheric precipitation, radiation, tropospheric gasses, humidity, and many more parameters. These parameters are further used in retrieval algorithms to derive additional products which are of great interest for the common inhabitants and the research community. These products offer a great deal of valuable information that is directly usable on the continent of Africa to address the following areas to reduce risk:

- Health and disease control
- Disaster mitigation (e.g. fires, drought warning, floods, volcanic eruptions, dust storms, severe weather conditions, earthquake assessment)
- Hydrology problems
- Coastal erosion
- Ecological protection
- Agriculture efficiency and food security
- Air quality.

One of the most effective and expedient ways to involve African communities is to help them build the necessary capacities to take advantage of the remotely-sensed data. NASA practises open data policy throughout the world. In fact, NASA data is being downloaded in all continents via the direct broadcast capability on its two major (Terra and Aqua) platforms. This helps non-space system nations to take direct advantage of this and make use of space-observed data for their respective region. In order to benefit from this capability, of course, they require necessary know-how on the ground. The effective transfer of this knowledge for societal use is a prerequisite to capacity building. NASA missions and technology are very useful in increasing risk awareness in the greater African continent and allowing for alternate means or possible mitigation approaches (as applicable) to improve the overall quality of life. The direct broadcast system provided on some of NASA's major Earth observing platforms offers an outstanding capability to disseminate all this vital information to the user community.

Direct broadcast system

Enabling NASA's Earth science data utility worldwide is one of the primary functions of NASA's Direct Readout Laboratory (DRL). In doing so, NASA is assisting in the capacity building of developing nations by providing, freely, key software tools that allow for the processing of direct broadcast Terra and Aqua instrument data in real time. Along with these technology tools, select product algorithms are made available which have been converted to operate in a direct readout environment. These algorithms provide basic real-time products such as fire maps, vegetation index and true colour images which assist in real-time monitoring of environmental events that are particular to Africa.

But the 100 Earth Observing System (EOS) ground stations worldwide are still not enough to provide near-real-time access to many needed products in Africa. In an effort to mitigate timely access to image products, NASA's DRL also provides technologies that allow for real-time distribution of direct broadcast data from a direct readout station to any location with an Internet connection on a minimum 56K data modem. These technologies, combined with information and international coordination meetings, have begun to enable data sharing, which is a key ingredient to real-time data and product access in remote areas, as well as assisting with the objectives of the WSSD.

The following details some of the specific areas where NASA and other partner agencies can help achieve the implementation goals of the WSSD objectives.

Drought and food (in)security

Most parts of Africa experience extremes in rainfall variability marked by persistent drought or episodic flooding. The development and prosperity of most parts of the continent have largely been dependent on fluctuations in rainfall. Extreme droughts have occurred across the continent over the past 30 years, and continue to occur. In particular, the Sahelian zone has experienced a continued decline in rainfall compared to pre-1960s averages, and Lake Chad has shrunk to 5 per cent of its size 35 years ago. Other regions such as Eastern Africa and Southern Africa have experienced severe drought periods from 1980 to the present. While some droughts have been regional in nature, others have affected millions of people across the continent.

Drought impacts a wide spectrum of the social, economic and environmental sectors of society at large. Droughts are associated with increased temperatures causing stress on both rural and urban populations. Prolonged droughts negatively impact hydrological systems resulting in reduced river flows, shrinking reservoir and lake levels and diminished underground water supplies. In totality, droughts lead to crop failures, large scale losses in livestock, disease, food shortages and famine. Monitoring and mapping of the land surface is therefore a critical component in anticipating and mitigating the impacts of drought on society.

Most of Africa has experienced a decrease in the density of rain-gauge networks since the 1960s which are necessary for monitoring drought patterns and frequency. As a consequence, most countries have been ill-prepared to deal with droughts when they have occurred. Since the early 1980s, remotely-sensed measurements using NASA technology and analyses have enabled

various national, regional and international organizations to monitor drought conditions across the continent. These measurements of vegetation are important in mapping both the severity and extent of drought conditions, providing critical information on where food aid can be targeted to the most vulnerable locales.

The development of such historical, remotely-sensed measurement has created a long time series baseline from which the scientific community can begin to understand the spatial and temporal frequency of drought patterns, validate forecast models and provide critical information to a variety of end users to mitigate the negative impacts of drought on society. NASA can contribute to these efforts by developing a continuous and systematically calibrated time series of vegetation measurements from heritage instruments such as NOAA-AVHRR, LANDSAT, currently available data from Terra/Aqua MODIS, and continuing into the NPP-NPOESS era.

The climate variability over Africa is exemplified by episodic flooding and severe weather events. Such extreme variations are at different time scales (such the prolonged droughts of the Sahel region) and inter-annual variability (e.g. the patterns of rainfall departures over Southern Africa and periodically over Eastern Africa). Prevailing patterns of sea surface temperatures, atmospheric winds, regional climate fluctuations in the Indian and Atlantic Oceans, and the El Niño Southern Oscillation (ENSO) phenomenon all have a combined impact on climate variability over most of the continent. ENSO in particular manifests itself over Africa in different ways, with El Niño (La Niña) resulting in drought (wet) conditions over Southern (Eastern) Africa. During the 1991-1992 period, the entire Southern Africa region was affected by a large-scale drought associated with the 1991-1992 El Niño event, resulting in large-scale crop failures and water shortages. In contrast, the 1999-2000 La Niña event was associated with numerous severe land-falling cyclones and large-scale flooding across the region. The recent large-scale drought in East Africa in 2005-2006 was associated with a recent La Niña event.

Floods and droughts in Southern and Eastern Africa are linked to the fluctuations in frequency-magnitude relationship of the climatic fluxes over the region, attributed to the anomalous behavior of the intertropical convergence zone (ITCZ) and sea-surface temperatures (SSTs) over the Indian Ocean, induced by the ENSO. A variety of NASA remotely-sensed measurements of vegetation, SSTs, winds and rainfall can be used to study and understand the spatial and temporal frequency characteristics of floods and other extreme events over Africa to reduce negative impacts on agriculture, health and water supplies.

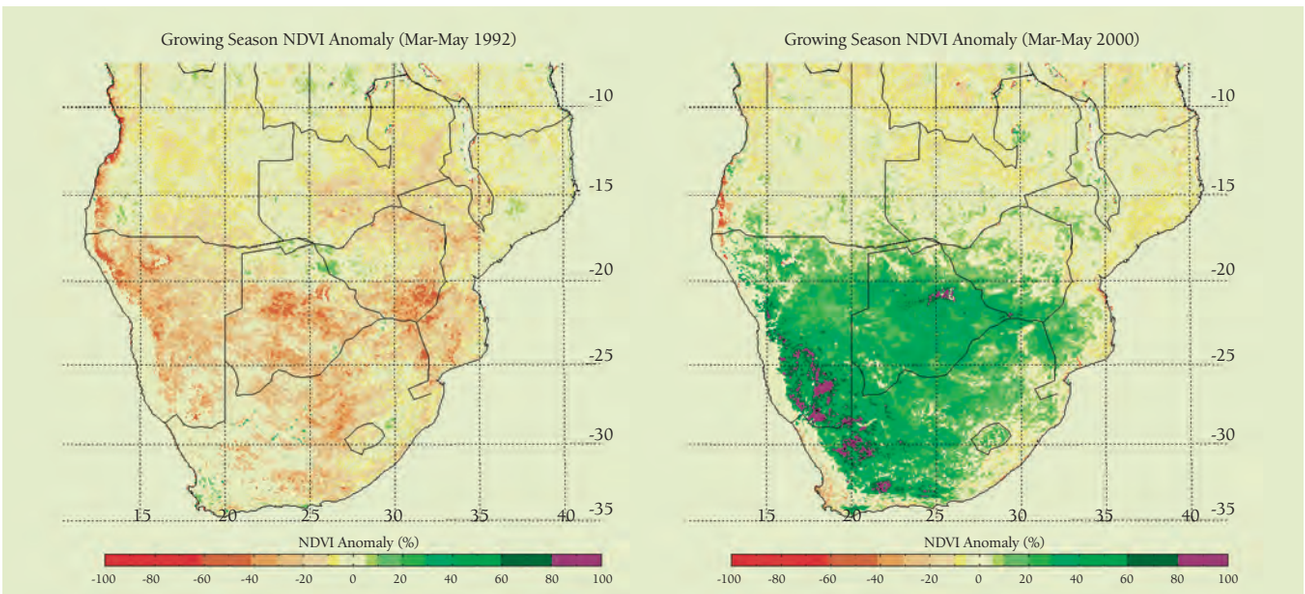
Sustainability for water resource management

Water resource management with goals of sustainable development is aimed at providing safe and plentiful water for human consumption and use with sound environmental practices. A successful programme for the sustainable development of water resources depends on two critical factors. The first is access to modern models, technical analysis and integration techniques. The second is access to basic meteorological, environmental, and hydrological data. The lack of basic data means that water resources managers are unable to implement modern technology for achieving sustainability.

A number of water resources management capabilities have been developed and implemented by US and other water agencies. These are in the form of decision support tools (DSTs) that are used for water resources planning and management. The usefulness of these DSTs is not limited to the region where they were developed and validated; however, the one factor preventing the adaptation of these systems commonly used in the developed world is the lack of sufficient data to drive them. These DSTs are available for use almost anywhere in the world if these data problems can be overcome. Satellite-measured hydrological variables, along with modelling and remote sensing science products, have the potential to overcome these data problems and provide water management data for a region with little or no hydrometeorological data.

