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Foreword

While many people are aware of the terrible impact of disasters throughout the world, few realize that this is a problem that we can do something about. This report, Living with Risk: A Global Review of Disaster Reduction Initiatives, should help to change that. It contains many examples of action by individuals, communities and governments, not only to reduce the risks and impacts of natural and technological hazards, but also to avoid creating those risks in the first place.

The scale of the problem is enormous. Disasters arising from floods, droughts, storms, earthquakes, fires and other events create great human misery and crippling economic losses. In 2002 alone, there were more than 500 disasters, which killed more than 10,000 people, affected 600 million others and caused $55 billion in total damages and $13 billion in insured losses. Disasters are also diverting precious resources away from efforts in developing countries to escape from poverty.

Communities will always face natural hazards. But hazards only become disasters when lives and livelihoods are swept away, mainly as a result of human activities. The vulnerability and what disaster analysts call "risk burdens" of communities and countries are being increased through a myriad of everyday development decisions at individual, local, national and international levels. For example, populations are too often being concentrated in risky areas such as flood plains. In addition, the destruction of forests and wetlands is harming the capacity of the environment to withstand hazards. Looming above all this is the threat of global climate change and rising sea levels as a result of increased greenhouse gas concentrations in the atmosphere caused by human activity.

This report, coordinated by the secretariat of the International Strategy for Disaster Reduction (ISDR), reflects a comprehensive effort by the United Nations system to review disaster reduction initiatives throughout the world. I hope it will contribute to more informed decision-making, including improved planning, better regulatory mechanisms and, most of all, innovation in development and environmental protection activities. A key recommendation of the report is that disaster risk reduction should be an integral part of all sustainable development projects and policies. Such an approach would further the objectives of the Johannesburg Plan of Implementation, and enhance efforts to achieve the Millennium Development Goals.

Disasters are a problem that we can and must reduce. I commend this publication to all involved in the effort to build resilient communities and nations in our hazard-filled planet.

Kofi A. Annan
Secretary-General
United Nations

Introduction

In recent years, there has been a major shift in peoples' attitudes and behaviours towards coping with natural disasters. In the past more emphasis was placed on humanitarian response and relief activities, with little attention being paid to disaster reduction strategies that have the potential to save thousands of lives by even the simplest of measures. Today, there is increasing recognition that while humanitarian efforts are important and need continued attention, risk and vulnerability are crucial elements in reducing the negative impacts of hazards and thus essential to the achievement of sustainable development.

The idea for conducting a global review of disaster reduction initiatives was born in the new millennium, following the United Nations International Decade for Natural Disaster Reduction (1990-1999). The Decade showed that despite the decline in loss of lives, the number of disasters and related economic losses is in fact increasing. In many cases such losses were due to a lack of coherent disaster reduction strategies by international and regional organizations, governments and decision-makers and the development of a culture of prevention among the public at large.

The Inter-Agency Secretariat of the International Strategy for Disaster Reduction launched the preliminary version of *Living with Risk - a global review of disaster reduction initiatives* in 2002, as a contribution to the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa of the same year. It was circulated among many people engaged in the humanitarian, environment and development sectors and involved in disaster risk reduction. The present version takes account of their many useful comments and critiques, reflecting a common concern in building disaster resilient communities and reducing human, social, economic and environmental losses due to natural hazards.

Living with Risk - a global review of disaster reduction initiatives is intended for people interested and practitioners in disaster risk management and sustainable development. It seeks to provide guidance, policy orientation and inspiration as well as a body of reference to further the study of the subject. Rather than focusing on specific experiences of disaster preparedness, response or recovery, it aims at providing a comprehensive compilation of initiatives and reference information on disaster risk reduction.

Reviewing past and present achievements in disaster reduction and outlining the broad range of activities and the many actors involved, *Living with Risk - a global review of disaster reduction initiatives* contributes to the process of establishing a common understanding of the subject. It complements the UNDP publication *Reducing Disaster Risk: A Challenge for Development* (2004), identifying trends and highlights future challenges and priorities in ensuring safer and sustainable communities.

The findings will form the backbone to the ten-year review of the implementation of the Yokohama Strategy and Plan of Action (1994). It will also contribute to set the future international agenda for disaster risk reduction to be discussed at the second World Conference on Disaster Reduction to be held at Kobe-Hyogo, Japan in January 2005.

The review is divided into chapters that closely follow the areas of focus as set out in the framework for disaster risk reduction described in detail in chapter six. Each chapter is divided into sections that address issues related to the overall chapter theme, concluding with a list of future challenges.

Commencing with an overview of current understanding and related contexts of disaster reduction, chapter one examines the evolution of the subject from its academic and scientific beginnings to its political implications in the realm of sustainable development of today. The second chapter explores the concepts of risk and vulnerability in terms of trends in hazards and the impacts of disasters, with a particular focus on risk assessment.

The third chapter outlines crucial elements of policy and political commitment for disaster reduction at the regional, national, municipal and local levels, using examples to demonstrate the importance of good governance and community participation in institutional and policy frameworks. It presents a comprehensive framework to guide and monitor disaster risk reduction as a tool for disaster risk management practitioners that can be adapted and applied in their daily work, jointly developed by the ISDR Secretariat and UNDP. Chapter four discusses the importance of knowledge exchange and information management through the sharing of experiences, networking, education, research and public awareness. Specific disaster reduction applications are considered in chapter five, including environmental management, land use planning, structural measures and the protection of critical facilities, the use of financial instruments and early warning systems.

In conclusion, chapter six summarises the key priorities in disaster reduction, paying particular attention to the need for better understanding of the subject, in addition to monitoring progress and setting specific targets for the future. It presents a comprehensive framework to guide and monitor disaster risk reduction as a tool for disaster risk management practitioners that can be adapted and applied in their daily work.

A list of acronyms and subject index appear at the end of this volume. A series of annexes that complement the information appearing in the main text, including a full glossary of terms, directory of organizations, overview of international agendas related to disaster reduction, bibliography and extracts of the Johannesburg Plan of Implementation resulting from the WSSD can be found in the accompanying volume.

Living with Risk - a global review of disaster reduction initiatives is a dynamic project that will require sustained efforts to maintain a comprehensive and systematic review of ongoing activities in disaster risk reduction. The application of a framework (as described in chapter six) to measure disaster risk reduction efforts over time is a good starting point which can contribute to the achievement of the objectives of the International Strategy for Disaster Reduction.

Preface: A journey to a safer world

Living with risk - disaster reduction strategy

A disaster reduction strategy is a global challenge today and for the future. It involves every human community and almost every human endeavour. It also involves almost every physical phenomenon on the planet, from the high stratosphere to the abyssal depths.

The challenge of a disaster reduction strategy, the theme of this review, is to find a way to live with these phenomena, rather than die from them. Earthly powers are a fact of life and one side of the coin of a good life. A natural disaster is only a disaster because people are in the wrong place at the wrong time, had no choice but to be in the way of a disaster or were caught unawares when it struck.

The 1990-1999 UN International Decade for Natural Disaster Reduction (IDNDR) was dedicated to promoting solutions to reduce risk from natural hazards. The decade ended with more deaths from more disasters, involving greater economic losses and more human dislocation and suffering than when it began. But could dedicating one decade to the topic be expected to solve the consequences of centuries of mismanagement and of passive fatalism before the vagaries of nature?

What IDNDR put in motion was an irreversible and positive political and social process. This review and the International Strategy for Disaster Reduction (ISDR) will build on this positive force. ISDR will foster greater awareness, public commitment, knowledge and partnerships to implement risk reduction measures of all kinds, at all levels.

A more vulnerable world

Global trends shows increasing losses from disasters. The reason is both simple and complex; it has to do with how people and societies are becoming more vulnerable. Although the frequency of dramatic natural events may be constant, human activities contribute to their increased intensity. Impact depends on development practices, environmental protection, regulated growth of cities, distribution of people and wealth and government structures. Human activity also has an impact on the planet's climate, which may result in increased sea levels and potential disasters.

The number of people at risk has been growing by 70 to 80 million per year. More than 90 per cent of population growth is in the developing world, among people with the smallest share of resources and the biggest burden of exposure to disasters.

In theory, natural hazards such as earthquakes, floods, drought, storms, tropical cyclones and hurricanes, wildfire, tsunami, volcanic eruptions and landslides can threaten everyone. In practice, proportionally, they tend to hurt the poor most of all. This is because the poor outnumber the rich and live in greater density in more poorly built housing on land most at risk.

But there were sharp reminders of human vulnerability in recent years, in the developed world as well as the developing nations. Europe suffered the worst floods for centuries, while Australia was hit by serious drought. Tropical cyclones hit Mauritius and Réunion, Republic of Korea, Japan and Mexico, and tornadoes left a trail of devastation in the United States. The insurance giant Munich Re counted 700 natural catastrophes in 2002, and estimated the economic losses at US$ 55 billion. In 2003, the World Meteorological Organization (WMO) pointed to record extremes of weather around the world. In May 2003, the United States recorded the highest number of tornados in any one month: 562, which killed 41

people. And June 2003 was the hottest month on record in Switzerland for 250 years. In India, 1,400 people died in a pre-monsoon season heatwave with temperatures reaching 49 degrees Celsius.

The price of life is constant vigilance. Natural hazards are constant threats. But every year the potential loss to life and livelihood soars as people converge in cities, where now half of the people of the planet live. With the growth of cities and populations come changes in the landscape and the disruption of natural ecosystems. Hillsides are cleared of trees for building materials and firewood but not replanted. Wetlands are drained to make space for new housing or workplaces. Rivers are engineered to follow unnatural routes. But with no trees, there is more erosion, and more silt to clog the rivers. All of these things make landslides, floods or drought more likely - and when they occur, more devastating.

People who have to struggle every day just to survive do not have the time or the strength to worry about more distant environmental and natural hazards. So a disaster reduction strategy is inseparable from social and economic development and from thoughtful environmental management. These are at the heart of sustainable development. A disaster reduction strategy must therefore be built on sustainable development policies which take into account potential risks and plans to reduce them, involving everyone and providing not only help but hope.

Imagine all the people...

It is possible to imagine a community or a nation that lived with a regard for nature, despite its hazards, with a coherent disaster risk reduction strategy in place.

Housing would be built out of appropriate materials, adapted to local conditions and according to building codes. Houses, hospitals, schools, markets, factories, government offices, power supplies and other critical services would be built on sites least exposed to risk. Communities would maintain forested or wetland areas as a form of natural flood control, as sources of local renewable revenue and as security against other threats such as erosion and landslide.

Civilians and government officials would be aware that a hazard that threatened one family or settlement would also be a threat to all. They would maintain a network of early warning systems and watchfulness, linked to the experts who monitored weather signals or seismic instruments.

Elected or traditional leaders would have regular dialogue not just with local officials and citizens but also with government agencies and scientists. Village councils would have ensured structures that serve as safe shelters in a cyclone and safe ground for livestock in the event of flood. Schools would teach children what to do when the river rises or when the earth begins to shake. Farmers would have granaries or fodder stores safe from storm and above any likely flood level. Health facilities would be safe and health centres would work with communities to reduce risk from disaster. Householders would have small but secure savings to help them through disruption caused by storm or inundation.

These communities would accept that information and communication were the most important elements of all. People would routinely listen to daily weather reports and follow local political and economic debate through radio, newspapers or television. Such communities would be more likely to shore up their own flood defences, maintain their drainage and secure their housing against destruction, through communal action. Legislators would understand that public safety was part of their obligation and administrators, of course, would be expected to police such legislation.

A journey to a safer world

This review, aimed mainly at practitioners as a guide and reference, is about how we can continue to develop a culture of prevention. It is a voyage of both discovery and rediscovery, about how human decisions increase or reduce vulnerability to natural hazards. It illustrates lessons and experiences in disaster risk reduction. It explores the way in which the understanding of disaster management and risk has evolved over recent years. It takes account of the technologies of the future - the satellite sensors that might read telltale signs of volcanic activity, seismic shift or collapsing hillsides days or weeks before any catastrophe occurs, or telemetry that can monitor the build up of soil moisture in a watershed that could serve as a warning of sudden flooding downstream.

Most of all, it looks at how societies organize themselves, how communities interact with each other, how civic and national authorities respond to the challenges of natural hazard. It explores the mosaic of interests, the kaleidoscope of attitudes and the network of actors that must be mobilized towards realizing risk reduction and disaster prevention.

The review considers how warnings progress from the work of technical specialists to the government authorities and from these to the people at risk. It considers the political short-sightedness, the increasing vulnerabilities and the unmet challenges that turn environmental degradation and natural and technological hazards into social and economic disasters in different cultures and societies.

The review explores the different strategies demanded by different kinds of human and environmental conditions. But it also addresses a universal truth; any disaster reduction strategy demands, first and foremost, political will. This commitment must then be linked to national and local development planning and sustainable action.

It builds on an understanding that risk reduction and disaster preparedness always make better economic sense than reliance on disaster relief. Although small groups cooperate spontaneously because of immediate shared danger, larger societies need coherent legal obligations and responsibilities that foster the involvement of the community and the participation of its people to face long-term risks.

None of these things can happen without some form of public debate and education at every level of society. It will require shared thinking at both international and regional levels because nations often share a forested terrain, a river or a mountain chain. Inevitably, they have a common interest in disaster prevention. It will also require new ways of looking at the landscape, with an understanding not simply on how it might be exploited but also on the price it will exact for the wrong kind of exploitation.

Secure societies are those that have learned to live with their land as well as from it. Disaster reduction strategies will have succeeded when governments and citizens understand that a natural disaster is a failure of foresight and evidence of their own neglected responsibility rather than an act of god.

Chapter 1

Living with risk - focus on disaster risk reduction

1.1 Setting the scene: understanding disaster risk reduction

The power and drama associated with natural disasters have always fascinated people. Prior to the widespread use of global communications, disasters seldom had the possibility to influence decisions and events beyond the area of immediate impact. The initial reaction of people who were not immediately affected by the tragedy was to organize urgent specialized services or other forms of help to respond to the needs of the victims.

This chapter intends to set the scene and discuss the strategic shift from disaster management practices towards an integrated disaster risk reduction approach in the context of sustainable development, including the following:

- *natural disasters shaping the agenda;*
- *learning risk reduction values from earlier societies;*
- *the shift towards disaster reduction;*
- *International Decade for Natural Disaster Reduction (1990-1999);*
- *International Strategy for Disaster Reduction;*
- *disaster risk reduction: a shared responsibility;*
- *understanding the meaning of disaster and risk reduction; and*
- *defining a few key terms.*

For more information on trends in hazards, vulnerability and disaster impact, see chapter 2.2.

Natural disasters shaping the agenda

In the final years of the 1990s, several powerful natural disasters occurred in different parts of the world, in countries large and small, industrialized or agrarian, technologically sophisticated or traditionally focused. The types of natural hazards that triggered these disasters varied from the seemingly unexpected occurrence of earthquakes, to more predictable seasonal floods and periodic storms.

Other less immediate and slowly evolving hazards such as drought and environmental degradation affected even more people with potentially greater costs for their future. More than anything else, the media images of natural disasters at the close of the 20th century underscored the human consequences and social dimensions of these events.

One need only recall the power of Hurricane Mitch that damaged up to 70 per cent of the infrastructure in Honduras and Nicaragua in 1998, devastating the economies of all the Central American countries, which are yet to recover fully.

One year later, the worst cyclone in 100 years hit the Indian state of Orissa, affecting ten times as many people as Hurricane Mitch, destroying 18,000 villages in one night. At the end of 2001, the powerful typhoon Lingling caused extensive damage and over 500 fatalities in the Philippines and Viet Nam.

Floods of a previously unremembered scale occurred several times in the past ten years; in Bangladesh, China and Southern Africa, famously in the latter case where people had no recourse but to seek safety in trees. In 1999, Mexico experienced its worst floods since 1600. Almost 300,000 people were made homeless.

In 2002, unprecedented flooding occurred in many countries, with particularly severe events causing losses of more than US$ 15 billion in European countries in the Elbe, Danube and Vltava river basins. In August 2002, the World Meteorological Organization (WMO) stated that "floods in more than 80 countries have killed almost 3,000 people and caused hardship for more than 17 million worldwide since the beginning of the year".

The trend during the last three decades shows an increase in the number of natural hazard events and an increase in the number of affected populations. However, even though the number of disasters has more than tripled since the 1970s, the reported death toll due to these disasters has halved.

Despite losses of US$ 30 billion in 2000, an amount that is only moderate in comparison to the average annual loss of the past decade, both the number of major natural disasters and their costs have increased rapidly in recent years.

In 2000, the insurance industry recorded 850 major loss events in the world, one hundred more than the previous record year in 1999. While the losses recorded in 2000 were lower than the US$ 100 billion incurred in 1999, they provide little comfort to the overall trend during the past decade. Overall, the 84 great natural disasters recorded in the 1990s number three times as many as those that occurred in the 1960s. Moreover, the combined economic loss of US$ 591 billion in the 1990s was eight times greater than that of the 1960s.

Ten thousand people died in natural disasters in 2000, compared to more than 70,000 in the previous year, or over 500,000 in the previous ten years. These figures must be treated with caution, as the accompanying social and economic cost of disasters is difficult to estimate.

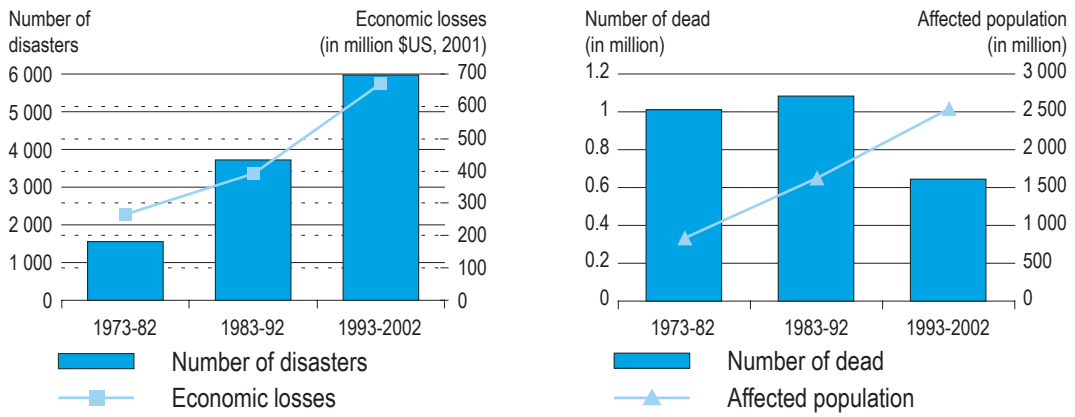
By and large, insurance claims tend to be misleading as an estimate of the economic impact of disasters. For the 1999 floods in Austria, Germany and Switzerland, at least 42.5 per cent of damage was covered by disaster insurance. But in Venezuela the same year, only four per cent of flood damage was covered.

Generally, disaster statistics tend to be more precise on a smaller scale; in particular on the national and regional level where the evaluation of damages is undertaken in a more systematic manner, based on agreed methodologies.

However, this is not the case in all regions and notably in Africa, where the lack of coherent disaster-related figures means the impact of disasters is highly underestimated. In addition, large disasters receive much media attention and the setbacks that these events create in the development process are well noted. Some experts estimate that if the economic impact of the smaller, localized, but often recurrent disasters were assessed, all of these figures would be much higher.

These statistics also do not appropriately reflect the millions of poor people whose lives are indirectly disrupted by the economic impact of natural disasters. Their ability to raise a modest income is reduced and the prospect of escaping poverty postponed. Similarly, the loss of women's

Figure 1.1
Economic and human impacts of disasters*, 1973-2002



Source: EM-DAT: The OFDA/CRED International Disaster Database - www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium, 2004
*Note: Includes drought, earthquake, epidemic, extreme temperature, famine, flood, industrial accident, insect infestation, miscellaneaous accident, land/debris-slides, transport accident, volcano, wave/surge, wildfire and windstorm.

home-based work space, supplies and equipment can have serious repercussions for the household economy but these losses to workers in the informal sector are rarely documented. While all of these losses may be modest in absolute economic terms, they are socially devastating.

There is a demand from the development sector for reliable and systematic data on disasters to assess socio-economic impact in the short term. In the long term there is a need to measure the consequences of the many smaller and unrecorded disasters. While attempted in limited areas, a need remains to document consistently these losses that are often recurrent and that are eroding the capacities of communities to grow and develop.

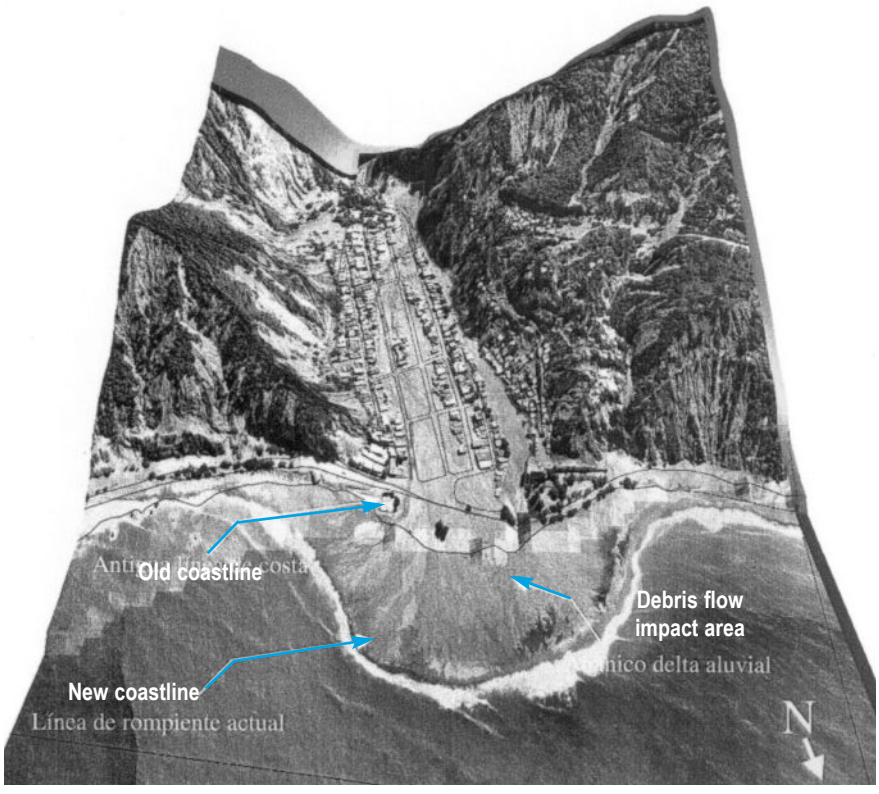
Whatever the scope of a hazard to induce a crisis, it is now widely understood that prevailing conditions within any group of people in a society determine the extent of their susceptibility or resilience to loss or damage.