Remotely-sensed data and data products from data assimilation schemes are capable of producing variables needed for sustainable water resources development such as surface water balance, soil water balance, reservoir storage, surface temperature and vegetation type. These are the common hydrologic variables that are needed in any water resources management scheme. For example, flood preparedness, early warning and forecasting, post-flood char-

Growing season normalized difference vegetation index (NDVI) comparisons for two seasons



Source: NASA GSFC Earth Science Divison

acterization and continuous streamflow predictions are all important areas that must be addressed in any water resources sustainable development plan. Similarly, reservoir and water distribution systems are critical aspects of any comprehensive scheme. Another example is sustainable management of ground water. Many water-scarce regions of the world rely heavily on groundwater for both drinking water and agriculture. Thus, the availability, sustainability and quality of groundwater are of vital importance to these economies. All of these can be implemented using satellite data and model data products, either solely or to augment traditional hydrologic data, with appropriate DSTs.

Wildfires

Large fires occur in many vegetated landscapes across the world, and may be ignited by lightning, accident, or deliberately either in arson or for purposeful agricultural uses. Regardless of origin, fires are formidable agents of disaster, voraciously consuming natural and man-made resources and concurrently emitting particulate and gaseous pollutants into the atmosphere. Remote sensing provides a powerful means of fire monitoring and disaster mitigation for sustainability. Earlier fire remote-sensing activities were limited to identifying fire locations, because the sensors used were easily saturated by strong signals from large or intense fires. With the enhanced radiometric range of the fire channel on the Moderate Resolution Imaging Spectroradiometer (MODIS) sensor aboard the EOS Terra and Aqua Satellites, it is now possible to measure from space the rate of release of fire radiative energy (FRE) associated with remotely-sensed fires at 1km spatial resolution globally four times a day.

FRE is a powerful parameter that is well correlated with the amount of biomass burned and the amount of smoke emitted, and can be used to derive these quantities shortly after it is measured. In addition, the Spinning Enhanced Visible and Infra-Red Imager (SEVIRI) sensor aboard the Meteosat Second Generation (MSG) satellite covering Africa and Europe, is now able to measure FRE at 4km spatial resolution every 15 minutes. NASA scientists working on the remote sensing of fires and emissions are now collaborating with their European colleagues to combine the advantages offered by NASA satellites and the MSG to monitor biomass burning and smoke emissions in Africa, and to make the results available to scientists and the community.

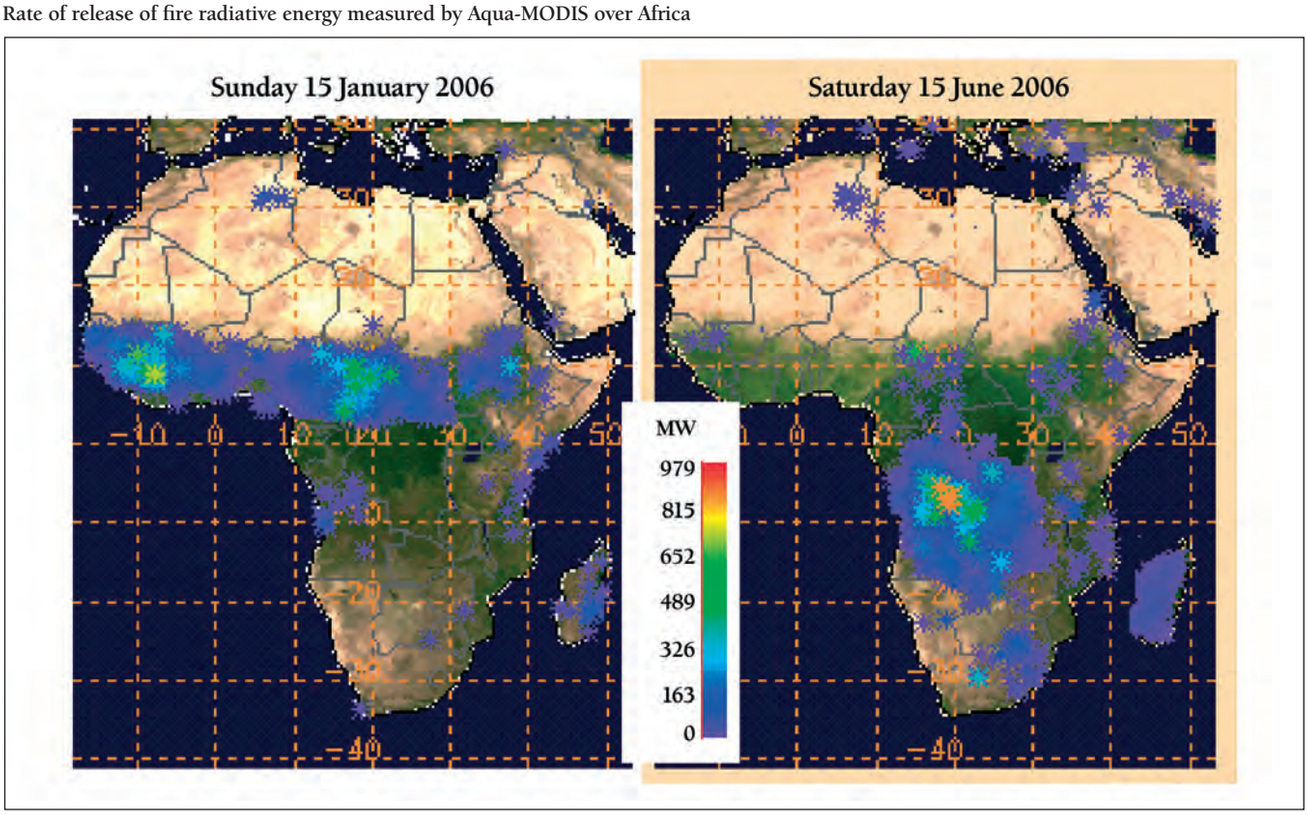
NASA's role in building sustainability on a global scale is an important mission of the US. The African continent has specific needs that can be met by NASA data and model products. The process of infusing this knowledge into Africa is underway in collaboration with the international community, WSSD and CEOS.

Building sustainability for developing countries requires an integrated systems approach, an integrated observing system, reliable models, and adequate decision-support systems. Once we have received inputs to our in-house inventory, we will use the information to achieve the following goals:

- Document and communicate current efforts to use Earth observation data for sustainable development in the developing world, particularly in Africa
- Provide an initial evaluation for each DST identified which supports sustainable development in Africa and which may benefit from use of NASA research results
- Provide recommendations for future funding activities, especially regarding evaluation, verification and validation, benchmarking, gap analysis and transition to operational activities.

We can then develop the environmental data and products that can feed the African people with the knowledge and tools to make better decisions for societal benefit.[1]

Rate of release of fire radiative energy measured by Aqua-MODIS over Africa



Source: NASA GSFC Earth Science Divison

GIS and spatial technologies in disaster management: a case study approach

Satya Priya, General Manager, Spatial Modeling, RMSI

Information is the key for managing disasters better. Fortunately, access to information and its timely analysis for better decision-making and management is fulfilled today by information technologies in ways that were not effective, efficient or economical a decade ago. Geospatial technologies, and geographical information systems (GIS) in particular, provide the tools to store spatial and non-spatial data digitally and a platform to retrieve, analyse and represent this data in ways that support decision-making. GIS, along with other geospatial technologies such as global positioning systems (GPS), remote sensing, aerial photography and web mapping, form a toolkit that is critical for improved disaster management.

The following case studies demonstrate RMSI's application of these geospatial technologies in different phases of the disaster management cycle:[1]

1. Development of a GIS-based flood hazard model to prevent disasters
2. Vulnerability and adaptation to drought – economic impact scenarios
3. Addressing vulnerability to climate variability and climate change through assessment of adoption issues and options.

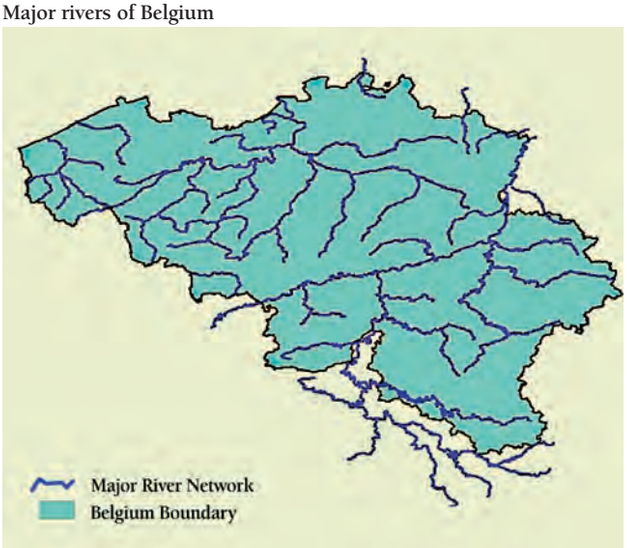
Case study 1: Development of a GIS-based flood hazard model to prevent disasters

Flooding is a hazard with serious socio-economic consequences for all activities and infrastructure within an affected floodplain. Accurate delineation of the extents and depths of floods within the floodplain is essential for flood management officials to make sensible and fair decisions regarding construction, insurance, and other regulated practices on land and property potentially affected by flooding. While there are plans for the whole of Europe to model floods, Belgium was chosen as the first country, due to business needs. The model development part of the project entailed extensive spatial analysis, including the development of a modelled river network, a hydrologically corrected digital elevation model, catchment delineation, rainfall to runoff modelling, and flood extent and flood depth information.

The flood risk model developed by RMSI comprised four different modules:

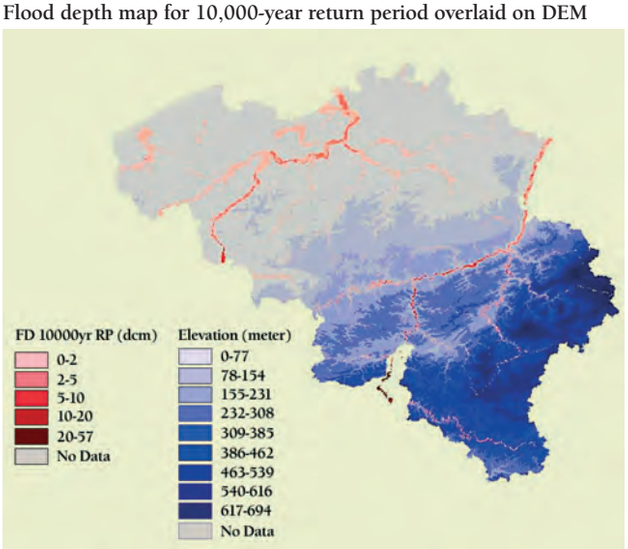
Event definition module – This module involved gathering information on historical flows covering all the river gauge stations across Belgium and the development of flow-frequency curves using extreme value distribution. The stochastic event set contained a range of possible winter and summer river flood events that caused losses on and off the major floodplains, representing flood events sampled from the equivalent of 10,000 years of simulation. The event set was based on extensive analysis of hydrological data and research into the causes of historical events, and was calibrated against historical records of extreme flows and precipitation. Flood hazard was determined for each of stochastic events at administrative division boundaries resolution.

Major rivers of Belgium



Source: RMSI

Flood depth map for 10,000-year return period overlaid on DEM



Source: RMSI

Hazard data development – A spatially accurate river network is one of the most important data layers for any flood model. For modelling purposes, only major rivers were considered. A lower resolution river network (1:1 millon) was used to identify major rivers and a high resolution (1:50,000) was used to ensure that it was spatially accurate. RMSI developed semi-automated techniques to handle spatial corrections with a quick turnaround.

A 25-metre lateral resolution digital elevation model (DEM) was used for the higher end GIS-based flood risk model. The vertical resolution of the DEM was 1 metre. This DEM was hydrologically corrected using semi-automatic techniques developed by RMSI, to make it compatible with established GIS-based flood modelling. These corrections included sink filling, reconciliation of the DEM with respect to the river network, removing artifacts etc.

Model simulations were carried out using the Federal Emergency Management Agency approved hydraulic model (HEC-RAS). For each river segment, water surface profiles were simulated for flows ranging from two-year to 10,000-year return periods. The computational procedure was based on a solution of one-dimensional continuity, energy and Manning's equations using the standard step method. Flood extents and depths at 25-metre grid resolution were derived for each stochastic event.

Flood depths were aggregated to various resolutions depending on the urban concentration. Flood hazard was calibrated for recent events. Hazards included off-floodplain flooding from small streams, sheetflow and drainage overflow.

Vulnerability functions – The vulnerability functions in the Belgium river flood model were based on cost modelling methods that consider replacement and reinstatement costs for each component of loss. The model was calibrated and validated using historical loss information and expert knowledge. The vulnerability functions produce mean damage ratios for buildings as well as contents coverage for a wide range of occupancies and construction types. Coverage for residential alternative living expense and commercial business interruption was also included. While most of the damage from catastrophic floods occurs from inundation by large rivers, significant losses also occur due to sheetflow, the flooding of small streams, or backup of drainage systems. The vulnerability model reflected these different flood types, with specific relationships for river inundation and off-floodplain losses. The hazard database and damage curves were then fed into the client's software to carry out financial loss computations.

The Belgium river flood model provides high-resolution capability for pricing and underwriting policies, and the effective management of company-specific flood aggregates and exposure.

Case study 2: Vulnerability and adaptation to drought – economic impact scenarios

Drought sets off a vicious cycle of socio-economic impact beginning with crop yield failure, unemployment, erosion of assets, decrease in income, worsening of living conditions, poor nutrition and subsequently, decreased risk absorptive capacity.

The state of Andhra Pradesh in India has historically been most severely affected by drought. The failure of monsoons has had a fatal affect on the state's sizeable agriculture sector and on the large share of the population dependent on agriculture for its livelihood. The state has many ongoing programmes for drought and watershed management. The World Bank wanted to complement the efforts of the state government by assessing the economic and fiscal implications of drought, based on potential climate change and risk mitigation scenarios.

The objectives of this study included developing a robust analytical framework for simulating the long-term impact of drought at the micro (drought-prone areas) and macro (state) levels; conducting a quantitative probabilistic risk assessment of the impact of drought under different scenarios; and assisting the state government in the development of a forward-looking and anticipatory strategy for adapting to frequent drought events and conditions of water deficit.

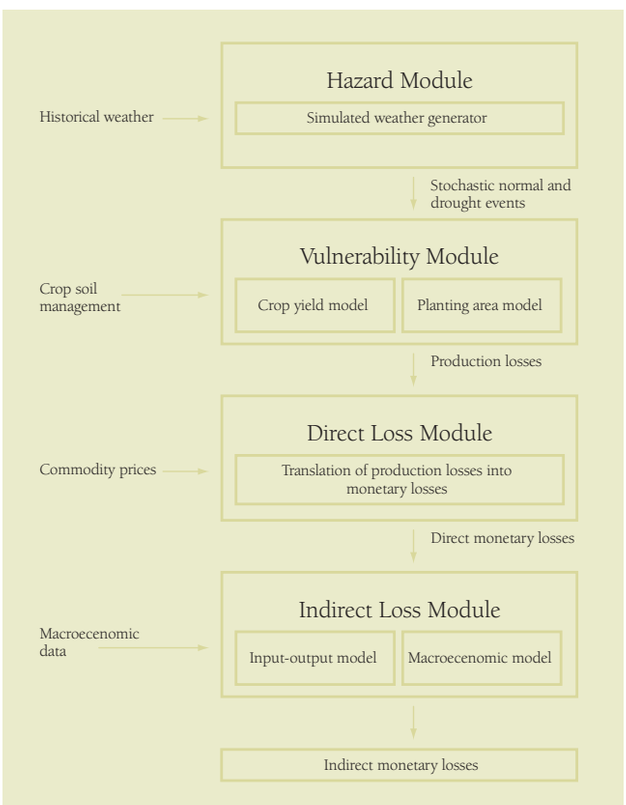
In addition to macroeconomic and drought management scenarios, the development of the modelling framework was also aimed at assessing the possible increase in frequency and severity of droughts that may occur due to human-induced climate change.

The methodology for undertaking this study included developing a probabilistic drought risk assessment model that included hazard, vulnerability and economic modules.

The hazard module included stochastic events simulating the characteristics of historical events. A probabilistic drought risk model in the form of a weather generator was used to analyse and quantify the impact of potential future drought in the state and to compute direct losses including probable maximum and average annual losses.

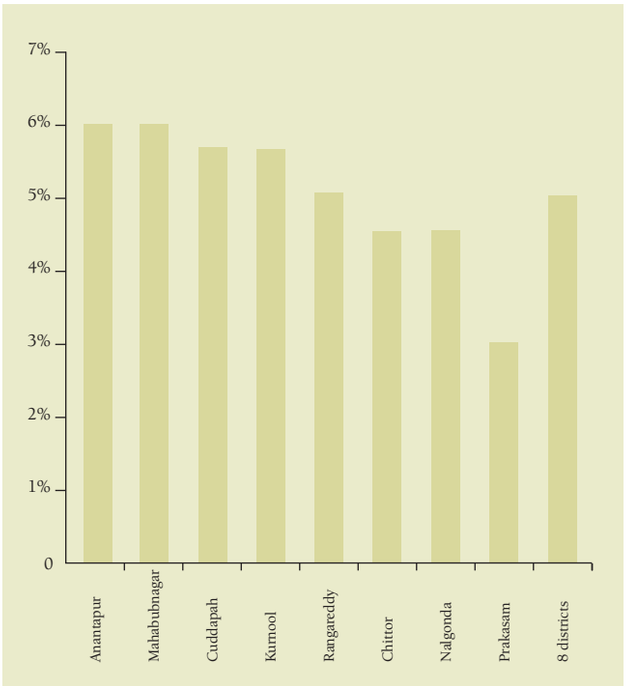
A vulnerability module helped quantify the damage caused to each crop due to weather hazards. An agro-meteorological model was then used to analyse the impact of drought on crops. The analysis included daily time step weather, rainfall distribution and intensity, as well as deficiencies in surface and sub-surface water supplies and soil moisture.