There is recognition across a growing number of professional fields and in some governments that different population segments can be exposed to greater relative risks because of social or economic inequalities that create more vulnerable everyday living conditions. Because of this, disaster reduction has become increasingly associated with practices that define efforts to achieve sustainable development.

The relationships between human actions, environmental stewardship, climate change, and disaster risks are becoming ever more crucial. Disasters not only affect the poor and characteristically more vulnerable countries but also those thought to be well protected. In recent years, Canada, Czech Republic, France, Germany, Poland, United Kingdom and United States experienced record-setting floods of such magnitude that previously accepted procedures for protection and the utility of structural barriers have had to be re-evaluated.

The El Niño/La Niña events of 1997-1998 were the most intense occurrences of the cyclical climatic variation during the 20th century. Beyond representing costly economic variations to normal climate expectations, these events also created conditions around the world which led to extensive flooding, extended drought conditions and widespread wildfires.

The extraordinarily heavy rainfall associated with Hurricane Mitch caused a landslide at the Casita volcano in Nicaragua that was 18 kilometres long and 3 kilometres wide. It totally destroyed three



The village of Carmen de Uria, Venezuela, was completely covered by debris flow in December 1999 (shaded area indicates location of former settlement)
Photo: R. Prado, 1999.

towns and killed more than 2,000 people. In 1999, torrential rains triggered the landslide of denuded and unstable slopes in Venezuela resulting in more than 20,000 fatalities.

Less than two years later, one of the earthquakes in El Salvador caused a landslide that buried almost 700 houses of a well-established neighbourhood. While the houses may once have been safely situated, uncontrolled development or unregulated land-use practices such as deforestation and slope-mining on the hill above them created a hazardous situation that might have been avoided. Other earthquakes of recent years in Algeria, Colombia, El Salvador, Greece, India, Italy, Peru, Taiwan (Province of China), and Turkey have also shaken complacent official views about building practices.

The most severe winter storms in a century swept through Canada in 1998, through Western Europe in 1999, and the following year in Mongolia, with even greater loss of livelihoods and longer-term consequences because of the decimated flocks of nomadic herders. In 2001, disastrous floods and mudslides caused more than 800 fatalities, most extraordinarily in the Algerian capital, Algiers.

The economic and public health consequences of uncontrolled wildfire and related conditions of severe atmospheric pollution proved to be widespread and severe, blanketing neighbouring areas in Central and North America, South-East Asia, Southern Europe, and Australia.

In general, in these cases, the drama of such disasters and the urgent international activity to provide emergency relief commands the attention of the international media for only a few days. However, the consequences of disasters last much longer and are more poignantly measured in isolation – lives lost, livelihoods disrupted, property destroyed and environments damaged. These losses impede human development and often erode previously hard-won individual and national accomplishments. They also compromise current and future resources upon which societies and future generations depend.

Learning risk reduction values from earlier societies

There are early historical examples of societies protecting their people and their important resources. This was accomplished first by anticipating potential catastrophes based on knowledge of hazardous conditions and possible destructive events, then by investing in protective measures.

Almost 2,000 years ago, the Chinese invented an ingeniously simple seismograph that indicated the direction of the epicentre and measured the force of earthquakes. Over more than 1,000 years, the Chinese constructed protective dykes in anticipation of the annual flooding of the Yangtze and other major rivers.

The Incas, living in the Andes between the 13th and 15th centuries, took great care to create terraces on steep slopes to conserve the scarce soil and water necessary for their crops. Many of these terraces remain today, as do similar constructions maintained for over 1,000 years in the mountain provinces of Indonesia and the Philippines.

Low-lying countries in Northern Europe, such as the Netherlands, are famous for constructing an extensive system of sea dykes that have both reclaimed land and protected inhabitants from flooding since the 18th century.

Structures were also built elsewhere to provide protection from floods. Embankments in Shanghai, China and similar constructions in Singapore have protected lucrative commercial and port activities since the middle of the 19th century.

In Viet Nam, villagers have been obliged over the centuries to clean, repair and strengthen their crucial irrigation channels and sea dykes prior to the start of every annual cyclone season. This has been recognized as a necessary precaution to ensure the continued cultivation of rice, on which the society has always depended.

Anticipating the consequences of drought and seeking to invoke protective measures against famine, officials in India devised policy measures and risk reduction practices from an early period. An early example of such foresight is contained in the 1874 'Administrative Experience Recorded in Former Famines. Extracts from official papers containing instructions for dealing with famine, compiled under orders of the Government of Bengal', by J.C. Geddes.

"When rains fail and anxiety is felt, it is of the utmost importance to make active preparations and thereby put heart into the people. There is no greater evil than the depression of the people; for moral depression leads directly to physical deterioration."

Source: 'Preliminary Measures of Enquiry and Preparation when there is likelihood of distress', Bengal Famine Code, Bengal Secretariat Book Depot, Calcutta, revised edition 1913.

Principles for famine relief were prepared by the Indian Famine Commission in 1878, when it cited, as its first instruction, the need, "to be fully prepared for famine or scarcity". In the former state of Madras too, civil administrators were advised by the Madras Famine Code of 1883 "to monitor grain prices as an indicator of famine". These precautions and many more detailed instructions became enshrined in the Bengal Famine Code in 1895, later revised and published in more than 300 pages by the Bengal Secretariat in Calcutta in 1913. Many of these administrative instructions and preparedness procedures remain relevant 100 years later.

On the fragile char lands inhabited by the poor in Bangladesh, women engage in extensive homestead gardening and raise crops with medicinal properties for home health care. Preserving seeds, conserving water, composting to improve poor char soil, constructing housing resistant to strong winds, and planting seedlings to stabilize the shifting char lands are common activities evolved over time by women to make life safer during floods.

Traditionally, Pacific Islanders built their houses from local, lightweight but strong materials that could absorb torrential rains, yield superficially to the high winds of typhoons and withstand the shaking of earthquakes. Local crop preservation techniques were also used as a hedge against possible drought or other conditions of food shortage.

Traditional practices of farmers around the world have been influenced by locally-developed knowledge of weather patterns or naturally occurring indicators in plants and animals to forecast particularly harsh conditions. Though imprecise, these methods demonstrate an awareness of potential risk that have led people to consider alternate courses of action in order to protect their livelihoods.

More recently, with the increase of scientific knowledge, policies have been developed in some countries that try to protect people from the forces of nature or to control those forces. Sometimes those efforts have grown from concepts seeking to prevent or to reduce the immediate consequences of potentially hazardous conditions and the adverse effects that they could cause to surrounding life, habitation and property. It must be noted that they have met with mixed success over the long term, but additional experience has also been gained along the way.

Following extensive flooding that covered almost three-quarters of the country in 1987, Bangladesh officials launched an extended Flood Action Plan to study more than 25 different dimensions of flood prevention. Over three years and with an expenditure of several million dollars, an exhaustive multidisciplinary evaluation was conducted of the many different administrative, structural, social and economic aspects of both productive capacities as well as risks of flooding in the country.

The resulting recommendations overwhelmingly suggested the need for much greater investment in "flood-proofing" societies by learning to live with the inevitable floods in a way that would minimize harm and loss, rather than trying to prevent the powerful forces of nature. Findings were ultimately guided by the fact that almost the entire riverine country of Bangladesh is a highly fertile flood plain. The country would neither exist, nor be as productive as it is without the annual floods continually renewing and extending its landscape.

By contrast, the Japanese experience of monitoring volcanic activities associated with Mount Usu in Hokkaido is a telling example of how science and technology can save lives and assets when they are linked to effective early warning and evacuation procedures. Similarly, scientific monitoring showed an immediate threat posed by the possibility of Mount Pinatubo's crater lake breaching its walls and disastrously flooding villages on the flanks of the

volcano. This early warning allowed Philippine officials to drain the lake safely in a controlled manner, with full public awareness and preparations for evacuation had it been necessary.

In another example of developed experience, long-accepted policy measures and operational principles originally conceived to prevent forest fires are now understood to have created conditions of excessive fuel accumulation. This resulted in much more intense, uncontrollable and ultimately more costly wildfires at a later date. Now, more subtle measures are being employed in managing the relationship between natural fire hazards, human use of forested natural resources and sustainable environmental benefits.

The shift towards disaster reduction

It is important to establish a common understanding of the basic tenets of disaster risk reduction as this review addresses them. The outlooks, abilities and practices that are presented here are distinctive from those elements and understanding conventionally related to emergency or disaster management. Over the past 30 years, there has been a continuous evolution in the practice of crisis or disaster management. These bodies of practice have been known, variously, as civil defence, emergency assistance, disaster response and relief, humanitarian assistance, emergency management, civil protection, disaster mitigation and prevention, and total disaster risk management.

The subject of disaster risk reduction in the modern era draws its relevance largely from earlier contributions and previous practices in the field of civil defence and later disaster management. In this respect, the traditional focus has been on the preparation and improved operational capacities for more timely and effective response to an impending event, or the provision of urgent services to restore basic requirements of the public if a disastrous event has already occurred. In many places political commitment and the allocation of resources to address hazardous conditions have been concentrated overwhelmingly on short-term emergency contingencies.

There is no doubt that the role of relief assistance during the acute phase of a crisis will remain important and needs to be enhanced at all levels. However, the question must be asked: can modern societies afford to value their social and material assets only after they have been lost in a disaster?

By contrast, in more recent years and perhaps motivated at least partially by the frequency and severity of major disasters during the past decade, those people associated most closely with affected populations – local political authorities, a broad range of professional and commercial interests, public organizations, educational institutions and community leaders – are progressively recognizing the essential public value of sustained efforts to reduce the social, economic and environmental costs of natural hazards.

This translates into the need for much greater attention on implementation of protective strategies which can contribute to saving lives and protecting property and resources before they are lost. It is for this reason that a more holistic approach that emphasizes vulnerability and risk factors has coalesced around the concept of risk reduction, or disaster risk management.

There has, for example, been a tidal change in the understanding of these issues in countries in Central America over the past years, following the repeated devastating effects of natural disasters since 1998. European countries too have been forced to re-assess their respective exposure to risks, as they have been experiencing unacceptable and recurrent losses from natural hazards that exert increasingly severe consequences.

Although for different reasons, in such varied Asian countries as China, India, Japan, Thailand and Viet Nam, more emphasis is being placed on the identification and management of risks as part of development planning. Additional human and material resources are slowly being allocated to risk reduction activities from sources other than emergency contingency funds.

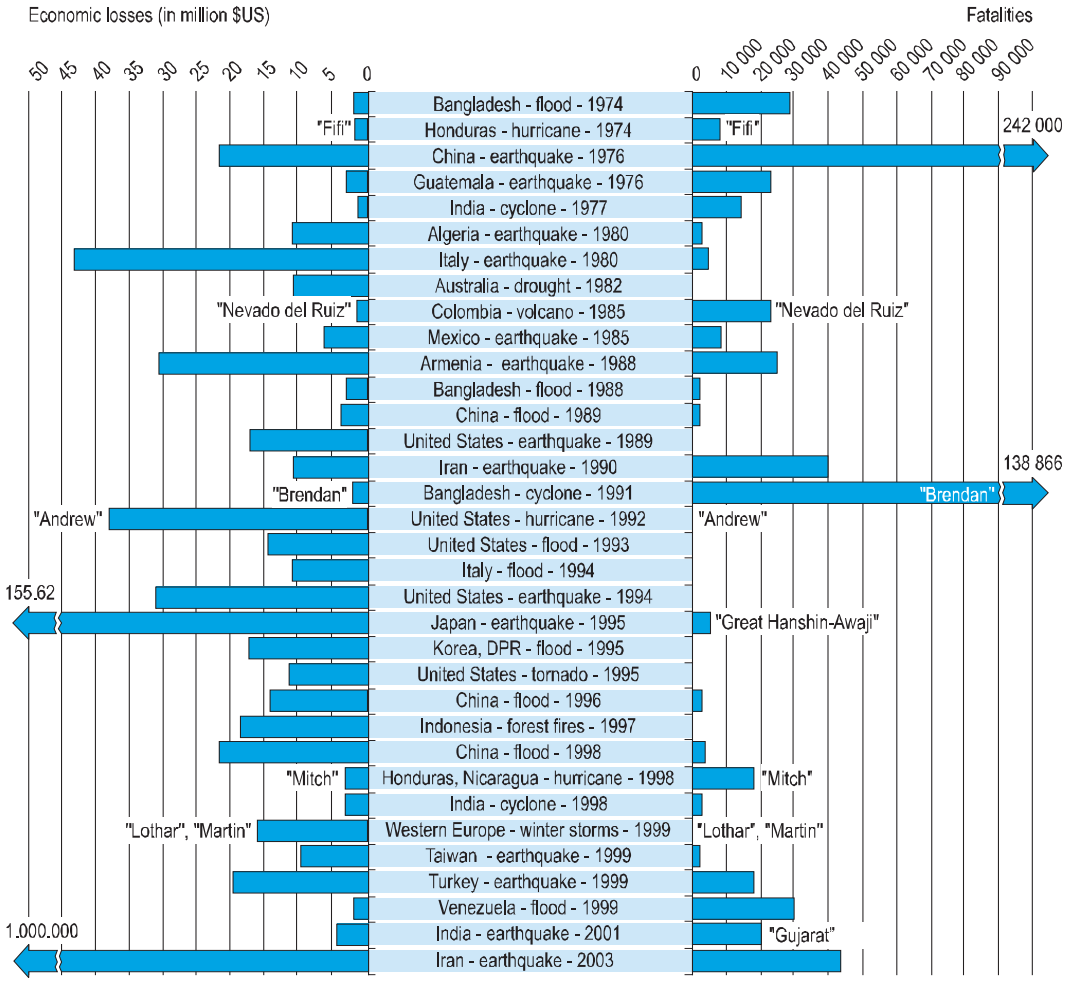
There is a growing recognition underlying such a rationale; the risk of disasters is fundamentally linked to environmental problems and unresolved issues essential for sustainable development. More countries now accept that political leadership cannot be allowed only to follow the loss and destruction of social assets and economic resources.

Disaster reduction policies and measures need to be implemented with a two-fold aim: to enable societies to be resilient to natural hazards and ensuring that development efforts do not increase vulnerability to those hazards.

It is equally significant that the reduction of risks is viewed as a continuous series of endeavours pursued across social, economic, governmental and professional sectors of activity. Instead of being understood as a specialization of security, emergency services or experts, comprehensive disaster risk reduction needs to involve many segments of society – starting with those members of the public who are themselves most exposed to anticipated hazards.

This understanding is essential if communities are to become more resilient to the effects of hazards so that disaster losses can be reduced in coming years. Such socially engrained and professionally routine activities make the news much less often, perhaps because they are mostly concerned with people doing their work, focused on incorporating risk awareness into their daily existence. It is difficult to report on 'what did not happen'. Nonetheless, they are the key to successful, and sustainable, disaster reduction strategies.

Figure 1.2
Some large impact* natural disasters in the last 30 years



Source: EM-DAT: The OFDA/CRED International Disaster Database - www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium, 2004
*Note: Includes disasters with at least 2000 people killed or 10 billion $US of economic losses (2002 $US value)

International Decade for Natural Disaster Reduction
IDNDR
1990 - 2000
Building a culture of prevention

International Decade for Natural Disaster Reduction (1990-1999)

Given the increasing concern about the impact of disasters, the UN General Assembly declared 1990-1999 the International Decade for Natural Disaster Reduction (IDNDR). Under the theme 'Building a Culture of Prevention', work was done to advance a wider commitment to activities that could reduce the consequences of natural disasters. Initially, IDNDR was influenced by largely scientific and technical interest groups. However, a broader global awareness of the social and economic consequences of natural disasters developed as the decade progressed.

The Yokohama Strategy and Plan of Action for a Safer World (Yokohama strategy), conceived at the World Conference on Natural Disaster Reduction in Yokohama in 1994, stressed that every country had the sovereign and primary responsibility to protect its people, infrastructure and national, social or economic assets from the impact of natural disasters. The importance given to socio-economic vulnerability in disaster risk analysis underlined the crucial role of human actions in reducing the vulnerability of societies to natural hazards and related technological and environmental disasters.

The 1995 IDNDR focus on 'Women and Girls: Keys to Prevention' was an example. This campaign encouraged local and national initiatives highlighting women's capabilities in disaster contexts. This in turn encouraged the need for wider participation of local communities to become involved in hazard and risk reduction activities, working together with a progressively broader range of professional interests and abilities identified as being related to the subject.

Box 1.1
The role of science and technology

The idea of launching a decade dedicated to natural disaster reduction came from the scientific community. It was motivated by a desire to expand the scope of scientific and technical abilities in disaster reduction.

Science and technology play key roles in monitoring hazards and vulnerabilities, developing an understanding of their continually changing patterns and in developing tools and methodologies for disaster risk reduction. The dissemination and application of new strategies and measures to protect lives, livelihoods and property within societies experiencing change are key areas of work for the scientific and technical communities.

Scientific knowledge and technical expertise have to be shared as an integral part of multidisciplinary technical cooperation. Efficient disaster reduction requires interaction among scientists, decision-makers and informed citizens.

However, the limitations of science and technology in responding to the problems of people and political processes identifying and managing risks need to be carefully considered. An over-concentration on technical abilities at the expense of the human aspects that compose the economic, social and political dimensions of societies will provide disappointing results in sustained commitments to risk reduction. In particular circumstances, science and technology can be misapplied, sometimes provoking or aggravating risks to a society.

The scientific and technical applications relating to each aspect of disaster risk reduction are addressed extensively throughout this review.

World Conference on Natural Disaster Reduction, Yokohama, 1994

Yokohama Strategy and Plan of Action for a Safer World

Basis for the strategy

"Natural disasters continue to strike and increase in magnitude, complexity, frequency and economic impact. Whilst the natural phenomena causing disasters are in most cases beyond human control, vulnerability is generally a result of human activity. Therefore, society must recognize and strengthen traditional methods and explore new ways to live with such risk, and take urgent actions to prevent as well as to reduce the effects of such disasters. The capacities to do so are available."

Principles

Although expressed in 1994, the following principles contained in the Yokohama strategy are possibly more relevant now to risk reduction than when they were conceived.

The Yokohama principles are as follows:

1. Risk assessment is a required step for the adoption of adequate and successful disaster reduction policies and measures.
2. Disaster prevention and preparedness are of primary importance in reducing the need for disaster relief.
3. Disaster prevention and preparedness should be considered integral aspects of development policy and planning at national, regional, bilateral, multilateral and international levels.
4. The development and strengthening of capacities to prevent, reduce and mitigate disasters is a top priority area to be addressed so as to provide a strong basis for follow-up activities to IDNDR.
5. Early warnings of impending disasters and their effective dissemination are key factors to successful disaster prevention and preparedness.
6. Preventive measures are most effective when they involve participation at all levels from the local community through the national government to the regional and international level.
7. Vulnerability can be reduced by the application of proper design and patterns of development focused on target groups by appropriate education and training of the whole community.
8. The international community accepts the need to share the necessary technology to prevent, reduce and mitigate disaster.
9. Environmental protection as a component of sustainable development consistent with poverty alleviation is imperative in the prevention and mitigation of natural disasters.
10. Each country bears the primary responsibility for protecting its people, infrastructure, and other national assets from the impact of natural disasters. The international community should demonstrate strong political determination required to make efficient use of existing resources, including financial, scientific and technological means, in the field of natural disaster reduction, bearing in mind the needs of the developing countries, particularly the least developed countries.

Box 1.2
Yokohama message

"We, the States Members of the United Nations and other States, having met at the World Conference on Natural Disaster Reduction, in the city of Yokohama, Japan, from 23 May to 27 May 1994, in partnership with non-governmental organizations, the scientific community, business, industry and the media, deliberating within the framework of the International Decade for Natural Disaster Reduction, expressing our deep concern for the continuing human suffering and disruption of development caused by natural disasters, and inspired by the *Yokohama Strategy and Plan of Action for a Safer World…* adopted the following Principles, Strategy and Plan for Action."

International Strategy for Disaster Reduction

The IDNDR provoked the recognition that disaster reduction was a social and economic imperative that would take a long time to fulfil. As the successor to IDNDR, the UN General Assembly founded the ISDR in 2000 to continue to promote work and commitment in disaster reduction. It has worked to shift the primary focus from hazards and their physical consequences to emphasize more the processes involved in incorporating physical and socio-economic dimensions of vulnerability into the wider understanding, assessment and management of disaster risks. This highlights the integration of disaster risk reduction into the broader context of sustainable development and related environmental considerations.

ISDR also provides a global framework for action with the objective of reducing human, social, economic and environmental losses due to natural hazards and related technological and environmental phenomena. It aims at building disaster resilient communities by promoting increased awareness of the importance of disaster reduction as an integral component of sustainable development. Its strategies build on lessons from IDNDR, the experience of the Yokohama Strategy and the Geneva Mandate of 1999.

In January 2000, through resolution 54/219, the General Assembly established two mechanisms for the implementation of ISDR; the Inter-Agency Secretariat and the Inter-Agency Task Force on Disaster Reduction. This was reconfirmed in resolution 56/195 in December 2001.

The General Assembly also called upon governments to establish national platforms or focal points for disaster reduction, and to strengthen them where they already exist, with a multisectoral and interdisciplinary approach.

Inter-Agency Task Force on Disaster Reduction

The Inter-Agency Task Force on Disaster Reduction (IATF/DR) was established in 2000 as the main forum within the UN system for devising strategies and policies for the reduction of disaster risks and vulnerabilities. It is tasked with identifying additional needs to improve disaster reduction policies and programmes, and further recommending remedial or additional action as may be considered necessary. In both cases, particular attention is given to ensuring complementary action by the different UN agencies involved in disaster reduction endeavours.