Probabilistic drought risk assessment model including hazard, vulnerability and economic modules



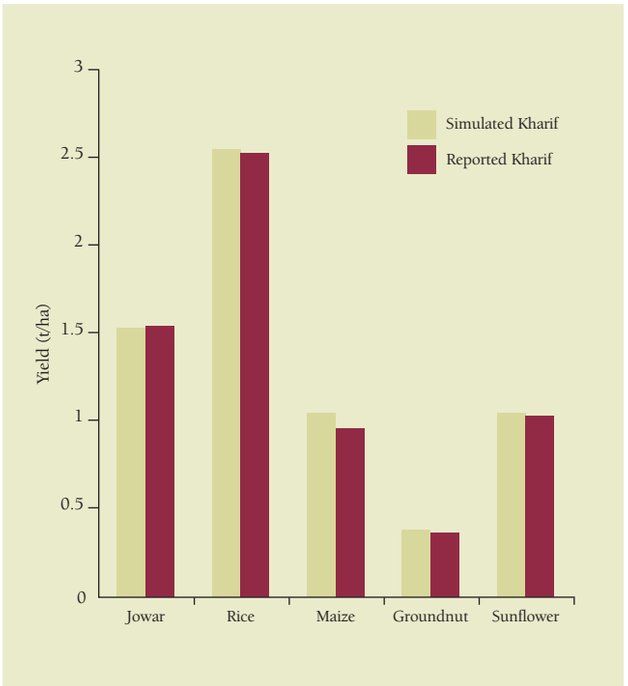
Source: RMSI

AAL of production value as a percentage of normal year for each of the selected eight districts and also the consolidated AAL for all districts



Source: RMSI

Crop yield validation for select crops in the Ananthpur district of Andhra Pradesh



Source: RMSI

Macroeconomic and financial modules were developed to assess the impact on various sectors of the state economy; the fiscal implications for the state budget; and for making suggestions on cost-effective risk financing and risk transfer arrangements.

The probabilistic drought risk assessment model ensured accurate and extensive drought risk assessment with statistical outputs, such as average annual loss (AAL), and loss exceedance curve (LEC) calculations. It further formed a powerful tool to investigate the impact of risk coping strategies and climate scenarios on crop yield and production in each block of the drought-prone districts selected for the study.

The model was calibrated using local experience in management practices and crop phenology in the selected districts. Its validation proved extremely successful for the five major crops grown in these districts, i.e. paddy, maize, jowar (sorghum), sunflower and groundnut.

Droughts generate significant indirect losses, as compared to direct losses in crop production. These indirect losses were estimated through a macroeconometric and an input-output analysis. A critical task was to link drought risk analysis at the block level for the selected districts to the statewide macroeconomic analysis. A prototype macroeconometric model was developed to explain how the variability of the value of crop production in selected districts impacts the variability of the state gross value added (GVA) in the main economic sectors of Andhra Pradesh. The input-output model, the first ever developed for Andhra Pradesh, was used to provide details of the linkages between the different sectors and sub-sectors of the economy, the flow of goods and services, and employment.

Contrary to rapid onset disasters, droughts normally lack highly visible impacts. Instead, their impacts are generally nonstructural and spread over long periods and large areas. Therefore, though our approach broadly followed the general catastrophe risk-modelling framework used for assessing the impacts of rapid onset disasters (such as cyclones, floods and earthquakes), it was customized to be applicable for slow onset events.

Case study 3: Addressing vulnerability to climate variability and climate change – an integrated modelling system development

Nearly two-thirds of India's population lives in rural areas and is greatly dependent on climate-sensitive sectors such as rainfed agriculture, forestry and fisheries, which are highly vulnerable to current climatic variability, particularly floods and droughts. Moreover, agriculture represents a core part of the Indian economy and provides food and livelihood activities to a major portion of the Indian population.

While the magnitude of the impact of climate change varies by region, it generally has an impact on agricultural productivity and shifting crop patterns.

The overall objective of this study was to assess the impact of climate change, which in turn would help determine how the climate is expected to change at the regional level; what will be the projected impact of increased climate variability and climate change on water and agriculture resources; which regions are vulnerable to climate-induced changes in water resources, and the impact of these on agricultural crops.

The study was carried out for three regions of India: Pennar basin in Andhra Pradesh, Lower Mahanadi basin in Orissa, and the Godavari basin in Maharashtra.

An integrated modelling system (IMS) was developed to establish functional links between water and agriculture resources. Under this study, water and main cereal crop productivity was assessed with an emphasis on water management to clarify its vulnerability to climate change. The assessment included:

- Baseline climatology and meteorology

- Third generation regional climate model (HadRM3) derived projected climate scenarios
- Hydrological modelling using SWAT including irrigation water, and agricultural crop modelling using EPIC modelling.

The modelling framework used in this study established identified links between these components. These included databases and models that were designed to facilitate water resources and crop modelling under climate variability and climate change scenarios. The baseline and future climate scenarios from HadRM3 were used as inputs to both hydrological and crop simulation models.

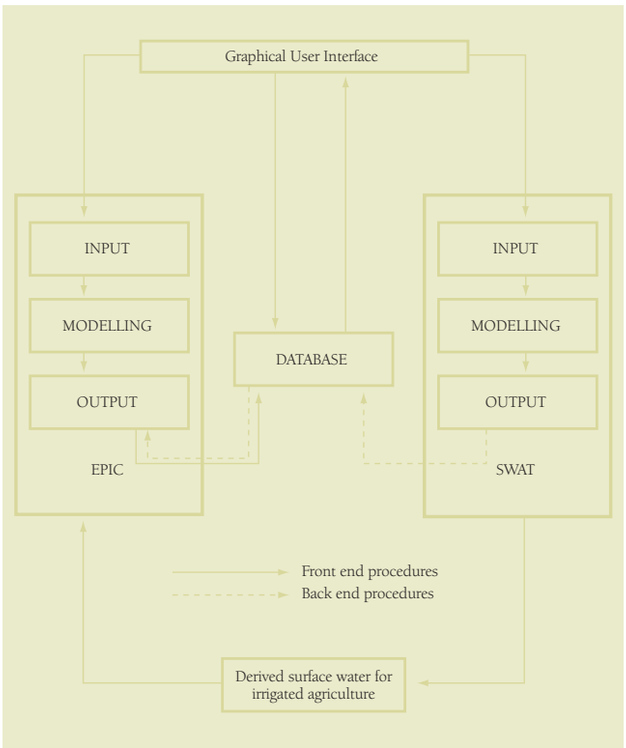
A range of emission scenarios was developed in the Intergovernmental Panel on Climate Change (IPCC) Special Report on Emission Scenarios (SRES). These reflected a wide range of the main demographic, technological and economic driving forces of future emissions. The future climate was projected for the years 2071 through 2100 for IPCC SRES A2 and B2 scenarios (A2 and B2 represent high- and low-level emission scenarios respectively for the region in which India lies).

Results for the Pennar region revealed that the mean annual flows in the river system would increase by 8 per cent in A2 and 4 per cent in B2, whereas the increases in evapotranspiration losses were found to be about 10 per cent in A2 and 12 per cent in B2.

Three rain-fed crops (groundnut, jowar, sunflower) showed decreased yields under A2, whereas in B2 they seemed to fare relatively better. The decrease was significant for groundnut: 38 per cent for A2 and 20 per cent for B2. Rice, being an irrigated crop, showed a decrease in yield by 15 per cent and 7 per cent for A2 and B2 scenarios respectively. The decrease in yields was mainly due to further increases in temperature under climate change scenarios, as has also been observed in experiments.

The modelling framework developed by RMSI is biophysical in nature and can adequately predict the observed and current cropping mix. This framework can be ported to other areas with or without modifications.

The system architecture of the IMS

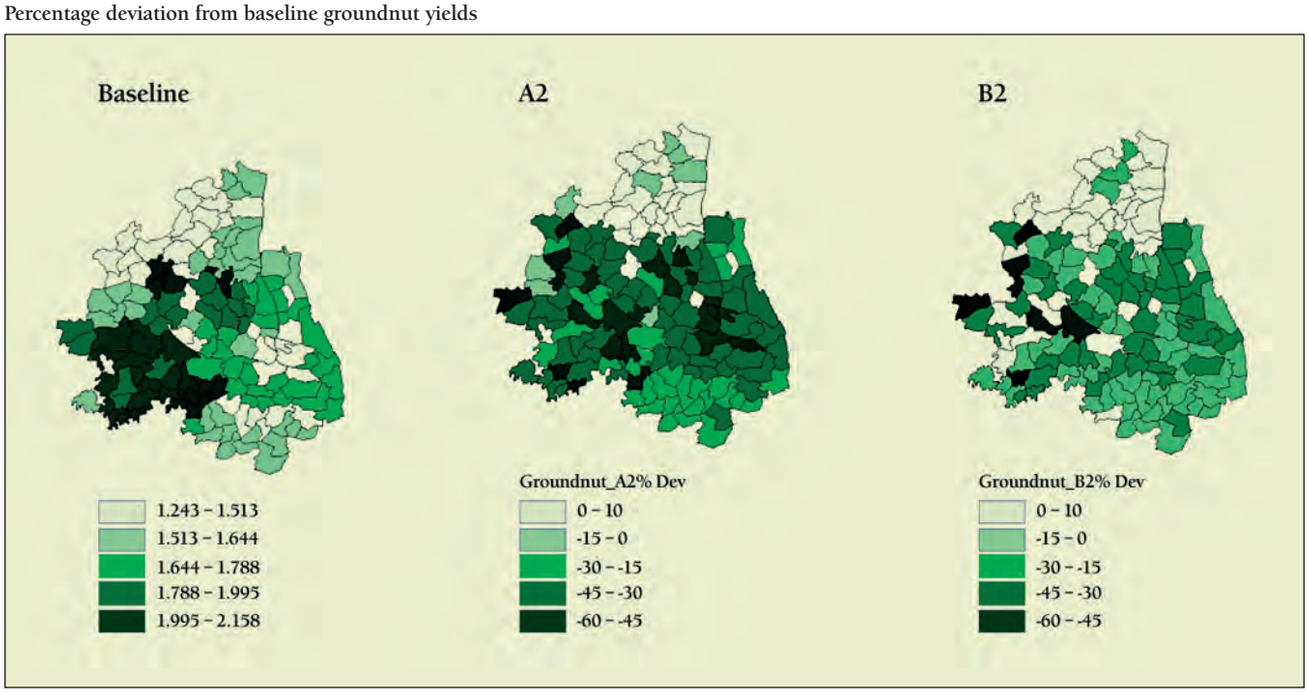


Source: RMSI

Conclusion

Geospatial technologies are indispensable tools to manage natural disasters, as evidenced by the case studies above. An innovative combination of information technologies in general, and geospatial technologies in particular, with science and engineering, makes the best decision support systems for managing disasters.

Percentage deviation from baseline groundnut yields



Source: RMSI

Moving from technology to its applications: using satellite remote sensing for disaster prevention and vulnerability reduction

F. Pisano and E. Bjorgo, UNITAR Operational Satellite Applications Programme

As satellite technology evolves, and imagery resolution becomes higher, there is increasingly open discussion on the potential of existing and foreseeable tools in all sorts of scientific and social areas. Though still unaffordable in several developing contexts, satellite technology is rapidly becoming part of the daily (working) life of millions of people. Personal navigation systems and, more recently yet, desktop earth observation applications like Google Earth are exposing millions of users to the amazing world of remote sensing from space.

As a reflection of this evolution, global programmes are taking shape, which will change the current perception of space applications as purely scientific, and instead help bring space down to earth. Ventures such as the European Space Agency's (ESA) Global Monitoring for Environment and Security (GMES), and the Global Earth Observation System of Systems (GEOSS), are evidence of space wanting to move into diverse societal benefit areas. Meanwhile the United Nations has been following and in some cases spearheading reflection on the potential of space applications through institutions such as the UN Committee for the Peaceful Use of Outer Space (COPUOS) and programmes like UNOSAT, the Operational Satellite Applications Programme of the United Nations Institute for Training and Research (UNITAR). Other examples exist, such as UNEP, FAO, WFP, WMO, and WHO. Through these capacities, the UN is striving to take a balanced approach to the use of space and satellite applications in the multiple areas in which it holds a mandate, not forgetting that this matter relates as well to information and communications technology (ICT) development and ICT for development. UNITAR is one example of a UN initiative looking at both satellite technology and ICT from the angle of their applications towards concrete benefits for societies and individuals.

For a sector like space that has strong scientific and engineering components, it is not easy to think in terms of beneficiaries at the local level. But for the UN this is an imperative. That is why the space sector and the UN have found several ways to collaborate and each provide their own contribution to the advancement of these applications while targeting specific groups of users, from humanitarian relief to emergency response, to local capacity building and environment protection.

UNOSAT suggests an approach entirely aimed at understanding user needs and identifying the appropriate applications while developing local capacity in the medium- to long-term. It has done so in post-crisis reconstruction, but also in disaster reduction. The latter is one area where not only is the task before nations enormous; it is also one where talking about technology alone will not suffice to save the lives of those in danger. To achieve that requires usable, affordable and appropriate applications.

Earth observation data and geographic information systems (GIS) have proven to be useful tools for effective decision-making. For developing countries in particular, with relatively poor territorial documentation and often outdated maps, routinely acquired satellite imagery combined with local field surveys can be used in a variety of tasks. Local institutions, for example, can run analyses on the geophysical risks facing their communities, and then develop plans for improved urban and rural territorial management and time-stamp the environmental situation at certain intervals to monitor environmental parameters, such as forest cover and urban expansion.

Part of this work includes the collection of data from earth observation satellites and also local global positioning system (GPS) recordings, its storage in a GIS, its analysis, and finally mapping and integration in a holistic city and regional plan. Elements of such a plan include risk assessments of landslides, floods etc. and an estimate of overall vulnerability.

Risk analyses are carried out by combining geophysical and geological parameters (such as land-cover type, elevation, slope, hydrographic network) with socio-economic parameters (for example, population distribution and density, income, and asset values.). All this information can be allocated to a geographical distribution, hence applicable to a GIS. As the risk assessment surveys are directly applicable to the people living in the specific area, a community-based approach using detailed local knowledge about the territory in combination with GIS has proven a winning combination.

Risk assessment can be aimed at specific types of natural hazards in order to prepare emergency scenarios and improve resilience through adequate city planning. A practical example of this is the action taken by the community of Matagalpa in Nicaragua, to move the location of one of its schools from grounds at high risk from landslides to a new low-risk location. This alone reduced the vulnerability of an important population layer of the community. Another example is the recent, more restrictive policy applied by the same community to licences for building along the riverbanks. This zone is clearly very exposed to floods, but now the local GIS can quantify and illustrate the actual areas at risk.

The success of using satellite remote sensing and GIS in Matagalpa was possibly thanks to the work of UNOSAT and its

partners from the space sector, but above all thanks to the commitment of the local community and the mayor himself to developing technical capacity locally to respond to local needs. This policy mirrored precisely the mission of UNOSAT and led rapidly to the setting up of a local technical centre, the Centro de Información Geográfica de Matagalpa (CIGMAT). This happened on the heels of the catastrophic impact of Hurricane Mitch in 1998, and signified a new approach to using geographic information gathered during the emergency phase in order to benefit local populations after relief operations have ended. In a certain way, it was a forerunner of today's concept of early recovery in the specific area of information management.

The establishment of CIGMAT was not an end in itself. It rapidly became clear that what had caused most damage in the area when Mitch struck was the lack of appropriate urban planning supported by geographic information. As Alain Retiere of UNOSAT put it: "No territorial planning means no one knows how to manage the city growth, where to build and where not to; how to design roads and bridges; where to locate safe sites for public services and main infrastructures."

It was therefore necessary to create this capacity to visualize the town and the vulnerability of the community living in it. An international project was designed together with the mayor's office, which requested it, and two main objectives were identified:

- Strengthen the municipal office for territorial planning
- Establish CIGMAT as a technical support centre that would in future acquire and process the data necessary for the municipal offices to work efficiently.

The Canton of Geneva, Switzerland, funded the project for the most part, and some other institutions also supported the activities.

CIGMAT has been operational since June 2003. Currently it has a staff of seven people who received training by UNOSAT. Today Matagalpa is still regarded as a trend-setting example and one that should be replicated as widely as possible for at least two reasons: firstly, it is locally centred, expandable, and based on local needs, skills and techniques; and secondly it is relatively inexpensive.

Perhaps the most important benefit of using GIS for land planning, as in the case of Matagalpa, is the increased awareness that local administrators gain of the need to address development in a more holistic framework, including prevention and vulnerability reduction. In this context GIS has a role that goes beyond the mere technical aspect to become an objective and verifiable basis for sensible decision-making at the local level.

In the example of Matagalpa, CIGMAT has significantly contributed to a better understanding of the various aspects of urban planning and how this is inextricably linked to disaster prevention in communities exposed to endemic risk from natural hazards. According to the then mayor of Matagalpa, CIGMAT GIS services brought about the opportunity of an effective territorial management plan for the city. That is a major step forward for a region with strong demographic growth. Furthermore, the success of a community-based GIS service goes well beyond servicing the local decision makers. CIGMAT is often contracted to render services to other projects as an autonomous technical support capacity integrated in the community. As a result, CIGMAT is able to finance part of its own work, which is an impressive fact in itself. Locally funded services have included a Matagalpa city map and regional tourist map as well as land use analyses for neighbouring municipalities. This proves that GIS applications can also be cost-effective in disadvantaged communities.

CIGMAT is now discussing with local and national authorities and UNOSAT how to implement a regional watershed plan. This is an ambitious task that will also involve national institutes located on the west and east coasts of Nicaragua. By taking advantage of the motivation and professionalism that a community-based GIS service such as CIGMAT brings, the regional upscaling of a local programme may soon be another success story from Nicaragua.

Based on this concluding experience, UNOSAT has built other similar projects in African countries, always with the active participation of local authorities and other UN agencies. As a result, a more ambitious plan, the '1,000 Twinning Campaign,' is now taking shape. The campaign will be officially announced in September 2006 and rests on the straightforward fact that satellite-based GIS is still unaffordable in those places where it could be useful the most for people and society.