The Task Force is chaired by the UN Under-Secretary General for Humanitarian Affairs and is composed of up to 14 representatives of agencies and organizations of the UN system, up to eight representatives from regional entities and up to eight representatives of civil society and relevant professional sectors. The Director of the ISDR Secretariat acts as the Secretary of the Task Force.

In its first two biennia, the Task Force established four Working Groups to address climate variability, early warning, vulnerability and risk analysis, and wildland fires. An interest group focused on drought has drawn members from the Task Force to reflect the specific requirements of drought risks that cut across the other areas of attention. At present, the Task Force is reviewing its areas of focus and new subjects are being addressed, such as climate change, urban risk management, data management and preparation for the World Conference on Disaster Reduction in 2005.

Inter-Agency Secretariat of the ISDR

The Inter-Agency Secretariat of the ISDR (UN/ISDR) is the focal point within the UN system for coordination of strategies and programmes for disaster reduction and to ensure synergy between disaster reduction activities and activities in the socio-economic and humanitarian fields.

The Secretariat also serves as an international clearinghouse for the identification, management and dissemination of information pertaining to the current state of knowledge and range of activities underway that contribute to the progress of disaster risk reduction efforts around the world.

In part, this publication of a global review of disaster reduction initiatives reflects a growing international knowledge base about the subject and extends that information to an expanding field of collaborators. By means of this publication, *Living with Risk: A global review of disaster reduction initiatives*, ISDR seeks to advocate wider understanding and to further the greater multidisciplinary engagement of disaster risk reduction in practice. The many examples which it contains show that communities can become safer for their inhabitants, and disaster risks can be reduced by accomplishments working through political, professional, institutional and public forms of collaboration.

The Secretariat also develops activities such as advocacy campaigns to promote wider understanding about natural hazards and disaster risk to motivate a worldwide commitment to disaster reduction. A particularly important role is to encourage both policy and advocacy activities by promoting national committees, networks or platforms dedicated to disaster reduction, and working in close association with regional initiatives. Regional outreach programmes have been established in Latin America and the Caribbean and in Africa to this effect. Arrangements are proceeding to collaborate further with additional regional institutions in Europe, Asia and the Pacific.

The Secretariat has a facilitating role, bringing agencies, organizations and different disciplines together, providing a common platform and understanding of the scope of disaster risk reduction. In this regard, one main function of the Secretariat is to support the Inter-Agency Task Force on Disaster Reduction for the development of policies on disaster reduction.

Framework for action for the implementation of the ISDR

The Task Force, supported by the ISDR Secretariat, formulated in 2001 a framework for action for the implementation of ISDR with four main objectives:

- increase public awareness to understand risk, vulnerability and disaster reduction;
- promote the commitment of public authorities to disaster reduction;
- stimulate multidisciplinary and intersectoral partnerships, including the expansion of risk reduction networks; and
- improve scientific knowledge about the causes of natural disasters, as well as the effects that natural hazards and related technological and environmental disasters have on societies.

It also incorporates two additional activities specifically mandated to the ISDR Secretariat by the UN General Assembly:

- continue international cooperation to reduce the impact of El Niño and other aspects of climate variation; and
- strengthen disaster reduction capacities for the development of early warning systems.

In pursuing these objectives, the framework for action outlines the following areas of common concern:

- recognition and incorporation of special vulnerability of the poor and socially marginalized groups in disaster reduction strategies;
- environmental, social and economic vulnerability assessment with special reference to health and food security;
- ecosystems management, with particular attention given to the implementation of Agenda 21;
- land-use management and planning, including appropriate land use in rural, mountain and coastal areas, as well as unplanned urban areas in mega-cities and secondary cities; and
- national, regional and international legislation with respect to disaster reduction.

In 2003, following the completion of the preliminary version of Living with Risk: A global review of disaster reduction initiatives, the ISDR Secretariat in conjunction with UNDP developed a framework for guiding and monitoring disaster risk reduction (see chapter 6).

Disaster risk reduction: a shared responsibility

Governments and communities will benefit by understanding that disaster reduction policy is a wise investment. Direction and resource allocations often need to be provided from higher levels of authority within a society, even as decisions and individual commitment need to grow from the local understanding and participation by those people most immediately affected by disaster risks.

Where governments have not done so already, there is a need to regain a level of wide and inclusive national participation, before a disaster occurs. This public responsibility will require a collective discipline that can be sustained through the education and practice of many trades and professions.

Since disaster reduction is based on a continuous strategy of vulnerability and risk assessment, many actors need to be involved, drawn from governments, technical and educational institutions, professions, commercial interests and local communities. Their activities will need to be integrated into planning and development strategies that both enable and encourage the widespread exchange of information. New multidisciplinary relationships are essential if disaster reduction is to be comprehensive and sustainable.

Vulnerability should be considered in a broad context encompassing specific human, sociocultural, economic, environmental and political dimensions that relate to social inequalities based on age, gender, ethnicity and economic divisions.

Despite its negative consequences, a disaster also offers a good opportunity to formulate forward-looking policies pertaining to social development, economic growth, environmental quality and justice, in addition to other essential values that contribute to sustainability.

Table 1.1
Different management approaches: crisis management versus disaster risk reduction

Emergency assistance, crisis management		Disaster risk reduction strategies
1. Primary focus on hazards and disaster events 2. Single, event-based scenarios 3. Basic responsibility to respond to an event.	Emphasis	1. Primary focus on vulnerability and risk issues 2. Dynamic, multiple risk issues and development scenarios 3. Fundamental need to assess, monitor and update exposure to changing conditions
4. Often fixed, location-specific conditions 5. Responsibility in single authority or agency 6. Command and control, directed operations 7. Established hierarchical relationships 8. Often focused on hardware and equipment 9. Dependent on specialized expertise	Operations	4. Extended, changing, shared or regional, local variations 5. Involves multiple authorities, interests, actors 6. Situation-specific functions, free association 7. Shifting, fluid and tangential relationships 8. Dependent on related practices, abilities, and knowledge base 9. Specialized expertise, squared with public views, priorities
10. Urgent, immediate and short time frames in outlook, planning, attention, returns	Time horizons	10. Comparative, moderate and long time frames in outlook, planning, values, returns
11. Rapidly changing, dynamic information usage, often conflicting or sensitive 12. Primary, authorized or singular information sources, need for definitive facts 13. Directed, 'need to know' basis of information dissemination, availability 14. Operational, or public information based on use of communications 15. In-out or vertical flows of information	Information use and management	11. Accumulated, historical, layered, updated, or comparative use of information 12. Open or public information, multiple, diverse or changing sources, differing perspectives, points of view. 13. Multiple use, shared exchange, inter-sectoral use of information 14. Matrix, nodal communication 15. Dispersed, lateral flows of information
16. Relates to matters of public security, safety	Social, political rationale	16. Matters of public interest, investment and safety

Source: T. Jeggle, 2001.

The integration of disaster reduction strategies with development policies should happen before a disaster occurs, thereby addressing a broad range of social, economic and environmental problems as well. This requires the participation of all relevant sectors in a society such as environment, finance, industry, transport, construction, agriculture, education and health. It also requires different forms of management and outlooks than those typically identified with emergency or disaster management.

The most efficient forms of hierarchical command and control practices for crisis management are much less suited to the deliberate and more widely considered forms of public, private and professional participation in reducing risk and vulnerability in daily life. To be effective, disaster risk reduction practices have to draw their information and inspiration from many different sources in a society and be based on widespread participation.

Difference between a hazard and a disaster

"Strictly speaking, there is no such thing as a natural disaster, but there are natural hazards, such as cyclones and earthquakes. The difference between a hazard and a disaster is an important one. A disaster takes place when a community is affected by a hazard (usually defined as an event that overwhelms that community's capacity to cope). In other words, the impact of the disaster is determined by the extent of a community's vulnerability to the hazard. This vulnerability is not natural. It is the human dimension of disasters, the result of the whole range of economic, social, cultural, institutional, political and even psychological factors that shape people's lives and create the environment that they live in."

Source: Twigg, J. 2001.

Understanding the meaning of disaster and risk reduction

Disaster reduction strategies include, first and foremost, vulnerability and risk assessment, as well as a number of institutional capacities and operational abilities. Essential features of a disaster reduction strategy include the assessment of the vulnerability of facilities crucial to the social and economic infrastructure, the use of effective early warning systems, and the application of many different types of scientific, technical, educational and other skilled abilities.

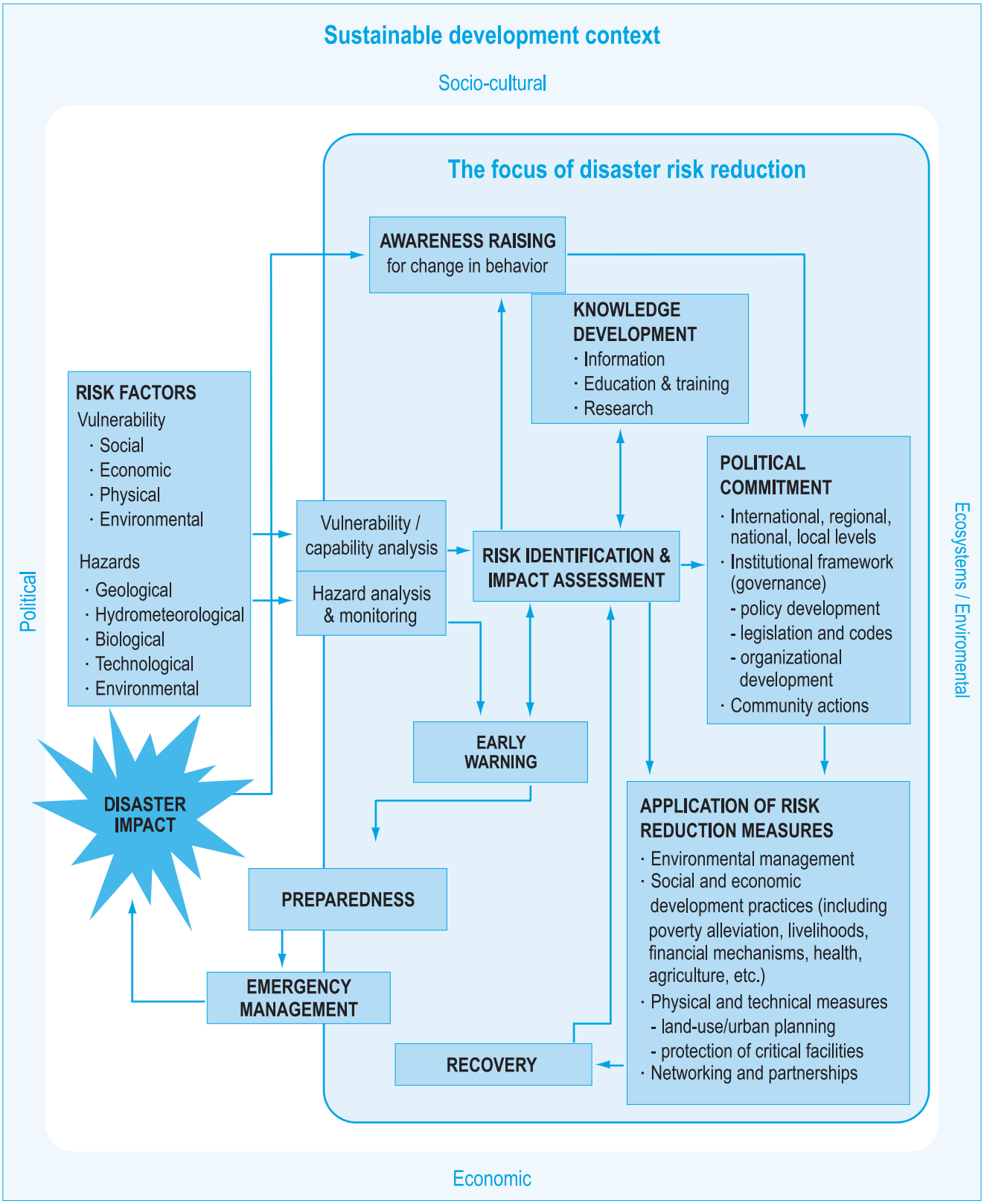
Sharing information and experience for the purposes of public information and all forms of education and professional training are important for creating a safety culture. Equally, the crucial involvement of local community action new forms of partnership can be motivated by the acceptance of shared responsibilities and cooperation.

Fortunately, modern forms of information access and communications can facilitate the wider exposure and networking that these new and shifting forms of association require. There are fundamental elements in every disaster reduction strategy, but the priorities, relative emphasis, available resources, and specific ways of implementation must take account of practices that are most suited to local conditions, understanding and effectiveness.

Figure 1.3 describes the general context and primary activities of disaster risk management, including the elements necessary for any comprehensive disaster risk reduction strategy. The sections of this review have been organized in consideration of these issues, with less emphasis on preparedness, response and recovery functions.

Figure 1.3

Framework for Disaster Risk Reduction



For more information see table 6.1, page 393

Defining a few key terms

One of the continuous functions of ISDR is to support a more uniform use of disaster related terms. This review provides concise definitions, based on a broad consideration of different international sources, in order to create a commonly understood terminology for disaster reduction issues. This effort will continue in the ongoing global review process to address a need expressed in several international forums, regional commentaries and national responses to the ISDR Secretariat.

Key terms used in this review are explained below. Definitions of additional terms can be found in Annex I.

Hazard

A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological and biological) or induced by human processes (environmental degradation and technological hazards). Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterised by its location, intensity, frequency and probability.

Vulnerability

The conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.

For positive factors, which increase the ability of people to cope with hazards, see definition of capacity.

Risk

The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.

Conventionally risk is expressed by the notation Risk = Hazards x Vulnerability. Some disciplines also include the concept of exposure to refer particularly to the physical aspects of vulnerability.

Beyond expressing a possibility of physical harm, it is crucial to recognize that risks are inherent or can be created or exist within social systems. It is important to consider the social contexts in which risks occur and that people therefore do not necessarily share the same perceptions of risk and their underlying causes.

Risk assessment/analysis

A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend.

The process of conducting a risk assessment is based on a review of both the technical features of hazards such as their location, intensity, frequency and probability; and also the analysis of the physical, social, economic and environmental dimensions of vulnerability and exposure, while taking particular account of the coping capabilities pertinent to the risk scenarios.

Capacity

A combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster.

Capacity may include physical, institutional, social or economic means as well as skilled personal or collective attributes such as leadership and management. Capacity may also be described as capability.

Coping capacity

The means by which people or organizations use available resources and abilities to face adverse consequences that could lead to a disaster.

In general, this involves managing resources, both in normal times as well as during crises or adverse conditions. The strengthening of coping capacities usually builds resilience to withstand the effects of natural and human-induced hazards.

Resilience / resilient

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. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures.

Disaster

A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.

A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.

Disaster risk management

The systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of hazards.

Disaster risk reduction (disaster reduction)

The conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development.

The disaster risk reduction framework is composed of the following fields of action:

- *Risk awareness and assessment including hazard analysis and vulnerability/capacity analysis;*
- *Knowledge development including education, training, research and information;*
- *Public commitment and institutional frameworks, including organisational, policy, legislation and community action;*
- *Application of measures including environmental management, land-use and urban planning, protection of critical facilities, application of science and technology, partnership and networking, and financial instruments;*
- *Early warning systems including forecasting, dissemination of warnings, preparedness measures and reaction capacities.*

Prevention

Activities to provide outright avoidance of the adverse impact of hazards and means to minimize related environmental, technological and biological disasters.

Depending on social and technical feasibility and cost/benefit considerations, investing in preventive measures is justified in areas frequently affected by disasters. In the context of public awareness and education, related to disaster risk reduction changing attitudes and behaviour contribute to promoting a "culture of prevention".

Mitigation

Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.

Preparedness

Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations.

Early warning

The provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response.

Early warning systems include a chain of concerns, namely: understanding and mapping the hazard; monitoring and forecasting impending events; processing and disseminating understandable warnings to political authorities and the population, and undertaking appropriate and timely actions in response to the warnings.

1.2 Contexts and policy framework of disaster risk reduction: sustainable development

"While we cannot do away with natural hazards, we can eliminate those we cause, minimize those we exacerbate, and reduce our vulnerability to most. Doing this requires healthy and resilient communities and ecosystems. Viewed in this light, disaster mitigation is clearly part of a broader strategy of sustainable development – making communities and nations socially, economically and ecologically sustainable."

Source: J. Abramovitz, 2001.

Political support for disaster risk reduction has to be established from the apex of political power but is only realistic if the perceptions of risk and the actions proposed accord with the cultural beliefs and habits of society.

The national character and chosen form of governance can be as much of a determinant in understanding and managing the risks in a given country as are other various social, economic and environmental determinants.

In today's world, societies are confronted with rapid change. Therefore, the value of disaster risk reduction can only be realized through rigorous identification and continuous evaluation of the relationships that exist between the beliefs and conditions in which people live, the changing environment people inhabit and depend upon for their livelihoods, and the forces of nature.

Most importantly, disaster risk reduction relies on the consequences of collective decisions made and individual actions taken or not taken. The emergence of a disaster reduction culture is conditioned by the following contexts and processes:

- political context;
- sustainable development in its three related contexts: sociocultural, economic and environmental; and
- regional considerations linking disaster reduction and sustainable development.

Promoting sustainability in disaster reduction means recognizing and making the best use of connections among social, economic and environmental goals to reduce significant hazard risks. This entails abilities to reduce exposure and aid recovery from infrequent large-scale, but also more common smaller-scale, natural and human-driven events.

The bottom line for any country, especially the poorest, is to build sustainable communities with a social foundation that provides for health, respects cultural diversity, is equitable and considers the needs of future generations. All countries require a healthy and diverse ecological system that is productive and life sustaining a healthy and diverse economy that adapts to change and recognizes social and ecological limits. This cannot be

Box 1.3
The six principles of sustainability

1. Maintain and enhance quality of life
2. Enhance economic vitality
3. Ensure social and intergenerational equity
4. Maintain and enhance environmental quality
5. Incorporate disaster resilience and mitigation into actions and decisions
6. Use a consensus-building, participatory process when making decisions

Source: J. Monday, *Building back better*, 2002.

achieved without the incorporation of disaster reduction strategies, one of six principles of sustainability supported by strong political commitment.

The motivation to invest in disaster risk reduction is very much a poverty reduction concern. It is about improving standards of safety and living conditions with an eye on protection from hazards to increase resilience of communities. A safer society to withstand disasters may be argued as a case of ethics, social justice and equity. It is also motivated by economic gains. Socio-economic development is seriously challenged when scarce funds are diverted from long-term development objectives to short-term emergency relief and reconstruction needs.

Environmentally unsound practices, global environmental changes, population growth, urbanization, social injustice, poverty, conflicts, and short-term economic vision are producing vulnerable societies. The impact of development on disasters in an increasingly unstable world should be fully embraced if disaster risk reduction is to yield its expected benefits. This takes on particular urgency in the face of long-term risks brought about by climate change which goes much beyond environmental degradation or mismanagement of natural resources. Development-as-usual is blind to risk and fuels disasters which threaten further development (BCAS 2002).

The political context

Political commitment is an essential ingredient for sustained risk reduction efforts. Obtaining political commitment from public authorities is one of the four principle objectives of ISDR. This objective needs to be addressed through increased coordination at all levels. Disaster reduction should be dealt with as a policy issue across relevant fields of government including health, agriculture, environment and development. (National and regional policies are elaborated in chapter 3).

For example, in Southern Africa other forces have combined to influence the political context of disasters. Decades of armed conflict, political instability and population displacement have conditioned more recent approaches to disaster management. In addition to the loss of lives, war-related damage and destruction to infrastructure, the prevalence of prolonged relief operations has been widespread in places, creating a sense of dependency on external assistance.

International humanitarian assistance that often inundates countries facing severe drought or flood crises is seldom accompanied by support for long-term institutional change that promotes practical mitigation efforts. To a significant extent, the emphasis given to the urgent supply of material requirements and logistical capabilities born of crisis and responding to the needs of unsettled populations, persists long after the acute conditions have been resolved. Too often a memory of relief supplies or a legacy of external assistance remains to discourage local initiatives or sustained institutional investments in disaster risk reduction.

If today, short-term actions reducing loss of life are effective, longer sustained commitment towards disaster reduction seems to be lacking. However, to be feasible, disaster reduction needs to show it is able to address short-term needs of survival as well as to take care of longer-term objectives of prevention and capacity-building.

This approach is illustrated by efforts undertaken in the cities of Manizales and Medellin in Colombia. There, the death toll and economic damage due to landslides and floods have decreased considerably thanks to initiatives undertaken by the municipalities, universities, private sector and community groups, through reforestation, planting ground cover, improved drainage systems and engineering works. In some cases, these investments are even generating income through harvesting and tourism.

"There is a hope for a less hazardous environment, and its achievement will depend upon the linking and convergence, and the integration, of hazard studies into the larger consciousness of sustainability and equity".

Source: White, Kates and Burton, 2001

"Managing risk depends on political will. Political will depends on political leadership and a shifting set of incentives, pressures and polemics. The political costs of redirecting priorities from visible development projects to addressing abstract long-term threats are great. It is hard to gain votes by pointing out that a disaster did not happen. How can we, who see risk management as a central priority and who have valuable technical knowledge and skills to contribute, enter this policy arena? This question is at the centre of the discourse. We know now that we must engage, but do we know how?"

Source: I. Christoplos, J. Mitchell and A. Liljelund, 2001.

"The state of a country's…political condition at the time of the onset of a disaster is a major determinant in the impacts on society of that event."

Source: M. Glantz, 2000.

"Can sustainable development along with the international instruments aiming at poverty reduction and environmental protection be successful without taking into account the risk of natural hazards and their impacts? Can the planet afford the increasing costs and losses due to so-called natural disasters? The short answer is, no."

Source: UN/ISDR, 2003.

Political change, economic reform and development of public policy to protect people and resources are fundamental solutions for disaster reduction. Capturing opportunities for social change during the "window of opportunity" following disasters, for example by utilizing the skills of women and men equally during reconstruction, is both possible and necessary. Politicians that undertake no-regret policies and apply precautionary principles in matters of environmental protection should take the same stance regarding disaster reduction.

Similarly, the public that exercises great pressure to bring about environmental policy changes should become a political force putting pressure on governments to protect people from disasters. If it becomes a popular issue, disaster risk reduction will gain momentum.