Thus, the idea of mobilizing local authorities and donors worldwide to take part in a global long-term initiative of cooperation among cities to bring satellite technology down to earth. Based upon the well-tested model of decentralized cooperation, the 1,000 Twinning Campaign will focus on communities in those geographic hotspots known for being at high risk from natural hazards. A large amount of data and maps has been generated so far by accumulating material created during emergency response operations.

While the key is to become able to transfer coherent information from the crisis to the reconstruction phases, it is accepted that additional dedicated funds and capacities are necessary to cater for GIS for disaster reduction. This is why in 2004, UNOSAT established the Global Mapping Grant Facility, a trust fund aimed at providing developing countries with satellite-derived products, services and training for capacity building, to be able to integrate GIS and satellite technology into land use management and development planning. This trust will be used to receive funds to power the 1,000 Twinning Campaign and ensure the overall coherence and transparency of the programme.

It is hoped that this initiative will stimulate the driver for translating technology into useful (and usable) applications. This is not being attempted for the first time, of course. But it is the first time concrete applications for identifiable beneficiaries at the local level are being pursued. The partnership proposed by UNOSAT gathers important actors like ILO, UNDP and ISDR, as well as local authorities and their associations. These large players, together, could make the difference.

Image: Space Imaging, distributed by INTA Space

Example of urban development as seen by satellite. Note the densely developed housing infrastructure in the centre of the image

Desalination as a potential technological hazard to the environment in the arid Western Asia region

Hosny Khordagui PhD, Chief, Water & Environment Team,
UN Economic and Social Commission for Western Asia

Water is a very scarce commodity in the West Asia region, known as one of the most arid areas in the world. Severe water-related problems have been compounded in recent years by a sharp increase in water demand, due mainly to the fast-growing population and rapid socio-economic development. In order to reduce the gap between supply and demand, countries of the Economic and Social Commission for Western Asia (ESCWA) region were compelled to develop large-scale, non-conventional schemes.

Experience in the Gulf states indicates that desalination technology has developed to a level where it can serve as a very reliable source of water at a price comparable to that of other conventional and non-conventional water sources. Desalination was proved to be the most feasible alternative to meet future water requirements and considered as a strategic option for satisfying current and future domestic water supply requirements. Evidently, desalination has become a major dependable source of water for large urban centres in most Gulf countries. This is particularly true when required water quality standards, social acceptability, and political vulnerability are all taken into consideration.

On a global level, the Gulf region produces over half of the world's desalinated water. Unfortunately, the environmental risks associated with the construction and operation of desalination facilities have not been given adequate consideration by the institutions concerned. There follows a brief inventory of those risks.

Environmental risks at the plant's intake

There are two types of intake effects associated with power-desalination: impingement effects and entrainment effects. As the seawater going into the power-desalination plant is screened and filtered, aquatic organisms are removed from it. This is called the impingement effect. Entrainment effects take place when smaller organisms passing through filters find their way through the process where they get exposed to chemicals, higher temperature or pressure — conditions which are severe, or which endanger their existence. Both of these effects pose the risk of increased mortality rates for plankton of all types as well as small fish. This in turn may result in reduced population and hence reduced biodiversity, production and yield.

Experience from the Gulf region indicates that cooling seawater for power-desalination has resulted in the impingement of large numbers of fish and macro-invertebrates. Several cases of massive fish kills were also reported in the vicinity of power-desalination plants.

Environmental risks of brine water discharge

In principle, desalination plants separate saline water into two streams: a low dissolved solid concentration stream (fresh water or desalinated water), and another stream containing the remaining dissolved solids (brine reject or blow-down). To extract, separate and concentrate the salts in the reject brine solution, intensive thermal or electrical energy is required. The characteristics of the reject brine are a direct function of the quality of the feed water, the desalination technology used, the per cent recovery, the chemical additives used within the process, the construction materials and the proficiency of the operators.

Most of the large-scale desalination plants in the ESCWA Region are located on the coastlines of the Gulf and Red Sea. Obviously, they discharge their brine concentrate into the adjacent near-shores. It is believed that rapid mixing and dilution are the keys to reducing risks associated with disposal of brine in the sea. The risk magnitude of brine discharge depends to a large extent on the physical, chemical and biological characteristics of the receiving near-shore marine environment.

In general, modern desalination plants in the Gulf region have sound designs for their intake and outfall, to avoid recycling of discharged effluents into the feed water intakes. The collective environmental risk of the pollutants constituting the brine water discharged to the near-shore marine environment might be manifested in one or more of the following forms:

Physical risk — Resulting from the discharge of hot brine from thermal desalination.

Chemical risk — Resulting from chemical agents remaining in the brine water and added within the process for the control of bio-fouling, scale formation and foaming. Additionally, seawater reverse osmosis (RO) necessitates an exhaustive pre-treatment of the feed water to avoid accelerated fouling and scaling of the RO membranes. This pre-treatment involves pre-chlorination, coagulation using coagulants and coagulant aids, sedimentation, clarification, sand filtration and dechlorination before conveyance to the RO membranes.

Biological risk — The secondary effect of oxygen demand exerted by natural and induced organics in the brine water. Relatively higher levels of biochemical oxygen demand (BOD) might be observed in the desalination plant effluents. The impact of BOD demand for dissolved oxygen (DO), associated with lower levels of DO in brine water due to higher salt content and temperature, will ultimately reduce the level of DO in seawater adjacent to the brine water out-falls.

It is also important to note that effusions during the commissioning, recommissioning and/or start-up of a desalination plant following construction or periods of shutdown for regular maintenance procedures cause more biological risks than the effluent regularly discharged when the plant is operating normally.

Risk of increased salinity in open seawaters

There has long been a misconception among some environmentalists that the concentrated salt content of the brine water disposed of by seawater desalination plants poses significant risk to the open near-shore marine environment. Fortunately, this has not been substantiated in the Gulf region for one or more of the following reasons:

- The amount of seawater withdrawn for desalination is relatively minute when compared to the water mass of the open sea
- The amount and nature of salts discharged with the brine are identical to the salt content of the open sea
- The brine concentration factor increases on average by no more than three-to-one. In most cases, brine is mixed with power production cooling waters, reducing the concentration factor from three to near-one
- In order to avoid the recirculation of plant effluents to the intakes of desalination plants, the outlets are specifically designed to discharge in coastal areas where hydrographic currents can easily disperse and dilute the brine.

It is safe, then, to assume that the risk associated with the increased salinity of open seawater in the vicinity of large seawater desalination plants has been overstated, and should not give reasons for concern, particularly when near-shore hydrographic circulation patterns are considered in the design of the plant's discharge outlets.

Risk of increased salinity in semi-enclosed marine environments

The discharge of brine water in shallow and relatively stagnant, nearly-land-locked coastal areas such as bays and harbours in the Gulf region might result in more pronounced risks. The unlimited disposal of brine water in sheltered bays or harbours might pose serious risks to local marine habitats, particularly to fauna and flora, resulting in the near disappearance of a variety of marine organisms.

Semi-enclosed and shallow bays in the Gulf are naturally characterized by a higher salt content due to the elevated rate of evaporation, lack of freshwater discharges and restricted dispersion and dilution. In some near-shore localities in the Gulf, the average salinity in summer can reach some 48 parts per thousand (ppt), compared to 37 ppt in winter. On the other hand, it is reasonable to suggest that the indigenous biota has adapted to the naturally prevailing environmental conditions characterized by its elevated salinity. This high salt content, in addition to natural cycles of even higher salinity, might have impacts several times the order of magnitude of discharges from desalination plants. Very limited environmental risks were documented, associating natural cycles of higher salinity with negative ecological implications. Hence, the slight increase in salinity in the proximity of points of brine-water discharge is projected to pose limited risk to the enclosed marine ecology of the Gulf.

Environmental risks of thermal pollution from blow-down

The temperature of the brine water effluent resulting from thermal desalination processes is typically five to eight degrees Celsius above that of feed water. The degree of damage to the biota present in the vicinity of the point of discharge is assumed to be a function of its type, the temperature levels (levels of exposure) and duration of thermal inputs (duration of exposure).

In the life of marine organisms, temperature elevations from ambient values cause thermal stress that might result into an ecotoxicological effect such as disturbed enzyme activity, water balance and cellular chemistry. The buoyancy, locomotion and respiration of some marine organisms have been found to be disturbed as a result of temperature-induced changes in density, viscosity and solubility of gases in the receiving waters. However, if the near-shore is open and well mixed, then the risks will only be noticeable to within 300 metres from the discharge point.

The impact of thermal pollution in enclosed areas might be more significant. These could be manifested by changes in community structure such as types of dominating organisms, and by changes in the characteristics of the individual species such as lower tolerance or adaptation. Thermal pollution will lower the amount of DO, increase bacterial and aquatic invertebrate activity, increase the growth rate of microscopic plants and fish, and increase the sensitivity of aquatic life to toxic elements. The common practice in modern desalination plants in the Gulf region is to ensure the minimization of these effects by selecting plant sites and engineering designs for their discharge systems that will expedite the dissipation of their thermal inputs in the receiving near-shore marine environment.

Environmental risks of residual chlorine oxidants in brine water

For well over half a century, chlorine has proven to be of immense benefit in bio-fouling control, in power plants, and lately in desalination plants. However, adverse toxic effects at trace levels have become evident. The chemistry of seawater is unique when chlorination is involved, owing to the presence of bromides in seawater. When mixed with seawater, chlorine reacts immediately with the bromide ions to form hypobromous acid.

The discharge of residual chlorine even at the very low fraction of one part per million (ppm) is posing a real risk to the near-shore marine environment, particularly to fish and invertebrates that were found to be more sensitive to residual chlorine oxidants than aquatic plants. Given these facts, it appears that the discharge of trace levels of residual chlorine oxidants, either in open or enclosed seawaters, is posing serious risks to aquatic life in the near-shore marine environment.

Risk of trihalomethanes in brine water

The formation of trihalomethanes (THMs) in brine water is a direct consequence of the chlorination process — free chlorine reacts with the natural organics occurring in seawater and other organic pollutants to form THMs. Some of the volatile THM species were found to be mutagenic to humans and harmful to seafood.

Brominated species dominate the formation distribution, with bromoform (CHBr3) accounting for more than 90 per cent of the total THMs. Currently, there is growing concern within the scientific community about possible damage to the near-shore marine ecology into which chlorinated brine is discharged. Except in the immediate vicinity of the brine water point of discharge, it is very unlikely that the concentrations of THMs are significant enough to pose any ecological threat. However, near the point of discharge the relatively high concentrations may pose some risks.

Environmental risks of trace metals in discharged brine water

In thermal desalination plants, it is plausible to find corrosion products in brine water resulting from the effect of water flow,

dissolved gases and treatment chemicals (acids) on the alloys utilized in the construction of desalination pipes and equipment. The corrosion products may include harmful heavy metals such as nickel (Ni), copper (Cu) and molybdenum (Mo) and less toxic metals such as iron (Fe) and zinc (Zn).

As conservative pollutants, metals will last and accumulate in different compartments of the marine environment perpetually. However, their ultimate sink is the marine sediment. The level of metals (primarily in sediments and to a much lesser extent in seawater) reflects the general status of the environment, but it does not necessarily reflect the biological availability of these metals.

After nearly 30 years of practising large-scale seawater desalination, studies conducted on the near-shores of Kuwait revealed that local fish and shrimp species were not contaminated by heavy metal. Fortunately, most of the reported data in the Gulf states indicates that the levels of heavy metals associated with brine water disposal are minimal and often below the detection limits of standard analytical procedures. This has been particularly true after blending brine water with large volumes of cooling water used in power production. When comparing the mass and nature of heavy metals released with brine water to the amount of heavy metals being released from land-based industrial wastewater, atmospheric fallout and crude oil spills, the risk is thought to be negligible.

Environmental risks of anti-scalants in brine water

The chemical analysis of seawater in the Gulf region indicates that scale, such as alkaline scale, can form in desalination plants. This occurs when the bicarbonate ion breaks down by heating. In order to control calcium carbonate scaling, concentrated sulphuric acid is added to the feed water to remove bicarbonate ions. The extremely large carbonate buffering capacity of the Gulf's water minimizes the impact of acids on the environment and renders it negligible.

Furthermore, threshold scale inhibitors such as mixtures of sodium hexametaphosphate and surface active agents like lignin sulphonic acid derivatives and esters of polyalkyl glycols are added in the Gulf region's desalination plants to hamper the growth of carbonate and sulphate crystals.

The greatest environmental risk of polyphosphate in reject brine on the near-shore marine environment lies in its nutritional value. When present with other nutrients, phosphate causes an overabundant growth of plants that are unusual or non-indigenous to the area. This excessive plant growth usually means a reduction in diversity of species, and results in an imbalance of food chain materials essential for intermediate organisms. In turn, their demise means an increase in BOD and turbidity of water.

Risk of volatile liquid hydrocarbons on the near-shore marine environment

Volatile liquid hydrocarbons (VLHs) are defined empirically as compounds with boiling points ranging between n-C6 and n-C14. Hydrocarbons within this range include normal and branched alkanes, monocycloalkanes, aromatics and alkyl-substituted analogues. Light aromatics such as benzene and toluene are considered to be the most immediately toxic components of petroleum other than the carcinogenic polycyclic aromatics. Traces of oil and grease leaking from operating power-desalination plants were found to contribute to the detected part per trillion (PPT) levels of VLHs in near shore marine environments. Since Gulf seawater is used for drinking after desalination, the produced distillate is free of all of the seawater's contaminants except for VLHs that can vaporize and, consequently, co-distil during the desalination process.

Despite their documented hazard to the aquatic environment and their ubiquity, very little information is available on VLHs in the Gulf marine environment. The detected levels should not give reasons for concern.

Photo: Image 100

Desalination is a reliable alternative source of water, but environmental effects must be taken into account

Notes and References

The following are notes and bibliographical references to the articles contained within *Real Risk*, as provided by the individual authors. For further information on any article or author, please contact the publisher.

Introduction
"Vision without action is but a daydream, but action without vision is a nightmare" — a global framework for reducing risk of disasters

1. Title quote from a Japanese proverb.
2. Source: Centre for Research on the Epidemiology of Disasters, Brussels.

Bringing disaster risk into development thinking: how often do we need to be shaken before we are stirred?

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4. As a general rule, it costs around ten per cent more to build in a disaster-resistant manner.
5. The authors are Director and Lead Evaluation Officer at the Independent Evaluation Group of the World Bank. This paper summarizes the recent IEG evaluation *Hazards of Nature, Risks to Development*.

Subregional strategies for preventing and managing disaster-related food crisis

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26. This article is based on the UN/ECA policy paper, *Subregional Strategies for Preventing and Managing Disaster-related Food Crisis*, December 2005.

Risk reduction and mitigation in the aftermath of Hurricane Ivan: a year and a half after the OECS/ECLAC damage assessment

1. Grenada is comprised of seven parishes, which include the island of Carriacou and Petit Martinique; together they have a population of 102,632 people (according to the Government of Grenada Population and Housing Census 2001).
2. *Grenada: Macro-Socio-Economic Assessment of the Damages Caused by Hurricane Ivan*. OECS. September 2004.
3. Direct damage refers to losses to assets and stocks at the time of the disaster. Indirect damage is defined as losses in flows (income and production flows following the occurrence of the disaster).
4. Of the six parishes on the island of Grenada, which were impacted by hurricane Ivan, four: St. George, St. David, St. Andrew and St. John, were most severely affected.
5. Hurricane Emily, a category 1 system, passed through Grenada on 15 July 2005. The damage was estimated to be 12 per cent of GDP.
6. Risk is defined as potential hazard or danger, exposure to mischance or peril. As of 4 July 2006, donors had committed USD17 million to relief and reconstruction operations. Resilience is understood as the capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure.
7. ECLAC. Grenada: A Gender Impact Assessment of Hurricane Ivan Making the Invisible Visible, LC/CAR/L.48. 29 June 2005.
8. ECLAC sub-regional headquarters for the Caribbean (Port of Spain, Trinidad and Tobago). The opinions here expressed are the author's own and may not coincide with those of ECLAC. Comments are welcome and can be sent to esteban.perez@cepal.org

Further reading:
USAID (March 2006) Grenada Business and Agriculture Development Programme. Final Report and Impact Assessment.
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Dynamic hazard mapping for food security: Examples from sub-Saharan Africa

1. Simply put, vulnerability is the product of two factors: exposure to risk, and coping capacity. When a population has a high exposure to potential risk (such as drought) and a low capacity to cope with such a shock, it is said to be very vulnerable to a loss in livelihood and food security.
2. See http://www.fao.org/giews
3. This is the main, unanimously agreed principle of the Kobe declaration (World Conference on Disaster Reduction, Kobe, Japan, January 2005).
4. This region includes the low rainfall band between the Sahara desert and the Sudanian ecological zones of West Africa. It is home to some of the world's poorest countries, such as Burkina Faso, Chad, Mali, Mauritania, Niger.
5. The SPI can be used to determine the rarity of a drought or an anomalously wet event at a particular timescale for any location in the world that has a precipitation record.
6. Henri Josserand is Chief of the Global Information and Early Warning Service (GIEWS) at the FAO/Rome.

NATO's growing humanitarian role

1. As Deputy Assistant Secretary General in NATO's Operations Division, Maurits Jochems is responsible for the alliance's work in the field of civil-emergency planning, among other areas. This article was first published in *NATO Review*.

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– Goldenberg, S.B., et al. (2001), 'The recent increase in Atlantic hurricane activity: Causes and implications,' *Science* 293, 474–479
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Property insurance in the post-Katrina world

1. This material is not intended as an offer or solicitation for the purchase or sale of a financial instrument. Securities or investments, as applicable, are offered in the (i) United States through MMC Securities Corp., a US registered broker-dealer and member NASD/SIPC, and (ii) European Union through Marsh Advanced Risk Solutions Ltd. ("MARS LTD"), regulated by the Financial Services Authority for the conduct of investment business in the United Kingdom. Reinsurance products are placed through qualified affiliates of Guy Carpenter. MMC Securities Corp. and MARS Ltd. are affiliates of Guy Carpenter.
2. The information in this section first appeared in an article by Liam Pleven, 'Bracing for the worst — believed at risk of a major hurricane, Northeast chafes as insurers pull out,' *The Wall Street Journal* 31 May 2006.