It should also be noted that political decisions can have negative consequences on disaster impacts. For example, huge hydraulic projects displace people and change landscape references of communities and their perception of risk, thereby increasing vulnerability by reducing the people's capacity to assess and anticipate hazard-related threats.

Sustainable development

Disaster reduction has emerged as an essential requisite for sustainable development. The UN General Assembly includes disaster reduction in its treatment of the sustainable development items in its annual deliberations. Furthermore, the 2002 World Summit on Sustainable Development (WSSD) adopted the Johannesburg Plan of Implementation including reducing risk and vulnerability as main targets by 2015 (for more detail see Annex 5).

The escalation of severe disasters poses a threat to both sustainable development and poverty reduction initiatives. Repeated exposure to disasters can lead to a downward spiral of poverty. As a consequence, Principle 1 of the Rio Declaration is at risk. This principle states that human beings are at the centre of concerns for sustainable development and are entitled to a healthy and productive life in harmony with nature.

The post-disaster reconstruction period provides the best time to introduce disaster reduction into sustainable development planning. When perceived as a distinct set of activities, risk management

Box 1.4
Paired perspectives

Two countries respond to the question of the role of political commitment in disaster risk reduction.

Country one: A highly disaster-prone country, with considerable technical, material and financial resources, with strong political aspirations to modernize.

"Disaster mitigation is not a priority item, except at times of disaster. With many pressing requirements related to health, education, development, defence, etc., disaster mitigation must during normal times be given diminished attention. We do not think that an easy recipe exists to overcome these obstacles."

Country two: A highly disaster-prone country, with few technical, material and financial resources, and much greater demands to realize its strong political aspirations to develop.

"It has been possible for the government to institutionalize the concept of disaster management and also to generate momentum at the grass-roots level for self-reliance in coping with and responding to disasters."

Source: ISDR questionnaire, 2001.

initiatives are placed in competition with other environmental and developmental objectives, rather than being seen as integral parts of the same whole. Therefore, political commitment and social acceptance of the value of risk reduction are necessary to increase the sustainability of communities.

Societies will become resilient when they integrate adaptive and risk management processes in sustainable development strategies. This implies the need to protect livelihoods against risk and uncertainty from global environmental changes, based on trade-offs between different components of the strategic development framework.

Sociocultural context

As a pillar of sustainable development, the links between disaster and the sociocultural system are important components in disaster risk reduction. (Social vulnerability is discussed further in chapter 2). The term culture is understood in a myriad of ways and represents a complex notion.

Differences exist among groups of people, and these differences reflect a variety of factors including language, socio-economic and political systems, religion and ethnicity as well as historical experience and relationships with nature. Each cultural group has its own set of experiences and expectations as do women and men and people in different age groups. Furthermore, these relationships among people are embedded in unequal power relations with different sets of values; some groups become dominant and others are marginalized. All of these factors are highly relevant in the context of natural disasters.

Much early thinking about disasters was based on a notion of nature and culture being separate. Disasters were seen as the products of a capricious and unpredictable nature and therefore beyond the control of humans. Often they were referred to as acts of supernatural forces, or acts of god. It became increasingly obvious that the causes of disasters are complex and that besides nature, people are also a causal factor. Looking beyond beliefs, more and more disasters are understood in terms of their cultural and social components. Vast differences in disaster vulnerability among countries and within individual societies have their roots in unequal sets of power relationships, leading to unequal distribution and access to wealth among different cultures or political settings. Therefore, much more research is needed on the social causes of disasters.

It is important that ownership of the disaster context is not stripped from local people by external interference. There is a growing appreciation of the need for disaster reduction activities to be based on more attentive participatory approaches involving local communities as much as possible, considering them as proactive stakeholders and not passive targets for intervention.

Common sense solutions in one cultural setting are often contrary to what may be common sense in others. Local socio-political structures and cultural conditions such as kinship arrangements, customary rights, community and family networks and systems of leadership nearly always persist during disasters. It is important that these are not undermined.

For example, it is important to recognize that death and illness have strong cultural implications. When decisions about matters such as mass burials are imposed on cultural groups by others, serious problems can occur that disrupt grieving and have long-term social, legal and psychological consequences. Some traditional practices must also be examined critically as cultural norms and family structures may increase the vulnerability of girls and women to disasters.

Cultural patterns which structure the lives of women and men also must be clearly understood. Their differing needs, roles and social power in various social contexts

A definition of culture

A complex whole which includes ways of life of a people, attitudes, values, beliefs, arts, sciences, modes of perception, and habits of thought and activity; that set of capacities is fundamental to the mode of adaptation of a particular people.

Adapted from: Dictionary of concepts in cultural anthropology, Robert H. Winthrop, 1991.

"The three-legged stool of environmentally sustainable growth, resource protection and conservation, and just social development will never prevent women and men from harm caused by naturally-occurring extreme events—but will certainly help prevent them from becoming disastrous in their effects upon people. But neither sustainability nor disaster reduction are possible so long as structural inequalities constrain women's lives and other forms of social inequality persist between peoples, nations, and regions. Women and men can and must find common ground as they take up the hard work ahead of building more sustainable, just, and safer ways of living on this planet."

Source: Elaine Enarson, 2002.

need to be taken into account. Men are usually seen as primary income generators while women's economic activities, often the mainstay of the household economy, are less visible. Women assume primary responsibility for the care of children, the elderly, the disabled and the ill whose mobility and survival in disasters may be limited. Sex-specific dependencies and vulnerabilities based on reproductive differences are relevant in disasters as is the respective ability of women and men to participate fully in household, community and national decision-making about hazard and risk management.

In many cultures, attachment to place is a critically important element, thus decisions to move people must be made carefully. In some cases, people reported feeling more afraid and at risk in relocation sites than if they had remained in their home environment. In many cases people are unwilling to leave a house in which they have invested most of their time and money, in which they earn income and care for family members. Often it constitutes their principal legacy to their children.

In other instances, host communities have felt imposed upon by those who have been relocated and violent reactions are not uncommon. Relocation of communities at risk may be scientifically the most attractive and seemingly reasonable prevention measure but it can be contrary to cultural norms.

Cultural change is an important consideration in disaster reduction, as is cultural continuity. For example, intercommunity cooperation following disasters was extremely common among traditional Pacific island communities, and to a large extent sustained by ceremonial exchange systems. These exchange networks fell away as commercial trading, often centred in colonial capitals, replaced traditional forms of exchange. Colonial governments replaced traditional political networks and missionaries further discouraged exchanges as threats to Christianity. Relief aid also reduced the need to maintain such networks.

With the migration of many Pacific islanders to places such as Australia, California and New Zealand, new exchange networks have emerged. Following disasters, major flows of resources now enter Pacific island states in the form of help from expatriates. Culturally, disasters have become important events through which Pacific island diaspora maintain links with their former homes.

An important finding of many researchers working in developing countries or in local communities is that a wide variety of measures for reducing disasters existed in earlier, often pre-colonial, times. A variety of sociocultural or economic factors have in some cases eroded these measures, undermining cultural support and social activities that might have otherwise contributed to sharing the exposure to risk among members of the community, or increasing their abilities to cope with abnormal situations.

Box 1.5
The impact of cultural change on disaster resilience

Cultural changes tend to reduce disaster resilience in traditional communities and at the same time, disasters can exaggerate their influence. While such changes most probably would have happened anyway, there can be little doubt that they can be hastened by disaster events, as the following examples from Pacific island states demonstrate:

- Introduction of new crops, especially cassava which is more vulnerable to high winds than yams or taro, the common traditional subsistence crops.
- Replacement of traditional hazard-resistant housing with climatically inappropriate disaster-relief homes.
- Reduced need for food preservation and storage resulting from relief supplies, especially of rice, which has become an increasingly dominant component of diets in both rural and urban areas.

Source: John Campbell, University of Waikato, 2001

Economic context

The links between disaster and the economic system, another pillar of sustainable development, are clear. Historically, people have always made investments to obtain, and then to protect, those resources that hold the greatest value for them. This is the principle behind insurance or other efforts to spread risk within a community, including joint ownership or responsibility for protecting assets.

The concern demonstrated by a farmer to protect a single cow, a homestead gardener to conserve water or a fisherman to mend nets in subsistence economies further reinforces the crucial role of economic systems in reducing risk.

Economics and the awareness of an increase in disaster severity and frequency provide incentives for development banks and international assistance institutions to integrate risk reduction in their development strategies and to develop innovative forms of financial investment. This also happens at the household and micro-entreprise level, and in national and regional economies.

Risk management planning involves an estimation of the impacts of potential disasters on the economy, based on the best available hazard maps and macroeconomic data. These include assessments of the costs of disasters, evaluation of the costs and benefits of disaster reduction and risk transfer measures (including the value of improved forecasting systems) and incentives from the international community that lead towards proactive disaster reduction projects. Such studies are carried out through international cooperative arrangements, especially by the Inter-American Development Bank (IADB).

Better understanding the real costs of natural disasters is difficult. Major impediments include a lack of reliable data, or clear and consistent definitions of what is being measured.

Methodologies employed tend not to be so readily comparable, and approaches to estimating costs or determining the extent of coverage can be inconsistent from place to place. In addition it remains to be proven that more precise damage and loss calculations would necessarily lead to evident changes in policy decisions or marketing practices.

Monetary indicators linked to disasters should be critically reviewed as they often fail to capture specific economic and social circumstances. Calculation of losses should take the nature and magnitude of employment losses into account. Similarly losses have to be related to households' situation and vulnerability before and after disasters. The impact of a US$ 50 loss of assets can be minor or huge depending on one's economic and social situation.

Given the recurrence and frequency of natural hazards, a concerted effort will always be required to respond effectively to them, and to assess the frequency of emergency recovery assistance, as well as the prospects of reducing damage in the future. Promotion of disaster risk reduction needs to be matched by reality. In the case of the 2000 floods in Mozambique, only 15 per cent of the money

Box 1.6
Economic loss due to natural hazards in 2003

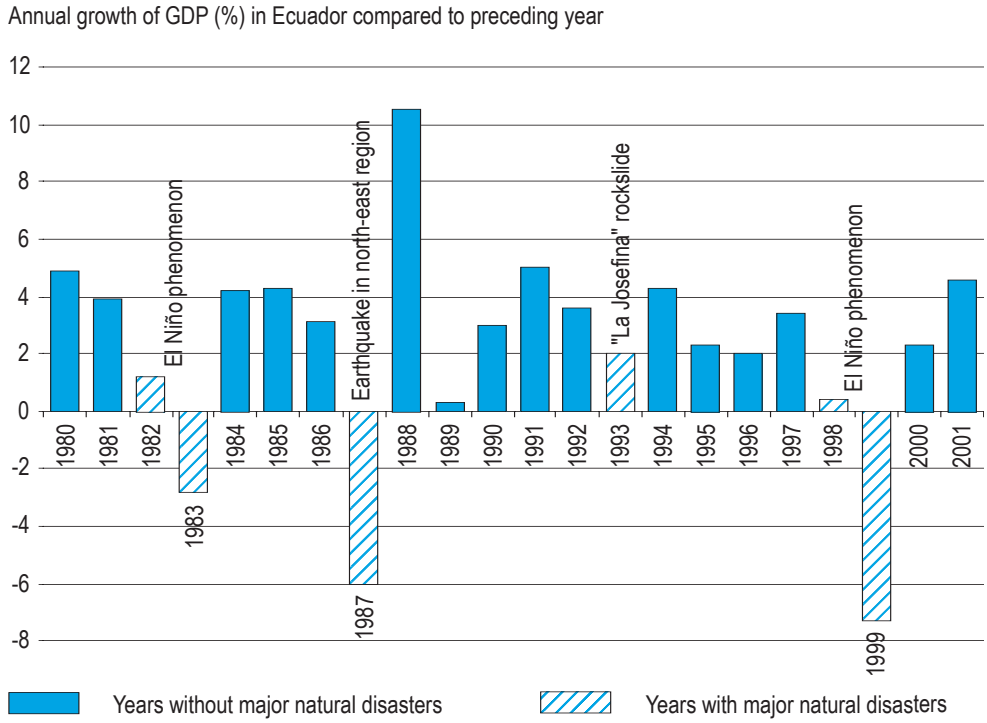
2003 was marked by a series of severe natural hazard events, with the number of fatalities far exceeding the long-term average. More than 50,000 people were killed in natural catastrophes worldwide, almost five times as many as in the previous year (11,000); such a high number of victims has only been recorded four times since 1980. The heat wave in Europe and the earthquake in Iran each claimed more than 20,000 lives.

The number of natural catastrophes recorded in 2003 was around 700 – the same level as in the previous year – but economic losses rose to over US$ 60 billion (in 2002: US$ 55 billion).

Around the globe, 70 earthquakes caused damage resulting in economic losses of approximately US$ 6 billion, far higher than the insured losses of approximately US$ 100 million. Windstorms accounted for about a third of the 700 events recorded, but for 75 per cent of all the insured losses caused by natural catastrophes.

Source: Munich Re, 2003.

Figure 1.4
Annual growth Gross Domestic Product (GDP) and occurrence of major "natural disasters" in Ecuador, 1980-2001



Source: PRECUPA/SDC project, Central Bank of Ecuador 2002

Box 1.7
Evidence of the economic benefits of disaster reduction efforts

In the Caribbean, empirical evidence shows that it is significantly more cost-effective to design and build a structure to standards that would withstand maximum expected wind or seismic forces in a given location, rather than build to lower standards and suffer the damages.

Source: Organization of American States, 1993.

Switzerland long ago recognized the value of forests in protecting important economic assets (roads, industries, infrastructure, tourism) as well as human settlements and people against avalanches and landslides. The economy provided by the protection afforded by forests was estimated between US$ 2 billion and US$ 3.5 billion per year.

Source: Swiss Agency for the Environment, Forests and Landscape, Economics and Climate, 1999.

In the United States, after the 1993 Midwest floods, government buyouts of flood-prone residents and movement of material property to areas outside the 100-year flood plain were successful in reducing flood claims in subsequent flood events. The buyout initiative resulted in a significant reduction in National Flood Insurance Program claims and the availability of land in flood plains for other purposes. In the long run, economic sustainability, hazard mitigation efforts plus enhanced risk assessment utilizing appropriate tools will have environmental pay-offs.

Source: Annual Hazards Research and Applications Workshops, University of Colorado, 2001.

Box 1.8
Economic initiatives for disaster reduction

- Assess natural disaster damage and loss potential (including historical perspective).
- Analyse costs and benefits of disaster management (cost-effective allocation of resources).
- Assess hazard risks at the project appraisal stage of all potential investment projects, including cost-benefit analyses that estimate the hazard vulnerability implications of alternative levels of overall quality and strength, as well as returns from specific disaster-proofing features.
- Evaluate trade-offs between quality and quantity of structural mitigation measures.
- Create incentives, cost-sharing and recovery for disaster reduction.
- Consider disaster risk transfer and financing opportunities.
- Enforce regulations under different levels of economic development and government capacity.
- Determine pricing policy designed for rational use of resources.

Adapted from: C. Benson, United Kingdom Overseas Development Institute, Department for International Development, 2002.

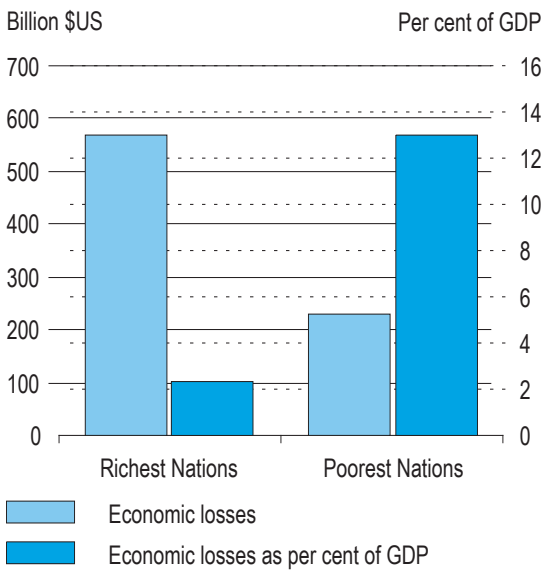
asked to replace river-level gauges was promised despite large aid sums otherwise pledged. As the aid was so slow to materialize anyhow, key infrastructure works could not be completed before the next rainy season.

The benefits of long-term disaster risk reduction versus the costs of repeated short-term post-disaster reconstruction need to be documented. In view of the exorbitant economic and social costs of recurring disasters, long-term hazard reduction planning is becoming, more and more, a guiding principle and prerequisite for the sustainability of physical investments. Efforts to estimate the net benefits of location or land use in hazardous areas, and also the actual benefits of extreme events both need to be undertaken.

Improvement and enforcement of regulatory frameworks for disaster reduction, including disaster-related insurance, building codes and land use planning can improve the chances that infrastructure is properly sited and built to minimize damages. This involves public insurance policy, market and regulatory incentives for risk and vulnerability reduction, protection against fluctuations in insurance and reinsurance prices, augmentation of insurance coverage at reasonable cost and backstop financial mechanisms.

The relationship between disaster and risk reduction and globalization also needs to be researched further to explore, on the one hand, the detrimental effects of deregulation, and on the other hand, the beneficial effects associated with economic competitiveness. Changes associated with globalization which impact social cohesion, environmental resources, economic stability and living conditions closely related to disaster resilience must not be underestimated. Capacities to cope should not be undermined by widening wealth gap, debt repayments, inequitable world trade practices and misguided economic adjustment policies. By contrast, the potential for risk reduction to become an essential element to increase competitiveness, protect investment and contribute to securing trade opportunities, while avoiding new risks and business interruptions, has to be more fully considered.

Figure 1.5
Disaster losses, total and as share of GDP, in the richest and poorest nations, 1985-1999



Source: Adapted from MunichRe, 1999

Box 1.9

The economic impacts of natural disasters in Pacific small island developing states

Experience in Pacific small island developing states (SIDS), as in many other poor countries, shows that it is probably not the actual dollar value of disaster loss that is most relevant, but rather the cost to the particular nation in terms of percentage of GDP – and this can be very significant indeed.

A South Pacific study of 1997 concluded that natural disasters have a significant impact on key economic elements such as GDP, employment and trade, and macroeconomic aspects, including government finances, monetary policy, inflation and the level of international reserves.

The conclusions underlined the importance of adopting appropriate policy and institutional capabilities in order to minimize the extent of physical damage and economic losses, in addition to the continuing role that donors have played in providing assistance for relief and rehabilitation purposes.

The study noted that, "with their limited economic diversification, combined with a high agriculture-GDP ratio prevalent among many of the small Pacific island states, [they are] particularly exposed to disaster devastation and considerable economic losses. In the short to medium term, the destruction of standing crops, physical infrastructure and housing could be severe, with the consequences that GDP could become sharply depressed for some time, with likely consequence of provoking macroeconomic instability".

In the longer term, the study noted that damage to productive assets could lead to a loss of output with reduced economic growth and declining standards of living. "The reallocation of financial resources after a disaster for emergency and rehabilitation purposes as well as reductions in capital investments can impede the realization of major national development objectives."

However it was equally noted that "the extent of the destruction and economic losses that result, both immediately and over time, depends on a variety of factors including the degree of dependence on agricultural production, the level of structural diversification achieved, resource endowment and the level of disaster preparedness".

In small countries generally, and in small developing states specifically, primary attention needs to be given to a range of mitigation strategies that can reduce the exposure or risk of damage to productive assets and associated economic losses.

The promotion of appropriate macroeconomic policies can also be vital in cushioning the destabilizing impact of natural disasters. These can include firm adherence to fiscal and monetary policies at the time of severe demands on financial resources created by emergency conditions or post-disaster requirements, the encouragement of property owners to adopt insurance as means of spreading their risk, and the creation of a disaster reserve fund to facilitate a quick recovery of vital economic activities or infrastructure facilities following a disaster.

At a more basic level of reducing risks long before they threaten, practices that maintain a continued commitment to strong macroeconomic fundamentals, including adequate external reserves, can serve as buffers against disaster-related crises.

Source: Adapted from Te'o I.J. Fairbairn, South Pacific Disaster Reduction Project, 1997.

Environmental context

The third system with which disaster reduction is closely linked is the environmental system, yet another pillar of sustainable development. Disasters do not only affect the built environment but also the natural environment.

Environmental degradation increases the intensity of natural hazards and is often the factor that transforms the hazard into a disaster. For example, river and lake floods are aggravated or even caused by deforestation which in turn causes erosion and clogs rivers. As stated by the Intergovernmental Panel on Climate Change (IPCC), social and economic systems are already affected by the recent increasing frequency of floods and drought.

Global environmental change, particularly climate change, poses an exceptionally complex challenge for humanity that affects vulnerability and hazard patterns. In this context, the work of the Global Environmental Change and Human Security (GECHS) project of the International Human Dimensions Programme on Global Environmental Change (IHDP) is of interest. It develops methods for an early warning system of environmental change and its potential impacts to determine why some groups or communities are more vulnerable than others, given the same level of biophysical risk.

Poverty and vulnerability are linked to this situation. The poor are compelled to exploit environmental resources for survival, therefore increasing both risk and exposure to disasters, in particular those triggered by floods, drought and landslides. Environmental refugees settling in fragile drylands with low resilience are major concerns to resource managers, especially in Africa. Addressing the poverty challenge is therefore urgent. The initiative taken by ten international organizations including the World Bank and UNDP to discuss how to integrate adaptation to climate variability and change into poverty eradication is a welcome step in this direction.

The natural environment provides solutions to increase protection against disaster impacts. Therefore, successful disaster reduction should enhance environmental quality, which includes protection of natural resources and open space, management of water run-off, and reduction of pollution.

Successful environmental policies should highlight the effectiveness of disaster reduction measures. This should entail an acceptance of some degree of natural disturbance to avoid the greater consequences of extreme events, and an appraisal of alternative solutions to an exclusively engineering approach. As women and men tend to use different environmental resources, a gender perspective is especially important. Women's roles as primary resource users and managers, not always in the interests of sustainability, make them vital partners in wise environmental management to reduce risk.

"Around the world, a growing share of the devastation triggered by 'natural' disasters stems from ecologically destructive practices and from putting ourselves in harm's way. Many ecosystems have been frayed to the point where they are no longer resilient and able to withstand natural disturbances, setting the stage for 'unnatural disasters' – those made more frequent or more severe due to human actions. By degrading forests, engineering rivers, filling in wetlands, and destabilizing the climate, we are unravelling the strands of a complex ecological safety net."

Source: J. Abramovitz, 2001.

Box 1.10
The International Human Dimension Programme on Global Environmental Change

Launched in 1990, the International Human Dimension Programme on Global Environmental Change (IHDP) is a non-governmental science programme devoted to interdisciplinary and international research on the human dimensions of global environmental change. Its national committees and programmes around the world bring scientists together on these issues. Research on urbanization, mountains, vulnerability assessment and "science for sustainable development" are some of its main activities.

Global Environmental Change and Human Security (GECHS) is one of its core projects. Working with a definition of human security that connects the theoretical with the practical, the purpose is to promote research on various topics related to environmental change and security, exploring among others the link between environmental stress, vulnerability and human security. Another goal of the project is to extend collaboration among scholars and link policy makers, researchers and other groups, facilitated by the International Network on Environment and Security (INES), a European-based project involving institutes interested in environment and security.

Box 1.11
Nature's solutions to reduce disaster impacts

"The time has come to tap nature's engineering techniques – using the services provided by healthy and resilient ecosystems. Dunes, barrier islands, mangrove forests, and coastal wetlands are natural shock absorbers that protect against coastal storms. Wetlands, floodplains, and forests are sponges that absorb floodwaters. Nature provides these valuable services for free, and we should take advantage of them rather than undermining them."

Source: J. Abramovitz, Unnatural disasters, 2001.

"Open space, greenways, and riverside parks serve as habitat for wildlife, protect streams from pollutants, help maintain water temperatures, and keep people and development from the highest-risk floodplains. Trees can drastically reduce storm water management costs. American Forests studied Garland, Texas, and calculated that the city's canopy reduced storm water runoff by 19 million cubic feet during a major storm. Annually, the trees save Garland US$ 2.8 million in infrastructure costs and US$ 2.5 million in air quality costs and residential energy bills."

Source: Natural Hazards Research and Applications Information Center, 2001.

Around the village of Guarita in Honduras, local people practiced traditional Quezungal farming methods consisting of planting crops under trees, maintaining ground vegetation and terracing in order to root the soil and reduce erosion. During Hurricane Mitch, only 10 per cent of the crop was lost, leaving reserves that could be shared with more severely affected neighbouring areas.

Source: UNDP/BCPR communication, 2002.

The Viet Nam Red Cross Society conducted an environmental preservation project in Thai Binh province to address different aspects of risk relating to typhoon occurrence that threatens the people living on the coast. Two thousand hectares of mangrove plantation were created along the coastline serving to reduce wind and wave velocity and action, thereby protecting landscape, human life and local development assets.

Resource opportunities for improving livelihoods were provided by a healthier natural environment. The limited damage provoked by the worst typhoon in a decade provided the best possible indication of the effectiveness of the plantation in reducing risks and its ability to enhance the resiliency of local communities.

Source: International Federation of Red Cross and Red Crescent Societies, World Disasters Report, 2002.

During the 2002 summer floods in Europe the floodplains of Moravia absorbed the Danube flood wave and helped protect Bratislava from higher flooding levels. This effect could be multiplied across the whole Danube basin to prevent future losses of life, property, and threats to human health – all that is needed is governments to invest in nature rather than in hard, old-fashioned, engineering solutions.

Source: World Wide Fund for Nature, 2002.

There is growing recognition that by following principles of wise environmental management, increased hazard protection as well as economic benefits can be provided by the natural environment. This can be accomplished by building capacities, exchanging information, experience and knowledge and collaborating with other groups.

The wealth of information in both environmental and disaster management studies should be shared. Both areas are multidisciplinary and innovative in their approaches and analysis of the socio-environmental nexus. Traditionally, each is dominated by the public sector and non-governmental organizations which encourages wide participation. Tools such as vulnerability indexing, inventory mechanisms, educational programmes for public awareness and impact assessments are continuously being refined in both fields.

Encompassing long-term comprehensive goals to manage growth, development and land use implies incorporating an effective environmental component into disaster reduction strategies. Sustainable management of natural resources, including reforestation and settlement schemes should increase the resilience of communities to disasters by reversing current trends of environmental degradation and by addressing hazard management in a comprehensive way. This will also contribute to the social acceptance, political feasibility and economic rationale of disaster reduction programmes. Furthermore,

synergies with policy goals pursued in the area of adaptation to climate change will bring additional support to efforts in disaster reduction.

Disaster reduction and environmental management should become joint national priorities. Entities responsible for disaster reduction should have clear environmental mandates. Inter-agency programmes are needed to promote a holistic problem-solving strategy, justifying the protection and restoration of natural functions of ecosystems, and assessing programme subsidies to create the right incentives for sustainability.

Until recently, there was scant discussion and even less organizational contact between environmental management experts and risk reduction experts. In fact, antagonism, power and authority struggles and competition over uses of land and natural resources often prevailed. It should also be recalled that the existence of environmental divisions within organizations and national ministries of environment were not the norm in the 1980s.

As disaster reduction and environment have a lot in common, the disaster reduction community should look closely at experience gained in promoting environmental policies. The environmental community has been promoting its agenda for 30 years. Today, an environmental strategy to achieve sustainable development is a given policy option. Disaster reduction policy must follow a similar path.

Environmental accounting systems that produce information suited for decision-making should reflect disaster reduction considerations. Additional studies are needed to improve systems of ecological economic accounting. Translating environmental resources and services into conventional economic figures is still very much a challenge.

Some of these boundaries have been breached. In the late 1990s in Latin America and the Caribbean, El Niño, Hurricane Georges and Hurricane Mitch focused attention on the full spectrum of the hydrological cycle to both development and disaster concerns.

The magnitude of the resulting fires, drought, flooding and landslides associated with these disasters inevitably stimulated discussion about the relationships that exist between environmental mismanagement and the occurrence of hazards.

Until recently, the gender dimensions of sustainable development, as well as in disaster risk reduction were easily neglected. This occurred despite ample evidence that environmental degradation, development practices, and natural disasters impact women's and men's health and livelihoods differently. Women are also especially proactive in risk reduction initiatives at the household and local levels.

An important initiative in linking environmental management to disaster risk reduction was the publication of *Strategy for the Reduction of Environmental Vulnerability in Central America when Faced with Natural Disasters: Environmental Management and the Evaluation of Vulnerability* (May 1999). Produced in

Box 1.12
Linking the environment and disaster reduction activities

- Assessment of environmental problems linked to hazards based on reliable sources of existing information with the related evaluation of impacts and the need for additional data.
- Mapping of environmentally sensitive areas, description of the characteristics of the environment and development trends in these areas.
- Examination of environmental benefits to be drawn from disaster reduction activities throughout various sectors.
- Monitoring to provide information for decision-making purposes (for example, suitability of land for development).
- Environmental tools for disaster reduction purposes: regulations, incentives, conservation programmes, hazard control and mitigation, water/watershed, and coastal zone management.

"The failure by the development community to take climate change and disaster reduction seriously represents a double disconnect in policy which threatens the lives of millions of vulnerable people around the world. Part of the problem is that professionals working within these sectors operate in different worlds and on different timescales. Disaster managers are too busy grabbing the phone and ordering more food and blankets to worry about risk reduction and development concerns. Meanwhile climate change scientists work with 100-year models that bear little immediate relevance to the timespan of policy makers and field workers. The development community sits between these two groups and bears the major responsibility for bringing them together into one coherent discourse."

Source: Bangladesh Centre for Advanced Studies/New Economics Foundation, 2002.

collaboration with the UN Economic Commission for Latin America and the Caribbean (ECLAC), UNDP, UNEP and the World Bank, this document provided an overview of the disaster and vulnerability problems in the region and proposed many wide-ranging projects for financing as part of the international process to rehabilitate Central America. The content of the proposals went quite beyond environmental problems, touching on almost every foreseeable topic of interest to risk analysts and managers.

Reflecting increased attention about the need for gender-aware and culturally-specific perspectives in the global dialogue about sustainability and disasters, the World Bank and IADB commissioned studies of gender issues arising from Hurricane Mitch. Within the UN, the Division for the Advancement of Women initiated a global Internet conference and subsequent expert working group to examine linkages between gender equality, environmental management, and natural disaster reduction.

The report and recommendations drew on extensive work conducted during the 1980s and 1990s to incorporate gender perspectives into sustainable development, disaster reduction, and emergency relief. Gender analysis has proven to be a useful common thread for weaving together ways of thinking about disasters and sustainability which, while too often separated institutionally, are inescapably joined empirically.

Box 1.13
Long-term environmental changes and disasters

At the beginning of the 21st century, there is, particularly in Pacific small island developing states (SIDS), growing concern about the long-term consequences of climate change, the El Niño phenomenon and the potential for rising sea levels. In recognizing the heavy dependence of SIDS on the natural environment and their exposure to almost all types of natural, technological and human-related hazards, there is a strong rationale for considering all these hazards in a generic sense as environmental hazards. Environmental impact is precisely the premise for disaster reduction in five generic environments:

- built environment – property, buildings, infrastructure;
- natural environment – geography, physiology;
- human environment – human life, socio-economic factors;
- terrestrial environment; and
- marine environment.

Regional considerations linking disaster reduction and sustainable development

Progress can be shown through examples of regional strategies for sustainable development that strive to reduce the risk of disasters.

It was only after unacceptable losses occurred that risk assessment and management processes were included in infrastructure development projects. Angry demands of the public after particularly disastrous events (e.g. after the Gujarat earthquake in India, following Hurricane Mitch in Central America, or in the aftermath of the floods in Mozambique) provoked important and new commitments. These include the mandatory inclusion of risk assessment by international and regional development banks and development assistance agencies in their respective activities.

Asia

Although there have been few examples of effective, systematic and long-term integration efforts between disaster reduction and poverty alleviation programmes, a dialogue between these two interest groups is beginning to take place in the region.

In February 2001, the Asian Development Bank (ADB) organized the Asia Pacific Forum on Poverty. One of the key focus areas was social protection to diminish vulnerability to risks, generate employment and improve productivity and working conditions in Asia and the Pacific. It was one of the few times that a discourse on poverty alleviation in the region recognized disaster reduction as one of the key interventions for social protection.

A notable example of an integrated programme is the initiative of the Mekong River Commission (MRC). Following the extensive floods in Viet Nam and Cambodia in 2000, it developed a holistic strategy for flood management and mitigation that emphasizes land-use planning, structural measures, flood preparedness and emergency response.

The Phnom Penh Regional Platform on Sustainable Development for Asia and the Pacific, adopted in the wake of the WSSD, noted that the

financial crisis of 1997, the isolation and vulnerability of small island developing states and recurrent natural disasters pose major constraints to the achievement of sustainable development.

Gender and risk issues linked to environmental management and mitigation of natural disasters were discussed at the Asia Pacific Forum on Women, Law and Development (March 2002). States were urged to "recognize the impact of development policies and projects on environmental crises and natural disasters that manifest themselves in an aggravated and differentiated manner for women, causing the loss of their income, workspace and livelihoods; and, often, leading to destitution and denial of women's human rights".

In preparation for the Third World Water Forum (Kyoto, March 2003), the Asian Development Bank conducted a series of consultations on poverty, floods and gender. Results of these workshops that looked into the impacts of water-related disasters on the poor are available on their website. <http://www.world.water-forum3.com/>

Coping with natural disasters is perceived as an essential issue to be addressed in the region. Measures are called for to ensure that populations suffering the consequences of natural disasters, severe environmental degradation and other relevant humanitarian emergencies are given every assistance and protection so that they can resume normal life as soon as possible.

The region, however, has a long way to go in terms of integrating poverty alleviation and disaster reduction programmes in practice. More research is required on understanding the nature of linkages between poverty and vulnerability in different social, political, economic and hazard-specific contexts. This will then improve specific frameworks, tools and methodologies developed and applied to integrate poverty alleviation and disaster reduction programmes.

The Pacific

The crucial relationships that exist between natural disaster risks, the environment and their combined impacts on human societies are particularly evident in the Pacific small island developing states. People are highly dependent on the natural environment, and historical records testify to the devastating effects that natural disasters cause in the region.

There is growing concern among government officials and scientists about the potential for increasingly frequent and more severe meteorological and hydrological hazards resulting from climate change, and how they may affect Pacific islands.

Africa

Poverty levels remain high in Africa, especially among the rural poor. High levels of foreign debt and international conflicts have discouraged investment and growth. Under these austere conditions, significant investments at household or national level to mitigate the impact of natural or other threats are difficult to achieve.

In Southern Africa, the Southern African Development Community (SADC) expressed concern that ten years after the adoption of international agreements at the UN Conference on Environment and Development, Southern Africa was still "confronted by social, economic and environmental crises".

Among the core issues identified, poverty was highlighted as the primary constraint to socio-economic development, but matters of health, food security, climate change, water availability, land degradation and market access were also cited as critical issues.

Each of these factors has a bearing on prevailing vulnerability and risk issues in the region. In a region still heavily dependent on agriculture to maintain household livelihoods and national food security, drought and floods present serious challenges to sustainable development. Although the links between disaster reduction and national development programming are still weak in Africa, some countries including Ghana explicitly integrate disaster reduction in their poverty reduction strategy.

The African Ministerial Statement to the WSSD stated that the increased incidence of

natural disasters in Africa poses a major obstacle to the African continent's efforts to achieve sustainable development, especially in view of the region's insufficient capacities to predict, monitor, handle and mitigate natural disasters.

Reducing the vulnerability of the African people to natural hazards and environmental risks is mentioned as a requirement to achieve the poverty reduction goals of the Millennium Declaration alongside other basic requirements including economic growth, access to sources of energy and basic health services. Extreme weather events such as floods and droughts induced by climate change are singled out.

Latin America and the Caribbean

The health sector has recognized that risk reduction is a key consideration for an improved health sector throughout the region. The hurricanes and earthquakes affecting the region in the 1990s have convinced the Pan American Health Organization (PAHO) and most health authorities that a culture of prevention must include mitigation of structural and non-structural damages to health facilities and water supply systems.

This was made clear following the collapse of several hospitals during an earthquake in Mexico in 1985. Action requires significant capital investment, a decision in the hands of ministries and financing organizations. As a result, only a limited number of hospitals have been retrofitted, illustrating that disaster reduction requires broad consensus and political will.

The severity of the El Niño/La Niña phenomenon of 1997-1998, led to the establishment of the Andean Regional Programme for Risk Prevention and Reduction (PREANDINO) with the objective of promoting the development of disaster risk prevention and mitigation policies and new institutional arrangements aimed at incorporating prevention into development planning.

The Rio de Janeiro Platform for Action on the Road to Johannesburg 2002 was adopted by the Regional Preparatory Conference of Latin America and the Caribbean for WSSD. Ministers of environment and other senior representatives from Latin American and Caribbean countries stressed the need for actions that reduce disaster vulnerability and promote a culture of risk awareness by means of education, improved information dissemination and the use of early warning systems.

In Central America, natural hazards are exacerbated by the high level of vulnerability in the region. Therefore, any sustained commitment to reduce risk needs to be considered in the context of poverty reduction.

Increasing attention is being given to the global notion of risk as opposed to a more restricted view of disaster management. United Nations Development Programme (UNDP) in El Salvador has proposed the use of risk management as a uniting concept in the design of its five-year programme with the government. The conceptual framework used in the Lower Lempa Valley implemented with the Ministry of Environment was elaborated around the notion of global or total risk, where risk reduction is regarded as a component of development investment.

Europe

Disaster reduction has traditionally been approached through rigid civil protection frameworks at the national levels throughout Europe, but shifts from emergency to prevention outlooks and from national to regional perspectives are now taking place.

The European Commission has no overall disaster reduction or prevention strategy, but it is funding specific activities related to this field. Council decision of 9 December 1999 (1999/847/EC), establishing a European community action programme in the field of civil protection recognized that a greater awareness of the relationship between human activities and nature may in the future make it possible to prevent many disasters, including floods.

By referring to risk awareness, assessment and sustainable development, the decision encouraged projects in the area of prevention, preparedness, detection and study of the causes of disasters as well

as analysis of the socio-economic implications of disasters. In this regard, an integrated European strategy on prevention, preparedness and response to natural, human-induced and other risks is being elaborated. The sixth Community Environment Action Programme also foresees a network for exchange of prevention practices and tools.

At the Ninth Ministerial Session of the EUR-OPA Major Hazards Agreement in Bandol (France) in October 2002, several recommendations concerning national Euro-Mediterranean disaster reduction platforms were adopted. These involved considerations about elaborating a risk culture, a first phase implementation of risk prevention initiatives and ISDR. It called for strengthening and developing cooperation with the European Commission, in particular the Directorate General of the Environment to develop and implement the existing EUR-OPA initiatives in risk prevention.

Concluding remarks

Despite the progress achieved, much more is required to implement institutional changes that will help in the evolution of a disaster reduction culture. The processes conditioning the emergence of disaster reduction need to be conducive to understanding risk and vulnerability, awareness and management, leading to safer long-term development planning based on anticipation rather than cure.

Disaster reduction strategies drawing upon sustainable development concepts should be proactive and continual. To be effective, they need to promote political commitment, a financial rationale, environmental sensibility and cultural awareness. Such a shift in mentality should, in particular, meet the mitigation requirements imposed by the slow-onset disasters that global environmental changes will bring about.

Chapter 2

Risk awareness and assessment

2.1 Understanding the nature of risk

Disaster risk is part of every day life. Awareness of risk is therefore a necessary condition to engage in disaster risk reduction. A focus on risk management, rather than on disaster events alone, reflects a proactive attitude for dealing with potential threats to social and material assets, before they are lost.

The analysis and lessons learned from prior experiences of disasters help to define profiles of risk related to people, activities and places that share attributes, in the face of particular potential sources of loss or damage.

Understanding risk relates to the ability to define what could happen in the future, given a range of possible alternatives to choose from. Assessing risks based on vulnerability and hazard analysis is a required step for the adoption of adequate and successful disaster reduction policies and measures.

This chapter will discuss:

- *the nature of risk, with emphasis on the linkages between hazards and vulnerability;*
- *emerging trends in hazard and vulnerability patterns and the impact of disasters; and*
- *risk analysis and assessments with examples of the application of these methodologies.*

Risk
The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.

Levels of risk awareness depend largely on the quantity and quality of available information and on the difference in people's perceptions of risk. People are more vulnerable when they are not aware of the hazards that pose a threat to their lives and property. Risk awareness varies among individuals, communities and governments, according to their particular perceptions. These can be influenced by the knowledge of hazards and vulnerabilities, as well as by the availability of accurate and timely information about them.

Risk notation

Risk = Hazard x Vulnerability

Two elements are essential in the formulation of risk: a potential damaging event, phenomenon or human activity – hazard; and the degree of susceptibility of the elements exposed to that source – vulnerability.

The negative impact – the disaster – will depend on the characteristics, probability and intensity of the hazard, as well as the susceptibility of the exposed elements based on physical, social, economic and environmental conditions.

The recognition of vulnerability as a key element in the risk notation has also been accompanied by a growing interest in linking the positive capacities of people to cope with the impact of hazards. It conveys a sense of the potential for capabilities to reduce the extent of hazards and the degree of vulnerability.

Social dimensions are intimately linked to the decision-making process to deal with disaster risk, as they embrace a range of risk perceptions and their underlying causes.

A closer look at the nature of hazards and the notions of vulnerability and capacities allows for a more comprehensive understanding of the challenges posed by disaster risk reduction.

Understanding the nature of hazards

Understanding the nature of natural hazards involves a consideration of almost every physical phenomenon on the planet. The slow movements in the earth's mantle – the convection cells that drive the movement of continents and the manufacture of ocean floors – are the starting and also the sticking point. They lift mountains and shape landscapes. They also build volcanoes and trigger potentially catastrophic earthquakes.

Like those other invisible movements that take place on a vast scale through the atmospheric medium – the carbon cycle and the water cycle and the nitrogen cycle – volcanoes and earthquakes, along with technological advancements, provide the bedrock of strong nations, rich industries and great cities. They do, of course, have the potential to destroy them.

While most natural hazards may be inevitable, disasters are not. By seeking to understand and to anticipate future hazards by study of the past and monitoring of present situations, a community or public authority can minimize the risk of a disaster.

It is a measure of people's wisdom and a society's values if a community is able to learn from the experiences of others, rather than to suffer its own. There is a wealth of knowledge about the nature and consequences of different hazards, expected frequency, magnitude and potential geographic impacts, but many fewer examples of lessons learned from them.

Hazards are dynamic and with highly varying potential impacts. Due to changing environments, many countries and regional organizations require a greater knowledge of hazard characteristics.

A wide range of geophysical, meteorological, hydrological, environmental, technological, biological and even socio-political hazards, alone or in complex interaction, can threaten lives and sustainable development. Hazards have often been divided into those deemed natural or technological, based on their origins. As environmental degradation continues to worsen, the intensity, frequency and impacts of hazards are also affected.

While natural hazards can be divided into three broad categories – hydrometeorological, geological and biological – the variety, geographical coverage and types of impacts vary considerably.

Forest fires, for example, are recognized as a natural hazard but are often referred to as environmental hazards. In order to distinguish between different types of hazards some institutions have developed hazard catalogues. Figure 2.1 summarizes current hazard thinking.

The compound relationship between different hazards means that cataloguing a hazard is often complicated. At what stage does a landslide, typically recognized as a geological hazard, become a mudflow, which is often classified as a hydrological hazard?