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10. Established after the 1998 Kandla cyclone, the Livelihood Relief Fund (LRF) of AIDMI has supported livelihood recovery of 12,912 victims to date. This demand driven and tailor-made relief has worked in 2001 Gujarat earthquake, 2002 riots, 2005 tsunami, 2005 Gujarat floods, and 2005 Jammu and Kashmir earthquake.
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Microinsurance for natural disaster risks? Insights from a ProVention/IIASA research initiative

1. See http://www.proventionconsortium.org

Top of the class! Governments can reduce the risks of disasters through schools

1. The review, as yet unpublished, is entitled *Let our children teach us! A review of education and knowledge in disaster risk reduction*. The researcher and author is disaster risk reduction expert Ben Wisner (bwisner@igc.org). The review was commissioned on behalf of the ISDR system Thematic Cluster/Platform on Knowledge and Education. This article coincides with the UN two-year World Disaster Reduction Campaign 'Disaster Prevention Starts at School', which was launched in June 2006.
2. See www.iiees.ac.ir
3. President Bill Clinton, UN Special Envoy for Tsunami Recovery, spoke of the "last mile in disaster preparedness" at the Third International Early Warning Conference in Bonn, Germany, March 2006. Highlights of the speech at: http://www.alertnet.org/thefacts/reliefresources/114372361721.htm
4. The ProVention Consortium has developed a community risk assessment toolkit that details the various community vulnerability assessment tools available: http://www.proventionconsortium.org/?pageid=39
5. This tool has been developed over five years and has informed the design of many programmes. The systematic process involves communities and other stakeholders in an in-depth examination of their vulnerability, whilst at the same time motivating preventative action. See http://www.actionaid.org.uk/100262/participatory_vulnerability_analysis.html for more information.
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The radio at school: transmitting knowledge and awareness for mitigation of natural risks

1. The project is a component of the ProVention Consortium, which manages a second Applied Research Grants Programme for Disaster Risk Reduction, with the University of Wisconsin Disaster Management Centre (http://dmc.engr.wisc.edu/) and the collaboration of other disaster centres.
2. About the author:
   Education: *Master in Social Psychology*, in progress since October 2004, Facultad de Filosofía y Letras. Universidad Nacional de Cuyo, Mendoza, Argentina. First degree: Psychology, Aconcagua University, Mendoza, Argentina, August, 2002; Thesis: 'Evaluation of human resources that are encouraged to intervene in the prevention and assistance to disasters.'
   Research experience: *Research Advisor*, in the research title: *Prevention – Mitigation of technological risks in our region from the Strategic Communication*, Universidad Nacional de Cuyo, Mendoza, Argentina, Jan. 2003 to Feb. 2005. Team leader of the project: *Study of awareness of earthquake risk in the population of Mendoza*, ProVention Consortium Disaster Risk Reduction Research Grant c/o Disaster Management Facility of The World Bank (It was declared of interest by the Direction of Civil Defense), July 2003 to Jan. 2004. Member of 'Psychologists without Frontiers' NGO.
   Contact information: E-mail: alejandradelca@yahoo.com.ar ; laradioenlaescuela@yahoo.com.ar

Disaster management graduate training: a contribution towards risk reduction in SADC

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Australia's aid programme: promoting effective disaster risk management in the Asia Pacific region

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Building local resilience for community transformation in three Latin American countries

1. **About World Vision**:
   World Vision is an international partnership of approximately 100 offices around the world, which exist to facilitate the reciprocal exchange of resources and skills between the developed and the developing world in order to enable the most vulnerable to live productive, self-reliant lives in their communities. World Vision International (WVI), located in Monrovia, California, serves a coordinating and facilitating function on behalf of national offices by providing regional management, technical resources, communications services, training, evaluation and fiscal accountability.
   World Vision (WV) commenced operations in Honduras in 1974 as the result of Hurricane Fifi with rehabilitation and reconstruction projects. It was

subsequently incorporated as a local organization, World Vision Honduras (WVH), and became a member of the WV Partnership, in 1979. It has since implemented a variety of programmes aimed at improving the standard of living in poor communities throughout Honduras. WVH is a respected member of FOPRIDEH, the Honduras association of development agencies and has served as chair of the association. WVH recently signed an MOU with COPECO (*Commission Permanente de Contingencias*, the emergency management commission of Honduras) detailing cooperation between the two entities.

WV accomplishes its work through an Area Development Programme (ADP) structure that is common to WV country operations in Latin America and other regions where it works. Each ADP is an independent Community Based Organization (CBO) and normally includes 15-20 rural communities targeted for participation in development programmes. WVH supports a total of 31 ADPs. Briefly stated, the function of the ADP structure is to empower communities to carry out their own development. Facilitating the strengthening of local capacities is the focus of WVH's role in its work with ADPs.

When it began in 2001 the WV Central American Mitigation Initiative (CAMI) project was part of a broad new Emergency Response and Disaster Mitigation (ERDM) initiative of the WV partnership. The ERDM initiative was part of WV's global strategy focused on large-scale emergencies. Currently called Humanitarian and Emergency Affairs, or HEA, ERDM is one of WV's three main branches of activity, including Transformational Development, Advocacy and Public Policy, and Humanitarian Emergency Affairs. Complementary activities at the regional and local levels extend the reach of the HEA strategy to the community level. HEA involves significant investments in human resources, training, and pre-positioning of relief supplies. The aim of HEA has been to strengthen WV's ability to respond to large-scale disasters and emergencies such as Hurricane Mitch.

Each National Office has developed a National Emergency Plan, which flows from the Global HEA strategy. A National Coordinator has been appointed to lead emergency response work at the country level. In order to maximize the reach of its HEA strategy and capitalize on its global investment in HEA to the benefit of the local communities it serves, WV seeks funding from a variety of sources for grassroots mitigation and disaster management initiatives.

The CAMI programme fit into the WVH HEA strategy. The WVH HEA strategy aims to optimize the results of prevention, preparation, mitigation and immediate response in order to minimize the negative impacts of disasters on human life. It also seeks to complement the concept of sustainable development in program areas. To accomplish this, the HEA strategy promotes a culture of disaster preparedness and mitigation throughout the organization and communities served. National, regional, and community Regional Rapid Response Teams (RRTs) work in hand-in-hand and coordinate and coordinate closely with other key actors (COPECO, NGOs, public and private institutions) to target the most vulnerable population groups.

This article is written as part of World Vision International's action research into community resilience.

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Managing climate risks through climate information applications: the Indonesian experience

1. This article is based on the numerous field visits and programme monitoring missions conducted by the authors. Corresponding author: subbiah@adpc.net

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3. *Agencia de Informacao de Mocambique* 2006, Maputo http://www.sortmoz.com/aimnews (accessed 21/04/2006)
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Disaster risk management needs media support: InWEnt's commitment to human resources development for journalists and press relations officers

1. InWEnt — Capacity Building International stands for the development of human resources and organisations within the framework of international cooperation. InWEnt's services cater to skilled and managerial staff as well as to decision makers from business, politics, administration and civil societies worldwide. InWEnt cooperates equally with partners from developing,

transition and industrialised countries. Each year some 55,000 people participate in our measures.

Mitigating Madhubani's menace

1. National Disaster Management of India, Ministry of Home Affairs – SITREP 20 Dt. 6.8.2004.
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3. www.undp.org.in/dmweb/Report/Quarterly/1QtrlyRpt.pdf
4. Census of India 2001.
5. Kennedy Dhanabalan is Director, Development Education and Capacity Building (DE&CB), and Esther Ghosh is an Officer, Disaster Management Unit with the Evangelical Fellowship of India Commission on Relief (EFICOR), New Delhi. www.eficorhq@vsnl.com

The tsunami hazard map — its role in tsunami preparedness for individuals and communities

1. These techniques were introduced in detail in *Know Risk*, UN/ISDR 2005.
2. The images prepared for the Taro area are accessible at http://www.pref.iwate.jp/~hp010801/tsunami/cg/3d_taro.htm

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The development of bamboo houses in earthquake prone rural areas, Yunnan, China

1. The author gratefully acknowledges the grant awarded by the ProVention Consortium to fund this research, and the support of the Asian Disaster Preparedness Center. Appreciation is also given to the mentor of this project, Dr Zhenyao Wang, Director General of the National Disaster Reduction Center of China.

Risk resilient communities: the Aga Khan Development Network in northern Pakistan

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3. www.dask.gov.tr/
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5. See www.istanbul.gov.tr and http://www.ibb.gov.tr/en-US/AnaSayfa/
6. Details of the Neighbour Disaster Support Project can be found at http://www.mag.org.tr/eng/index.html
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More to lose: Reducing family vulnerability to flood and storm damage in central Vietnam 1989-2006

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Are we ready for the next big event? NASA's strategy for Earth observations and solutions for society

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Review of UK space activities in support of disaster reduction: An update

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Effective risk reduction through monitoring of the environment from space

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1. The authors extend their special thanks and gratitude to their NASA colleagues: Charles Ichoku, Patrick Coronado, David Toll, Molly Brown and Assaf Anyamba for providing support in the development of this article.

GIS and spatial technologies in disaster management: a case study approach

1. For more information on RMSI or its services, please contact:
   Name: Inderjit Claire
   Designation: Director Sales
   E-mail: Inderjit.Claire@rmsi.com
   Phone: + 91 120 251 1102
   Fax: +91 120 251 1109