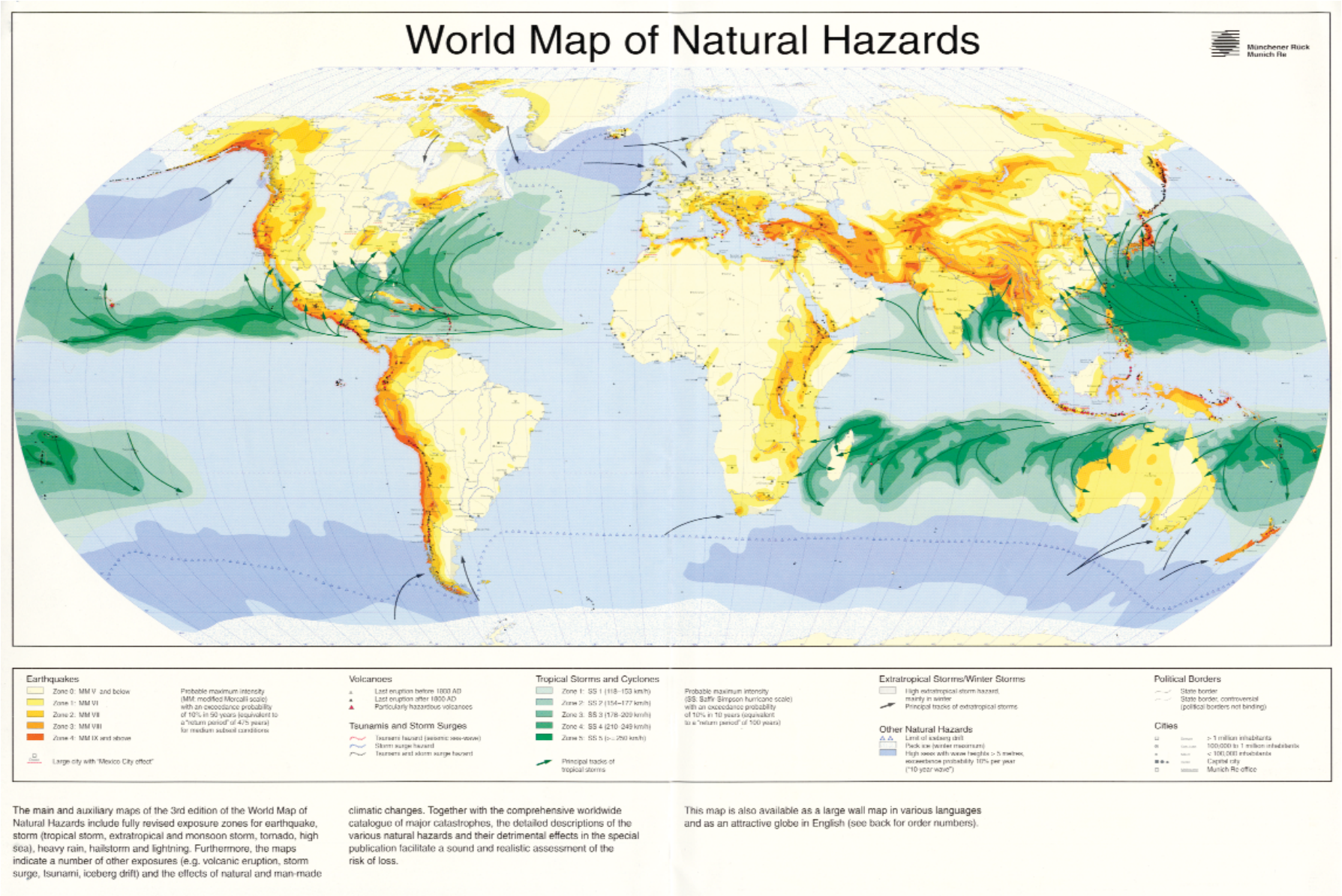
In the same vein, primary hazards often give rise to collateral or secondary hazards. In many cases, these present greater threats to a community than do the primary hazards. Tropical cyclones and other storms can trigger other hazards, in particular storm surges, flash floods and landslides. Often the most serious impacts of storms come from the associated coastal and river floods. Similarly, damages related to earthquakes are often caused by landslides, fires, tsunamis or floods.

Almost all communities – whether urban or rural – are vulnerable to hazards. Hydrometeorological hazards are most common and floods alone account for two-thirds of people affected by natural hazards. However, different regions will be more prone to certain types of hazards than others.

Floods and windstorms are the hazards that most frequently lead to disasters in Asia, the Pacific, Europe and North America. Droughts and epidemics are reported more often in Africa, while the Pacific and Caribbean islands are most vulnerable to the effects of tropical cyclones.

El Niño events, floods, volcanic eruptions and earthquakes have a greater impact on the Andean and Central American countries. Even within a specific region, such as the Pacific, the frequency and intensity of specific hazards varies from one country to another.

Figure 2.1
World map of natural hazards



The main and auxiliary maps of the 3rd edition of the World Map of Natural Hazards include fully revised exposure zones for earthquake, storm (tropical storm, extratropical and monsoon storm, tornado, high sea), heavy rain, hailstorm and lightning. Furthermore, the maps indicate a number of other exposures (e.g. volcanic eruption, storm surge, tsunami, iceberg drift) and the effects of natural and man-made climatic changes. Together with the comprehensive worldwide catalogue of major catastrophes, the detailed descriptions of the various natural hazards and their detrimental effects in the special publication facilitate a sound and realistic assessment of the risk of loss.

This map is also available as a large wall map in various languages and as an attractive globe in English (see back for order numbers).

Source: MunichRe, 1998

In the same way, different social groups are more or less vulnerable to certain types of hazards. While disasters of all kinds affect the poor most directly, women and men, people in different age and ethnic groups, and those with different levels of physical and cognitive ability, experience disasters differently.

Table 2.1
Hazard classification

HAZARD
A potentially damaging physical event, phenomenon or human activity, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

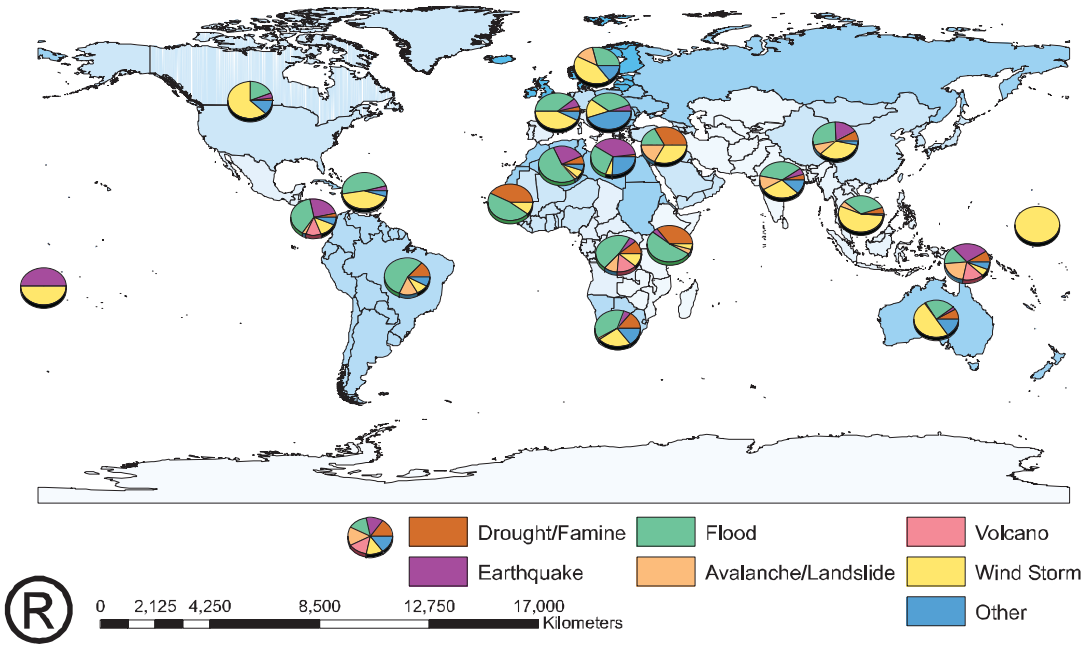
NATURAL HAZARDS
Natural processes or phenomena occurring in the biosphere that may constitute a damaging event. Natural hazards can be classified according to their geological, hydrometeorological or biological origins.

ORIGIN	PHENOMENA / EXAMPLES
Hydrometeorological hazards Natural processes or phenomena of atmospheric, hydrological or oceanographic nature.	• Floods, debris and mudflows • Tropical cyclones, storm surges, wind, rain and other severe storms, blizzards, lightning • Drought, desertification, wildland fires, temperature extremes, sand or dust storms • Permafrost, snow avalanches
Geological hazards Natural earth processes or phenomena that include processes of endogenous origin or tectonic or exogenous origin, such as mass movements.	• Earthquakes, tsunamis • Volcanic activity and emissions • Mass movements, landslides, rockslides, liquefaction, sub-marine slides • Surface collapse, geological fault activity
Biological hazards Processes of organic origin or those conveyed by biological vectors, including exposure to pathogenic micro-organisms, toxins and bioactive substances.	• Outbreaks of epidemic diseases, plant or animal contagion and extensive infestations

TECHNOLOGICAL HAZARDS
Danger associated with technological or industrial accidents, infrastructure failures or certain human activities which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation, sometimes referred to as anthropogenic hazards. Examples include industrial pollution, nuclear release and radioactivity, toxic waste, dam failure, transport, industrial or technological accidents (explosions, fires, spills).

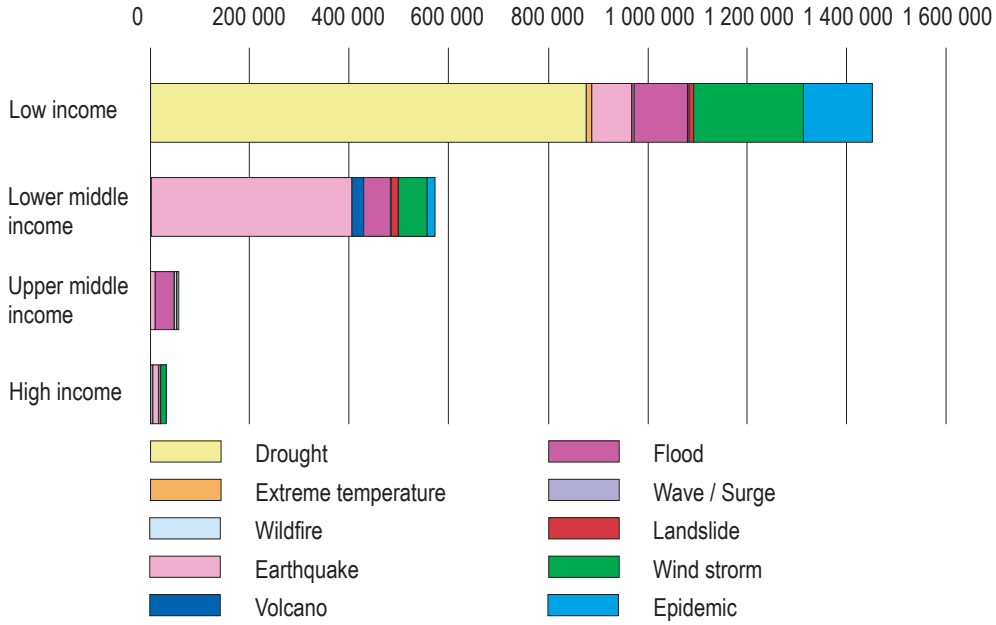
ENVIRONMENTAL DEGRADATION
Processes induced by human behaviour and activities (sometimes combined with natural hazards) that damage the natural resource base or adversely alter natural processes or ecosystems. Potential effects are varied and may contribute to an increase in vulnerability and the frequency and intensity of natural hazards. Examples include land degradation, deforestation, desertification, wildland fires, loss of biodiversity, land, water and air pollution, climate change, sea level rise and ozone depletion.

Figure 2.2
Distribution of natural disasters, by country and type of phenomenon 1975-2001



Source: EM-DAT: The OFDA/CRED International Disaster Database - www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium, 2004

Figure 2.3
Number of people killed (income class/disaster type), world summary 1973-2002



Source: EM-DAT: The OFDA/CRED International Disaster Database - www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium, 2004, based on elaboration by ADRC

Understanding the nature of vulnerability and capacity

Risk is rooted in conditions of physical, social, economic and environmental vulnerability that need to be assessed and managed on a continuing basis. The primary objective is to minimize exposure to hazards through the development of individual, institutional and societal capacities that can withstand loss or damage.

Over the past 30 years there has been a significant and important development in the understanding about people's susceptibility to hazards. The concept of vulnerability was initially used by engineers in considering construction designs related to levels of resistance to physical forces exerted by ground motion, wind and water.

During the 1980s and 1990s, there was a growing interest in the linkages between disasters and development. Originally focused on considering the impact of disaster on development, the scope of interest has since been expanded to address the impact of development on the toll of disaster-related damage. This expressed a new range of socio-economic and environmental concerns built around the notion of vulnerability.

The role of community participation and people's general coping capacities are also recognized as key elements in explaining disaster risk. The creative link between the negative conditions with which people live, and the often overlooked positive attributes which they also possess, underline the importance of the socio-economic dimensions of risk.

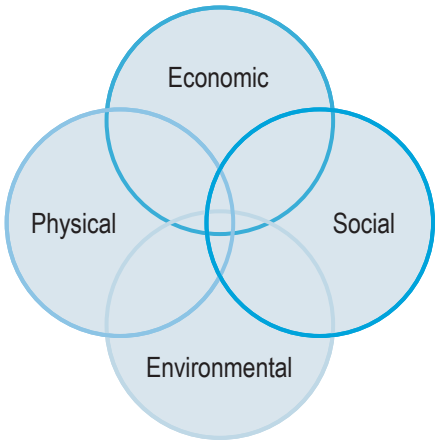
However, it remains a challenge to encourage the identification of locally available strengths and capacities that can reduce risk to hazards. The importance of revealing capacities hidden in non-disaster times becomes a critical task for disaster risk reduction. Capacities apply to all levels of society and social organizations, and encompass a broad range of physical, social, economic and ecological considerations.

Vulnerability is a reflection of the state of the individual and collective physical, social, economic and environmental conditions at hand. These are shaped continually by attitudinal, behavioural, cultural, socio-economic and political influences on individuals, families, communities and countries.

Governed by human activity, vulnerability cannot be isolated from ongoing development efforts. It therefore plays a critical role in all the aspects of sustainable development.

Figure 2.4 illustrates the four broad areas in which different aspects of vulnerability can be grouped, depicted by intersecting circles to show that all spheres interact with each other.

Figure 2.4
Interaction of vulnerability factors



Physical factors

This concept is conventionally materially oriented, and comes from the schools of land-use planning, engineering and architecture. Physical aspects of vulnerability, although continually being broadened in scope, still refer mainly to

Vulnerability
The conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.

Coping capacity
The means by which people or organizations use available resources and abilities to face adverse consequences that could lead to a disaster.

considerations and susceptibilities of location and the built environment. It may be described as "exposure" or "placed in harm's way" or "being in the wrong place at the wrong time". Physical vulnerability may be determined by aspects such as population density levels, remoteness of a settlement, the site, design and materials used for critical infrastructure and for housing.

Social factors

Social vulnerability is linked to the level of well-being of individuals, communities and society. It includes aspects related to levels of literacy and education, the existence of peace and security, access to basic human rights, systems of good governance, social equity, positive traditional values, customs and ideological beliefs and overall collective organizational systems.

Some groups are more vulnerable than others. People less privileged in class or caste structures, ethnic minorities, the very young and very old, and other disadvantaged and marginalized segments of the population are more likely to be exposed to greater risk. Gender issues, particularly the role of women, are also important. In many societies, women have a primary responsibility for domestic life, providing essential shelter and basic needs. Therefore, women are more likely to become more burdened or more vulnerable in times of crisis.

Public health, concerning physical, mental and psychological well-being, is a critical aspect of social vulnerability. The disabled, of whom there are hundreds of millions worldwide, are particularly susceptible, as their evacuation and continued care is severely hampered during disasters. Predisposition to infection, exaggerated exposure to communicable diseases, lack of defensive mechanisms represent individual conditions of vulnerability. Physical features in a community, such as insufficient basic infrastructure, especially water supply and sanitation, as well as inadequate health care facilities and supplies, are also expressions of increased vulnerability.

Traditional knowledge systems, as well as cultural aspects such as indigenous beliefs, traditions and ways of coping are important determinants in risk perception. Deeply rooted beliefs that are destiny-oriented or which pose a fatalistic vision of disasters can reflect a religious or ideologically inherited sense of vulnerability. Such views may present a great challenge in moving towards the acceptance of a culture of prevention and protection.

Social vulnerability is also linked with other politically-oriented societal factors, such as social power relations. Institutional organizations and governance structures also play an important role in the level of social vulnerability. Social cohesion and regulation improve coping capacities, whereas social insecurity increases vulnerability.

Economic factors

Levels of vulnerability are highly dependent upon the economic status of individuals, communities and nations. The poor, a disproportionately female and elderly group in most regions, are generally far more vulnerable than economically better off segments of society. This relates both to the possibility of higher proportional losses among the poor when a disaster strikes, and to their generally more limited capacity to recover from disasters.

Economic vulnerability also includes levels of individual, community and national economic reserves, levels of debt and the degree of access to credit, loans and insurance. An economy lacking in diversity is generally more vulnerable. Similarly, inadequate access to critical and basic socio-economic infrastructure, including communication networks, utilities and supplies, transportation, water, sewage and health care facilities, increase people's exposure to risk.

Environmental factors

Key aspects of environmental vulnerability include the extent of natural resource depletion and the state of resource degradation. In the same vein, a lack of resilience within ecological systems and exposure to toxic and hazardous pollutants are important elements that shape environmental vulnerability. A reduced access to clean air, safe water and sanitation and inappropriate forms of waste management, especially in densely populated and urban environments can deepen levels of

socio-economic vulnerability. Increasingly vulnerable environmental conditions such as diminished biodiversity, soil degradation or growing water scarcity can easily threaten food security for people dependent on the products of the land, forests, pastures, and marine environments for their livelihoods. A polluted environment also increases people's exposure to health risks.

As natural resources become more scarce the range of options available to communities becomes more limited, reducing the availability of coping solutions and decreasing local resilience to hazards or recovery following a disaster. Over a period of time environmental factors can increase vulnerability further by creating new and undesirable patterns of social discord, economic destitution and eventually forced migration of entire communities.

2.2 Emerging trends in hazards, vulnerability patterns and the impact of disasters

More than 90 per cent of the deaths related to natural disasters occur in developing countries. Disaster impact statistics show a global trend that there are now more disasters but fewer people dying, even though greater numbers of people are affected and economic losses are increasing.

Physical exposure of human beings and the fragility of economic assets to disasters have been partly shaped by patterns of settlement. Beneficial climatic and soil conditions that have spurred economic activities are associated with hazard-prone landscapes. Both volcanic slopes and flood plains historically have attracted human activities.

Where settlement patterns have contributed to configure risk scenarios, new forces such as population growth and increased rural/urban migration act as dynamic pressures which contribute to increasing people's exposure to hazards.

Poverty levels and the impact of development processes, especially those associated with an increasingly global society reflect current trends in socio-economic vulnerability related to the impacts of disasters. The pace of modern life has also introduced new forms of vulnerabilities related to technological developments and biological threats.

Localized and systemic environmental degradation is becoming highly influential as well, lowering the natural resilience to disasters. This is demonstrated by delayed recovery time and a weakened resource base on which human activity relies.

Phenomena like El Niño/La Niña, climate change and the potential for rising sea levels, are affecting the patterns and intensity of hydrometeorological hazards. Environmental degradation influences the effects of natural hazards by exacerbating their impacts and limiting the natural coping capacity and resilience of the areas affected.

Biological hazards in the form of plant or animal contagion, extensive infestations, human disease epidemics and pandemics continue to influence society in new and unpredictable ways. They exert particular impact on critical social aspects such as mortality, family relationships, health and economic productivity, among other things.

Disasters triggered by technological hazards often result in major accidents associated with industrialization and technological innovation. These can have a significant socio-economic and environmental impact. Although technological hazards have been part of society for hundreds of years, trends show increasing impact.

Specifically, in the energy, transportation and industrial sectors, technology can carry associated risks that are not always understood. The adverse effects of some technological disasters, both on society and on the environment, can considerably outlast the impacts associated with natural disasters.

Trends in impact of disasters

While no country in the world is entirely safe, the lack of capacity to limit the impact of hazards remains a major burden for developing countries, where over 90 per cent of natural disasters fatalities occur. Twenty-four of the 49 least developed countries still face high levels of disaster risk. At least six of them experienced between two and eight major disasters during each of the last 15 years, with long-term consequences for human development. These figures do not include the consequences of the many smaller and unrecorded disasters that cause significant loss at the local level.

In its annual publication *Topics* for 2000, the re-insurance giant Munich Re – a member of the Inter-Agency Task Force on Disaster Reduction – looked at the trend of economic losses and insurance costs over a 50-year period.

It based its analysis on what it calls "great natural catastrophes." There were 20 of them that accounted for US$ 38 billion in economic losses (at 1998 values) between 1950 and 1959. However, between 1990 and 1999, there were 82 such major disasters and the economic losses had risen to a total of US$ 535 billion. That is, the number of disasters had multiplied fourfold but economic losses were 14 times higher.

Economic losses in these cases are absolute figures, mostly losses incurred in industrialized countries. When seen as losses by percentage of GDP, it is developing countries that lose most, as shown in the table based on figures provided by Munich Re. For example, the economic losses of the United States from the 1997-1998 El Niño event were US$ 1.96 billion or 0.03 per cent of GDP. The economic losses in Ecuador were US$ 2.9 billion, but this represented 14.6 per cent of its GDP.

The International Federation of Red Cross and Red Crescent Societies, another ISDR Inter-Agency Task Force member, confirms the worsening trend of human suffering and economic loss during the last decade.

The total number of people affected each year by natural disaster – that is, who at least for a time either lost their homes, their crops, their animals, their livelihoods or their health, because of the disaster – almost doubled between 1990 and 1999.

In this period an average of 188 million people per year were affected by disasters. This is six times more than the average of 31 million people affected annually by conflict.

Even though the number of disasters has more than tripled since the 1970s, the reported death toll has decreased to less than half. It is important also to remember that smaller disasters are generally under-reported and therefore are not ordinarily reflected in global data. Their accumulated consequences likely reflect significant socio-economic tolls.

Box 2.1
The ecological footprint

Every human requires an area of land and shallow sea for food, water, shelter, transport, energy, commerce and waste.

In rich nations such as the United States, this ecological footprint is almost 10 hectares per person. But even in the poorest places in the United States this footprint is at least 1 hectare.

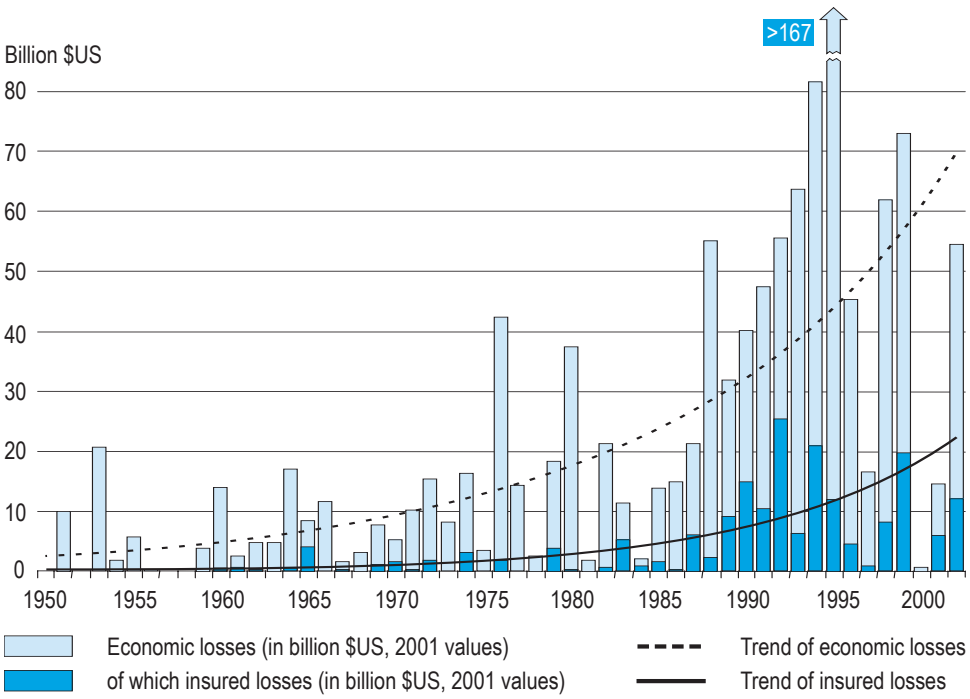
Every day, another 200,000 newborns will require up to 200,000 hectares of what might have been a benign and necessary wilderness. More people also means more fossil fuel consumption, which means more carbon dioxide emission, which means climate change.

Such a world, climate scientists have warned repeatedly, is a world with a greater frequency of extreme events. Demographic pressures result in more forest loss and more land degradation. This means increased flooding, drought or both. The combination of climate change and population growth will exact a price.

The latest UN calculation is that three decades from now, around 70 per cent of the world's land will be affected in some way by human activity and half the people in the world will be short of water. Many of the other half will be at risk from increased flooding. By that time, there could be 8 billion people on the planet.

Adapted from: E.O. Wilson, Scientific American, February 2002.

Figure 2.5
Economic losses, major* natural disasters, 1950-2002



Source: MunichRe, 2002
*Note: Exceeding 100 deaths and/or $US 100 million in claims

There is considerable geographic variation in the occurrence and impact of natural hazards. Asia was affected by approximately 43 per cent of all natural disasters in the last decade. During the same period, Asia accounted for almost 70 per cent of all lives lost due to natural hazards.

During the two El Niño periods of 1991-1992 and 1997-1998, floods in China alone affected over 200 million people in each period. Nevertheless, in relative terms and considered per capita, Africa is the most heavily affected region, in particular when drought, epidemics and famine are considered.

The most terrible year in human losses during the last decade was 1991, when a cyclone devastated Bangladesh killing 139,000 people, bringing the global deaths for that year to 200,000.

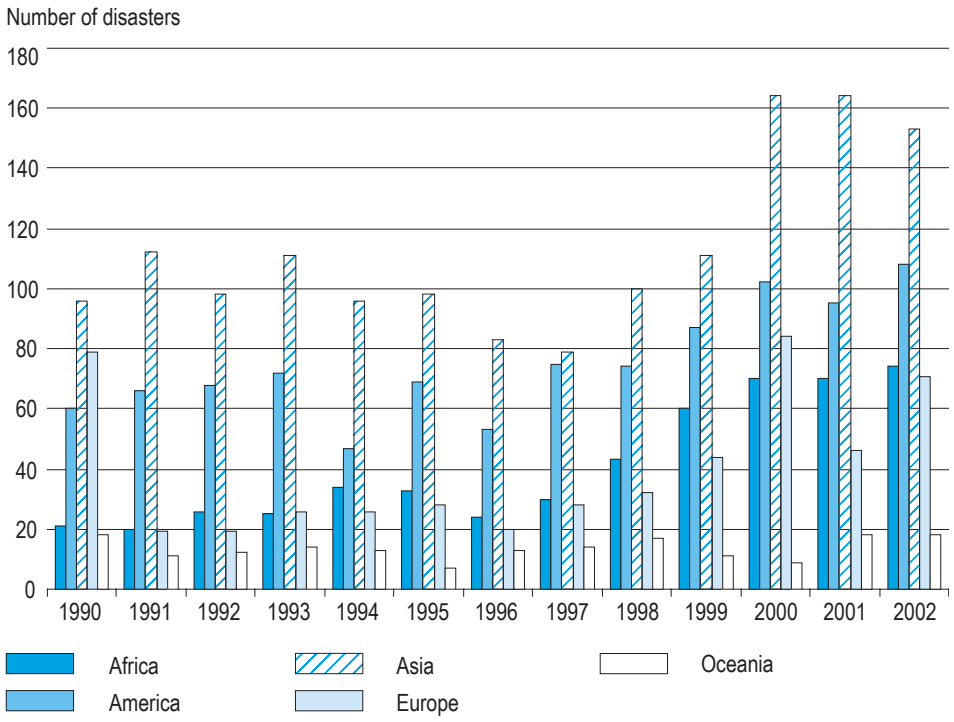
Cyclones continue to hit the Bangladesh coasts but such a catastrophe has not happened since. This is in part because the machinery of warning and preparedness – watchful officials, an aware public and a stronger sense of community responsibility – has improved in the last decade.

The worst disaster-related global economic loss of the 1990s was the 1995 Great Hanshin-Awaji earthquake in Kobe, Japan. A highly developed and well-prepared nation faced serious setbacks economically by losing important facilities of a primary port. Even eight years after that disaster, the amount of trade passing through Kobe remains 15 per cent less than pre-earthquake totals.

A particular concern emerging from long-term disaster trends is that the number and impact of weather-related disasters have rapidly increased over the last few decades. A comprehensive study undertaken by the World Meteorological Organization (WMO) looked at weather impacts for 2002 and examined their complexities and impact on different countries.

Notable points from this study were the catastrophic floods in Europe in August, causing losses of about $20 billion (the bulk of the year's global losses), the severe winter for Mongolia resulting in estimated losses equal to 15 per cent of gross national income, and the tropical storms in the Federated States of Micronesia, where the fatalities reached the exceptionally high national rate of 40 per 100,000 people.

Figure 2.6
Total number of reported natural disasters, 1991-2002



Source: EM-DAT: The OFDA/CRED International Disaster Database - www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium, 2004

Trends in hazards

Until recently, intensity and frequency patterns of natural hazards followed natural variations in global temperatures and tectonic activity. Today, while the scale of seismic and volcanic activity reflects these long time-scale variations, it appears that frequency and intensity of hydrometeorological hazards is being affected by a changing climate.

Although it is very difficult to show scientific evidence of these changes, projections for the future invite concern, as shown by the findings of the Intergovernmental Panel on Climate Change (IPCC). In some ways, societies are not only responsible for their own socio-economic vulnerability, but also are increasingly responsible for shaping new trends in hazard occurrence.

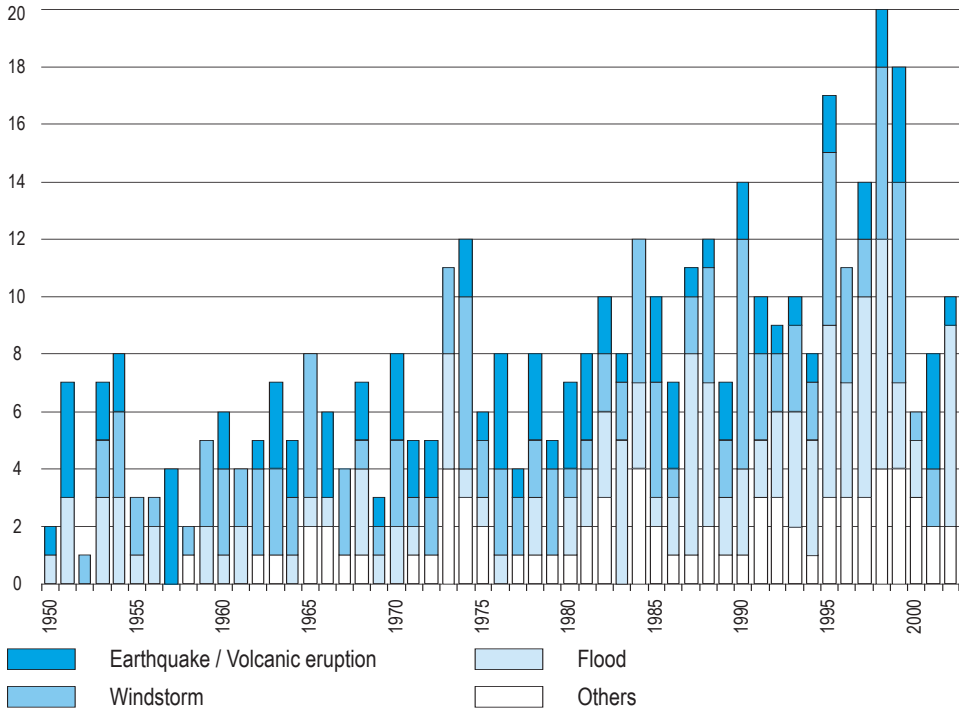
Hydrometeorological hazards

Societies are increasingly affected by inter-annual variations in climate such as those associated with El Niño/La Niña, which affect precipitation and temperature on inter-annual timescales that are only predictable to some degree. These regional climatic shifts can produce hydro-climatic hazard events associated with climate variability. The prevalence of droughts and floods that trigger disasters shows that many countries are vulnerable to natural climate variability and extremes.

Projected climate changes in coming decades expected to accompany global warming, are likely to change the frequency and intensity of climate hazards in ways that may adversely affect some regions. When dealing with the complex subject of climate change, some issues are now accepted by most scientists: temperatures are increasing globally, although these increases are not evenly distributed around the planet. As the atmosphere becomes warmer it can absorb more water vapour, leading to an increase in humidity. As a result, more water moving through the hydrological cycle will lead to more precipitation per event, more variability and more frequent climate extremes in relation to current climate ranges.

These factors are expected to influence the occurrence and impact of disasters by affecting the intensity and frequency of extreme

Figure 2.7
Great natural catastrophes, 1950-2002



Source: CRED International Disaster Database, 2003Source: EM-DAT: The OFDA/CRED International Disaster Database - www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium, 2004
Note: Natural disasters of at least 1 000 deaths or 1 billion 2002 $US of economic losses

Box 2.2
El Niño outlooks

Climatic factors that affect the occurrence of natural disasters are influenced by irregularly recurrent phenomena such as the El Niño and La Niña. Atmosphere and ocean circulation models project that as the earth's climate warms over the next 100 years, it is likely that a more El Niño like condition may persist, leading to an increase in the incidence of floods and droughts in many parts of the world.

Both the 1982-1983 and 1997-1998 El Niño events, the strongest ever recorded, had disastrous impacts on Pacific Rim countries and the effects were felt worldwide. According to a 1999 scientific study led by WMO, the socio-economic impacts associated with the 1997-1998 El Niño events included:

- more than 24,000 lives lost because of high winds, floods or storm tides, that occurred during intense storms;
- more than 110 million people affected and more than six million people displaced as community infrastructures, including housing, food storage, transport and communications, were lost during storms; and
- direct value of losses exceeding US $34 billion.

This highlights the need for better monitoring of the phenomena, better forecasts of the related extreme events, and more importantly, stronger institutions to deal with such information and to increase community preparedness and resilience.

WMO, in collaboration with the US National Oceanic and Atmospheric Administration and the International Research Institute for Climate Prediction, has undertaken to coordinate the preparation of El Niño outlooks whenever the threat of an event manifests itself, as a contribution to the Inter-Agency Task Force on Disaster Reduction.

These outlooks draw on additional contributions from the Australian Bureau of Meteorology, China Meteorological Administration, the European Centre for Medium Range Weather Forecasts, Japan Meteorological Agency, National Institute of Water and Atmospheric Research in New Zealand, Met Office United Kingdom, and the Climate Variability and Predictability Project of the World Climate Research Programme.

hydrometeorological events. As is known, changes in precipitation patterns, soil moisture and vegetation cover are linked to the occurrence of floods and droughts as well as contributing to landslides and other types of debris flow. Another likely result of global warming is rising sea levels which would contribute to higher storm surges during hurricane and typhoon landfall in coastal areas.

The Inter-Agency Task Force on Disaster Reduction (IATF/DR) has a working group dealing with climate and disasters. In the area of drought preparedness and mitigation, there are a number of coordinated and collaborative initiatives that are foreseen to be undertaken within the framework of the IATF/DR involving all its working groups.

Box 2.3
2002 floods in Europe

Flood damage
Unusually heavy rain provoked record floods in Europe and Asia in 2002. According to WMO, "Floods in more than 80 countries have killed almost 3,000 people and caused hardship for more than 17 million worldwide since the beginning of 2002. Property damage amounted to over US$ 13 billion with more than 8 million square kilometres of land affected by floods – an area almost as large as the United States".

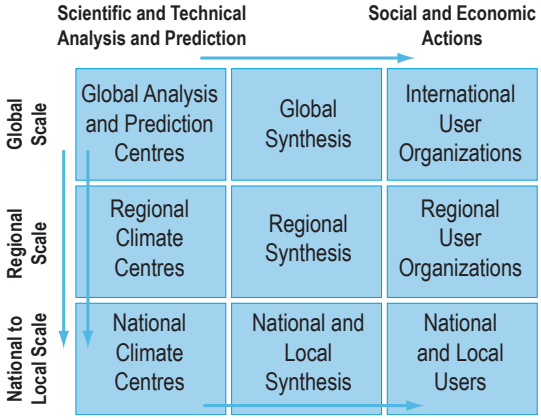
In Europe, the rains starting in August provoked flooding of the major rivers, including the Elbe, Danube, and Vltava. Prague and Dresden were at the centre of the storm, with the Czech Republic, Slovakia, Germany and Austria hit hard. Also affected were Italy, Spain, Russia, Romania and Hungary. Over 100 people died, hundreds of thousands were evacuated, and there was extensive damage to basic infrastructure and the commercial and private sectors. According to MunichRe, the losses in economic terms amounted to more than 15 billion Euros.

Tea and sympathy
Responding to the floods, some Mozambican artists organized a concert called "Bridge over troubled water" in sympathy for the affected people, although their country is still recovering from the 2000 and 2001 floods. The Government of Sri Lanka, for its part, airlifted no less than 2000 kilograms of Ceylon tea to German, Austrian and Czech flood victims.

Source: <http://www.reliefweb.int/w/rwb.nsf/s> and <http://www.iutcolmar.uha.fr/internet/Recherche/JCERDACC.nsf>.

Box 2.4
ISDR working group on climate and disasters

WMO leads a working group of the IATF/DR. It consists of members representing UN agencies, regional and scientific organizations and the private sector. It examines how scientific climate information is best conveyed to different user groups.



It is important that global, regional and national centres work together to ensure that users, who obtain information from various sources, receive a consistent message and applicable information.

The working group defined a matrix for more coordinated and systematic information transfer between those involved in the interpretation of scientific assessments and the many different user communities. The working group is also preparing El Niño outlooks.

In view of the increased frequency and intensity of meteorological and hydrometeorological hazards, this working group, together with another working group on risk, vulnerability and impact assessment, has expressed a need to improve disaster impact databases and to link them to climate databases.

Drought

Drought is usually characterized in terms of its spatial extension, intensity and duration. Its creeping characteristics and various impacts make the adoption of a precise and universally accepted definition of drought difficult, adding a degree of confusion. Drought is often forgotten once it ends, and seems to catch everybody unawares again once it reappears.

Droughts are usually classified as being meteorological, hydrological, agricultural, economic or social in nature, revealing the multiple and cross-cutting causes and impacts on societies and ecosystems.

Box 2.5
ISDR discussion group on drought

The ISDR ad hoc discussion group on drought, composed of sixteen experts, has produced a report, titled An Integrated Approach to Reducing Societal Vulnerability to Drought. The document identifies many critical issues associated with drought risk reduction, including:

- supporting and strengthening programmes for the systematic collection and processing of meteorological and hydrological observations;
- building and strengthening scientific networks for the enhancement of scientific and technical capacities in meteorology, hydrology and other related fields;
- developing an inventory of climate and water resources indicators and indices;
- improving understanding of drought climatology (frequency, intensity and spatial extent) and patterns;
- understanding the principal causes of drought at local, regional and global levels;
- developing decision support models for the dissemination of drought-related information to end users and appropriate methods for encouraging feedback on climate and water supply assessment products, and on other forms of early warning information;
- developing and disseminating vulnerability and risk assessment tools that are appropriate for different social and environmental conditions;
- disseminating drought planning methodologies that can be adopted by drought-prone countries in the preparation of plans;
- developing national and regional drought management policies that emphasize monitoring and early warning, risk assessment, mitigation and response as an essential part of drought preparedness;
- supporting development of regional networks for drought preparedness that build greater institutional capacity by sharing lessons learned in drought monitoring, prediction, vulnerability assessment, preparedness and policy development;
- educating policy makers and the public regarding the importance of improved drought preparedness as a part of integrated water resources management; and
- enhancing collaboration among regional and international organizations, within regions as well as between regions to address overlapping responsibilities and jurisdictional issues.

The complete report is available on ISDR's web site <http://www.unisdr.org>.

Meteorological drought is defined by the deficiency of precipitation from expected or normal levels over an extended period of time. Hydrological drought is best defined by deficiencies in surface and subsurface water supplies leading to a lack of water for meeting normal and specific water demands.

Usually triggered by meteorological and hydrological droughts, agricultural drought may be characterized by deficiency in the water availability for specific agricultural operations such as deficiency of soil moisture, which is one of the most critical factors in defining crop production potential. Economic droughts have been referred to as low rainfalls outside the normal expected parameters with which an economy is equipped to cope. Social droughts are linked to the direct, as well as indirect, impacts on human activities.

During coming years, it is expected that vulnerability to drought will increase, mainly due to population increases, environmental degradation and development pressures. Several efforts have therefore been made at international, regional and national levels to address drought challenges. In that context, and unlike sudden-onset disasters, drought presents unique characteristics that require different approaches to reduce their impacts.

- Drought does not directly destroy shelter, infrastructure or food stores.
- Drought effects are cumulative.
- It is often very difficult to detect the onset of droughts until major impacts become discernible, such as lack of water or food.
- Impacts can be spread over a larger geographical area than the damages that result from most other natural disasters.
- Quantification of impacts and provision of disaster relief is far more difficult.

Further, there are several social and economic parameters that affect the severity of drought. Food prices, conflicts, human activity, vegetation, water supplies and demand, all make it extremely difficult to quantify or define indicators of its severity.

Southern Africa

Drought has been a recurrent feature in most parts of Southern Africa, with five recent major

periods of drought, in 1980-1983, 1987-1988, 1991-1992, 1994-1995 and 1997-1998. Three of these events were regional in scale, with the 1991-1992 drought considered the worst in living memory, placing more than 20 million people at risk.

Central and South-West Asia

The persistent multi-year drought occurring in Central and South-West Asia since November 2001 is an example of climatic variability that has affected up to 60 million people in parts of Iran, Afghanistan, Tajikistan, Uzbekistan and Turkmenistan.

Chronic political instability in many parts of the region and military action in Afghanistan have further complicated the situation. A recent study by IRI concludes that over the last three years Central and South-West Asia represent the largest region of persistent drought in the world.

In Iran alone, 37 million people have been affected. Water reserves in the country were reduced by 45 per cent in 2001, 800,000 head of livestock were lost in 2000, and 2.6 million hectares of irrigated land and 4 million hectares of rain-fed agriculture were affected. Damage to agriculture and livestock has been estimated by the UN at US$ 2.5 billion in 2001 and US$ 1.7 billion in 2000. Afghanistan and Pakistan are affected on a similar scale.

Sea level rise and coastal systems

An estimated 46 million people living in coastal areas are at risk of flooding from storm surges every year, and sea-level rise poses a longer-term threat. Climate change may likely exacerbate these trends with significant impacts upon the ecosystems and populations. A growing number of people will inhabit coastal areas.

Many traditional communities and subsistence populations also rely on the wealth of resources in coastal areas and continue to be drawn to these high-risk regions. For example, indigenous coastal and island communities in the Torres Strait of Australia and in New Zealand's Pacific Island Territories are especially vulnerable.

Although adaptation options exist, such measures are not easily implemented on low-lying land. Also, climate change and sea level rise issues are not yet well incorporated in current models for coastal zone management.

Box 2.6
Reducing drought impacts

The need to improve drought preparedness through the development of policies and plans has become well accepted: South Africa (early 1990's), sub-Saharan Africa (UNDP/UNSO, 2000), West Asian and North African countries, Mediterranean region (CIHEAM, 2001), Morocco. Some of these programmes were developed with the UN Convention to Combat Desertification (UNCCD). The total number of countries who ratified the Convention is 190 (as at December 2003).

In Australia, the 1992 National Drought Policy is widely recognized as a successful policy and often replicated. It has three main objectives:

- encourage primary producers and other sections of rural Australia to adopt self-reliant approaches to managing for climatic variability;
- maintain and protect Australia's agriculture and environment resource base during periods of extreme climate stress; and
- ensure early recovery of agriculture and rural industries, consistent with long-term sustainable goals.

Table 2.2
Examples of impacts resulting from projected changes in extreme climate events

Projected changes during the 21st century in extreme climate phenomena and their likelihood[a]	Representative examples of projected impacts[b], all high confidence of occurrence in some areas[c]
Simple extremes	
Higher maximum temperatures: more hot days and heat waves over nearly all land areas (very likely[a])	• Increased incidence of death and serious illness in older age groups and urban poor • Increased heat stress in livestock and wildlife • Shift in tourist destinations • Increased electric cooling demand and reduced energy supply reliability
Higher (increasing) minimum temperatures: fewer cold days, frost days, and cold waves over nearly all land areas (very likely[a])	• Decreased cold-related human morbidity and mortality • Decreased risk of damage to a number of crops and increased risk to others· • Extended range and activity of some pest and disease vectors • Reduced heating energy demand
More intense precipitation events (very likely[a] over many areas)	• Increased flood, landslide, avalanche, mudslide and debris flow damage • Increased soil erosion • Increased flood runoff could increase recharge of some floodplain aquifers • Increased pressure on government and private flood insurance systems and disaster relief
Complex extremes	
Increased summer drying over most mid-latitude continental interiors and associated risk of drought (likely[a])	• Decreased crop yields • Increased damage to building foundations caused by ground shrinkage • Decreased water resource quantity and quality • Increased risk of forest fire
Increase in tropical cyclone peak wind intensities, mean and peak precipitation intensities (likely[a] over some areas[d])	• Increased risks to human life, risk of infectious disease and epidemics • Increased coastal erosion and damage to coastal buildings and infrastructure • Increased damage to coastal ecosystems such as coral reefs and mangroves
Intensified droughts and floods associated with El Niño events in many different regions (likely[a])	• Decreased agricultural and rangeland productivity in drought and flood-prone regions • Decreased hydro-power potential in drought-prone regions
Increased Asian monsoon precipitation variability (likely[a])	• Increased flood and drought magnitude and damages in temperate and tropical Asia
Increased intensity of mid-latitude storms (little agreement between current models[b])	• Increased risks to human life and health · Increased property and infrastructure losses

a Likelihood refers to judgmental estimates of confidence used by TAR EGI: very likely (90-99% chance); likely (66-90% chance). Unless otherwise stated, information on climate phenomena is taken from the Summary for Policymakers, TAR WGI.
b These impacts can be lessened by appropriate response measures.
c High confidence refers to probabilities between 67% and 95% as described in Footnote 6.
d Information from TAR EGI, Technical Summary, Section F.5.

Source: Report of working group II: Impacts, adaptation and vulnerability of the Intergovernmental Panel on Climate Change, 2001

Box 2.7
Disaster risk and climate change

Although climate change from rising greenhouse gas concentrations is not implicated as the primary cause of the growth of disasters over recent decades, it remains highly relevant to disasters and to disaster reduction for several key reasons:

1. The existing trends evident in weather parameters, though small, will be having some effect on hazard events already – for example rising global temperatures on heat waves.
2. The Intergovernmental Panel on Climate Change (IPCC) has consistently projected the likelihood of increased frequency and intensity of hazards in the future – when and where these changes will become manifest is very uncertain, so precautionary preparations are essential.
3. The experience of countries in managing multiyear climatic changes can provide valuable lessons for dealing with the projected longer-term changes.
4. Disaster reduction provides a solid, meaningful, no-regrets set of activities in support of climate change adaptation plans.
5. Responses to the climate change issue, in respect to both emission mitigation and adaptation, will inevitably alter the climate-related risks of countries, possibly negatively.

Source: Report of working group II: Impacts, adaptation and vulnerability of the Intergovernmental Panel on Climate Change, 2001

Geological hazards

Geological hazards include internal earth processes of tectonic origin, such as earthquakes, tsunamis and volcanic emissions, as well as external processes such as mass movements – landslides, rockslides, rock falls or avalanches, surface collapses, and debris and mud flows.

Earthquakes and volcanic eruptions represent the classic rapid-onset, sudden-impact hazards. The regional distribution of earthquakes and volcanoes is closely related to the geophysical activity associated with the tectonic plates. Most of the world's earthquakes and volcanoes occur along the tectonically active margins of these major plates – but also at weak points within them.

While many tectonic hazards occur less frequently in a particular place than other hazards, explosive demographic growth and rapid urbanization processes increase the exposure of human beings and their economic assets.

Earthquakes and volcanic activity also act as triggering events for secondary or tertiary hazards. Ground-shaking effects produced by earthquakes can promote tsunamis and seiches, and are associated with mass movements such as landslides, avalanches and rockfalls. In the same fashion, ground deformation that accompanies magma's rise in eruptive phases of volcanoes can generate massive landslides, debris flows and lahars.

Mass movement and landslides contribute to major disasters every year on a global scale, and their frequency is on an upward trend. The number of deaths caused by landslides is likely underestimated, since they are usually masked by the broad disaster statistics of earthquakes and floods. Recent examples are the debris flows in Venezuela in December 1999 with around 20,000 deaths, and the El Salvador earthquakes of 2001, which caused 600 deaths in just one landslide.

Box 2.8
Towards landslide risk management

The Joint Technical Committee on Landslides (JTC-1) comprises representatives from the International Society for Soil Mechanics and Geotechnical Engineering, the International Society for Rock Mechanics and the International Association for Engineering Geology. The JTC-1 promotes the development of educational programmes, including research, information dissemination and new techniques in landslide risk reduction. It also organizes events related to landslide risk management, such as the international symposium on landslides held every four years.
<http://www.em.pucrs.br/islrio>

Another initiative on this subject is the International Consortium on Landslides (ICL), a scientific NGO based at Kyoto University, created under the auspices of UNESCO, WMO, FAO and the ISDR Secretariat. The ICL aims to promote landslide research, as well as landslide risk assessment and mitigation studies. To this purpose, it is facilitating the development of specific projects in conjunction with the protection of cultural and natural heritage.
<http://icl.dpri.kyoto-u.ac.jp/>

Volcanic hazards

About 50 to 60 volcanoes erupt every year. Large eruptions endanger the lives, settlements and livelihoods of almost 500 million people estimated to live near active volcanoes. That number will increase in the future as more than 60 large and growing cities are located near potentially active volcanoes.

Volcanoes with high levels of activity are located predominantly in developing countries, particularly in Latin America, the Caribbean, and parts of Asia and in the South-West Pacific. Despite improvements in many national civil defence agencies, eruptions are becoming increasingly risky because of rising population densities and expanding infrastructure in the areas surrounding volcanoes.

As the physical characteristics and chemical properties of a specific volcano become better known, it can be monitored more easily. However, the prediction of an impending eruption is still a major challenge for volcanologists. Therefore, predicting future volcanic eruptions and related hazards must also be matched with a series of other forms of risk management, including:

- analysis of volcanic risks;
- early warning and short-term forecasting of eruptions;
- timely evacuation of people from hazardous areas;
- development of land-use and contingency plans to minimize future volcanic disasters; and
- sustained information programmes for the population.

Major volcanic eruptions do not occur spontaneously. They are preceded by a variety of physical, geological and chemical changes which accompany the rise of magma towards the Earth's surface. The monitoring of these changes with well-established scientific techniques provides the best opportunity to develop a warning system. Recent volcanic events show that the cost of monitoring volcanic activity and pre-disaster planning is very small when compared to the potential losses.

For early warning to be effective, sustained public education and information are necessary. This

Box 2.9

Nyiragongo Volcano, Democratic Republic of the Congo

Goma is overshadowed by two large and active volcanoes, Nyiragongo and Nyamalagira. Both are linked by a common subterranean geological structure, and the crater of the former contains what is said to be the largest lava lake in the world. According to a French-British scientific report in 2002, any weaknesses in the sides could result in catastrophic consequences for the surrounding population. Nyiragongo and neighbouring Nyamuragira are responsible for nearly two-fifths of Africa's eruptions.

Nyiragongo is considered by the scientific community as one of the most dangerous volcanoes in Africa. In 1977 extremely fluid, fast moving lava flows drained the lava lake killing about 50-100 people, although other estimates run as high as 2,000 fatalities. Additional activity occurred in 1982 and 1994. Significantly, following a crater eruption of Nyamuragira in January 2000, the only local volcanologist signalled the possibility of a later eruption of Nyiragongo, which indeed occurred in February 2001.

In May 2001, the small Goma observatory requested assistance to acquire seismographs, thermometers and funds to conduct field surveys. Nyiragongo again showed signs of activity later in the year, and an earthquake was felt in Goma while black smoke was sighted above the volcano. Similar phenomena were noted in January 2002, that suggested an imminent eruption.

The local volcanologist again sent messages to the international community four days later, raising the alarm and requesting assistance. Nyiragongo began erupting on 17 January and continued for six days. One lava flow headed for the town of Goma where it split the town in half. Another lava flow headed towards the town of Gisenyi in Rwanda.

According to an expert report, "the eruption forced the rapid exodus of 300,000 to 400,000 people, mostly into neighbouring Rwanda, with dramatic humanitarian consequences… Forty-seven victims were reported killed directly due to the eruption, to which one must add another 60 people killed during the explosion of the petrol station in Goma centre on January 21."

At least 16,000 homes were destroyed, leaving 100,000 people homeless, and 24,000 children without schools. Goma and Gisenyi also suffered from strong seismic activity associated with the eruption.

Adapted from: Final report of the French-British scientific team, 2002.

includes understanding results of volcanic studies and analysis, the possible dangers and the local plans to address them prior to emergency conditions. This can be done through education, although the best prepared communities also conduct regular disaster warning and prevention exercises.

In 1990, the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) launched a programme to support the UN International Decade for Natural Disaster Reduction (IDNDR) and to promote the reduction of risks related to volcanoes.

The initiative selected 16 volcanoes for monitoring and research with the aim of directing attention to a small number of active volcanoes. It encouraged a range of research and public-awareness activities aimed at understanding the volcanoes and the hazards they pose.

Biological hazards

A wide range of diseases, originated or transmitted by organisms that affect people, their crops or animals, are considered biological hazards.

Exposure to biological hazards is in many cases linked to the occurrence of other natural hazards, such as floods, drought, and storms. The increasing prevalence of hydrometeorological hazards may influence the occurrence of water- and vector-borne diseases such as cholera, malaria, leptospirosis and typhus.

In the same vein, vulnerability to insect infestations can constitute an additional source of concern for many countries, in association with the impacts of climate change. That could be the case for the Russian Federation, according to a recent national assessment of global climate change and associated risks.

The outbreak of severe acute respiratory syndrome (SARS) infected 6,000 people and caused more than 400 deaths in 30 countries. WHO has declared SARS as the most significant outbreak of disease spread through air travel in history. The various impacts of SARS,

Box 2.10
A society falling apart: Southern Africa's silent disaster

When more than 14 million people in Southern Africa faced famine in 2002, an intervention with food aid began that by February 2003 had averted mass starvation. But hunger was not the crisis. It was a symptom of a pernicious new process.

HIV/AIDS, together with food shortages, poverty, common disease and mismanagement is bringing a region to its knees. Millions are dying and all the food aid mustered will not save them. What is needed is an integrated approach that reverses the slow but inexorable destruction of Southern Africa's social fabric.

World attention is focused elsewhere because the television images that define disaster in Africa are missing in this case. There are not skeletal figures studded across the landscape, no agonizing evidence of malnutrition, no hunger camps, and no endless lines of wasting children with flies buzzing in their eyes.

Today's disaster is a silent one and most of those dying are dying at home. The disaster is the erosion of Southern Africa's communities. AIDS, a killer on its own, is uniting with other factors to weaken and undermine the ways in which people recover from adversity using age-old coping mechanisms.

Poor access to health care, the acculturated spread of tuberculosis, malaria and other diseases, an appalling absence of safe water and sanitation, uncontrolled urbanization and ineffective agriculture are among the aggravating factors. Added to this is AIDS. So many problems are emerging and they are quietly feeding and exploiting one another.

Life is becoming unsustainable. Farmers fall ill with AIDS, wives leave the fields to nurse them. Fewer hands in the field means less food, and coupled with drought, that may spell famine. But rain or no rain, there is poverty. The farmers die, leaving wives infected and penniless, wondering how to feed their children and pay for their education. They cannot afford seed or fertilizer, cannot work the land as they used to. And they agonize over their children's future. Who will care for them when they are orphaned?

Southern Africa already counts 3.2 million children orphaned by AIDS, many of them in households headed by the eldest child, where neither tomorrow's meal nor education is certain. Schools exclude them when they cannot pay the fees, buy exercise books and uniforms. While one generation is dying of AIDS, the next generation is being denied the right to succeed.

Adapted from: Juan Manuel Suarez del Toro, President of the International Federation of Red Cross and Red Crescent Societies, 2003.

ranging from the restricted access to goods, services and information as well as severe financial repercussions illustrate the increasing vulnerability to biological hazards in the context of a shrinking world.

Among the biological hazards that pose a threat to contemporary societies, the human pandemic HIV/AIDS occupies a special place. Due to its enormous social and economic impacts on communities, it also constitutes a major vulnerability factor for other natural hazards. In particular, HIV/AIDS exacerbates vulnerability to drought conditions.

The situation is very critical in Southern Africa, facing catastrophic consequences of HIV/AIDS infection. With many countries recording adult HIV infection rates of 25-30 per cent, the 1990s have seen the deaths of thousands of skilled people occupying middle-management positions in the private and public sectors.

Precious opportunities to develop sustainable local and technical capacities in disaster reduction have been undermined by continuing HIV-related deaths. With its far-reaching effects that span all professions, social sectors and communities in Southern Africa, HIV/AIDS will continue to constitute a major aspect of both household and national vulnerability for the foreseeable future.

Environmental degradation

As human activity continues to alter the biosphere, changes result in localized environments as well as in larger ecosystems. Environmental degradation compounds the actual impacts of hazards, limits an area's ability to absorb those impacts, and lowers the overall natural resilience to hazard impacts and disaster recovery.

In addition, environmental degradation that occurs and is significant enough to alter the natural patterns in an ecosystem, affects the regular temporal and spatial occurrence of natural phenomenon. Climate variability and climate change are currently the most obvious examples.

Environmental degradation, natural disasters and vulnerability are all linked. The connection between environmental degradation and the progressive impact of natural disasters can be illustrated by the case of the Yangtze River basin in China, where concerns related to environmental vulnerability have been incorporated in watershed management.

Viet Nam offers another example of the complex links between deforestation, floods and landslides. Viet Nam's forest cover dropped from 43 per cent to 28 per cent in 50 years. This is due to a combination of many years of war, with the use of deforestation as a tool of war; legal and illegal trade in timber as Viet Nam's economy became more open to international investment and trade; and also quite likely by climate change. Reduced forest cover makes the people of Viet Nam more vulnerable to floods and landslides.

Box 2.11
Flooding in China

The catastrophic floods in the Yangtze River basin, China, in 1998, brought to national attention the fact that changes in the use of land and the environmental degradation of watersheds had greatly exacerbated flooding. Extremely high levels of rainfall in the Yangtze Basin and rapid snowmelt from Tibet and the Himalayas only magnified the risks posed by degraded landscapes.

Prior to this event, the pressure for rapid development tended to overshadow environmental concerns. Since environmental degradation has now been firmly accepted as one of the root causes of increased impacts from natural hazards, it is essential to understand and act on both the conceptual and operational links between environmental management and disaster risk reduction.

Having concluded that flooding was worsened by environmental degradation, in 1999 the government formulated a new policy framework to promote ecological watershed management. As a result, a massive plan was initiated to redirect land-use management in river basins, targeted at the Yangtze and the Yellow River basins.

Figure 2.8
Link between environmental degradation, natural disasters and vulnerability

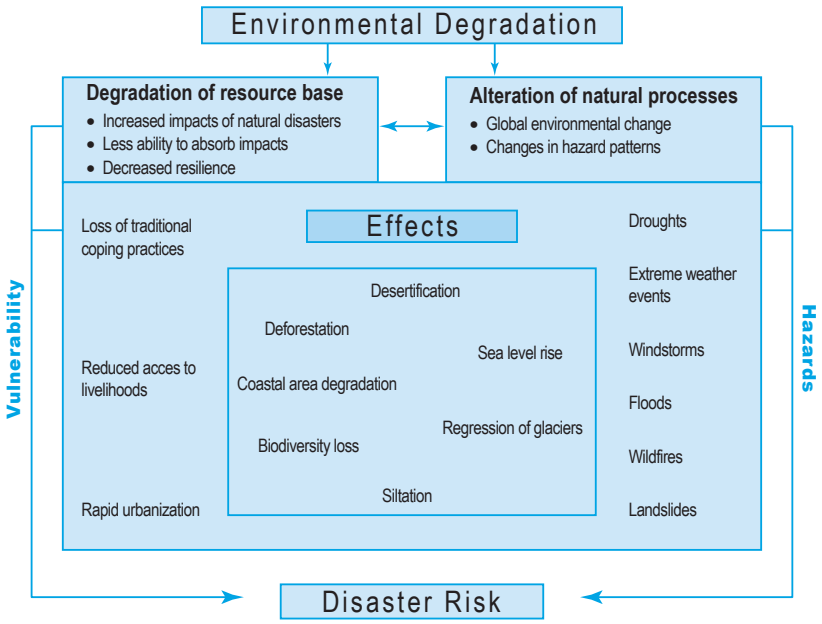


Figure 2.9 shows how primary and secondary effects of environmental degradation result in increased impacts of natural disasters – in this case in relation to watershed management and floods.

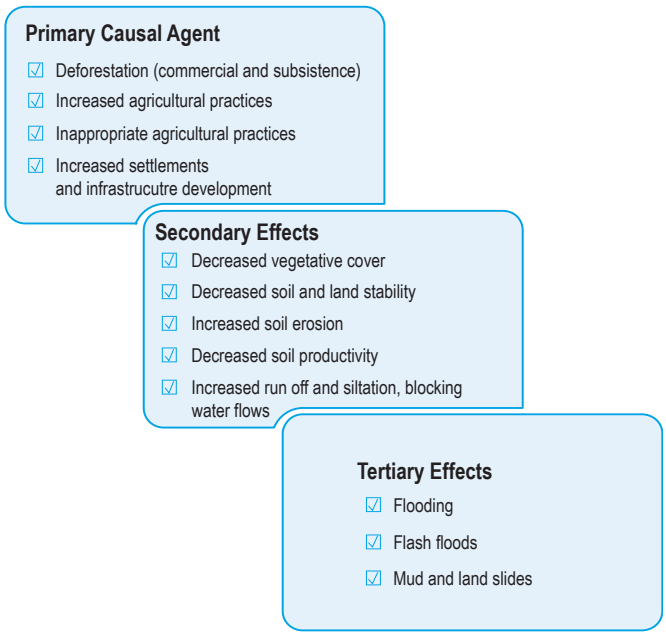
Land degradation and flash floods

According to UNEP data, two thirds of Africa is dry land, of which over 70 per cent is classified as degraded. About 90 per cent of pasture land and 85 per cent of croplands in the countries closest to the Sahara desert have been affected and there is some evidence that the desert is advancing on the south and east.

Deforestation is an important catalyst of land exhaustion and soil erosion. In Africa, more than 90 per cent of all wood is used for cooking and other energy needs and the demand for fuelwood has grown considerably. Since kerosene is expensive to buy, there is a shadow of land cleared of woodland around most settlements.

In effect, economic and social pressures – made worse by drought – have caused a breakdown of the traditional system of land-use management that was adapted to such fragile environments.

Figure 2.9
Primary and secondary effects of environmental degradation



Box 2.12
Land degradation in Southern Africa

Declining agricultural yields in countries of the Southern Africa Development Community (SADC) are also attributed to water erosion. In South Africa, as much as 6.1 million hectares of cultivated soil are affected by water erosion, with up to 300 million tons of soil lost annually due to physical degradation processes. Similarly, it is estimated that approximately 30 per cent of croplands in communal farming areas of Zimbabwe have been abandoned due to depleted soil fertility.

In Zambia, soil erosion by water is the most serious form of physical soil degradation, with approximately 100,000 hectares designated at various stages of degradation. Land degradation processes have been particularly prominent in Zambia as a result of deforestation, dense human population, overgrazing, poor crop cover and poor soil management techniques. This is reflected in marked deforestation, reaching 2,644 square kilometres annually from 1990-1995. While land degradation increases the severity of flood and drought impacts in the region, it is an unsurprising outcome, both of widespread rural poverty as well as macroeconomic forces.

Increasing land degradation also exacerbates flood risk, especially flash floods. In Southern Africa, escalating land degradation is strongly associated with overgrazing, which accounts for more than half the soil degradation in the region.

Wildland fire as an environmental hazard

Throughout the world, fire is part of agriculture and pastoral livelihoods. Natural wildfires are established elements in traditional land-use systems and have beneficial effects in natural ecosystem processes and in bio-geo-chemical cycles. However, the excessive use or incidence of fire due to rapid demographic and land-use changes leads to the destruction of property and reduction of natural productivity. Those consequences reduce the carrying capacities, biodiversity and vegetation cover of the landscape.

Climate variability such as the periodic occurrence of extreme droughts or the protracted effects associated with the El Niño/La Niña phenomenon add to the severity of fire impacts. Projected demographic and climate change scenarios suggest that these situations will become more critical during coming decades.

Box 2.13
ISDR working group on wildland fires

The objective of the ISDR working group on wildland fires has been to propose means and to facilitate the creation of mechanisms to share information and undertake tasks to reduce the negative impacts of fire on the environment and humanity. It brings together both technical members of the fire community and authorities concerned with policy and national practices in fire management to realize their common interests of fire risk management and disaster reduction at a global scale.

The working group was chaired and coordinated by the Global Fire Monitoring Center at the Max Planck Institute for Chemistry, in Freiburg, Germany. The working group attends to the existing programmes being implemented by its members to ensure complementary work plans. It has pursued several key priorities:

- Establish, and determine operational procedures for a global network of regional and national focal points for the early warning of wildland fire, fire monitoring and impact assessment, with the intention to enhance existing global fire monitoring capabilities and facilitate the functioning of a global fire management working programme or network.
- Propose internationally agreed criteria for the collection of fire data and related damage assessments in order to generate knowledge required by the various user communities at global, regional, national and local levels.
- Strengthen the existing regional, national and local capabilities in fire management and policy development through the dissemination of information and increased networking opportunities to meet multiple information needs. These include international initiatives such as the Convention on Biological Diversity, the Convention to Combat Desertification, the UN Framework Convention on Climate Change, the UN Forum on Forests, the FAO Global Forest Resources Assessment and the ongoing international criteria and indicators processes of the Collaborative Partnership on Forests. They also embody the overall scope of work of the UN agencies and programmes concerned.
- Transfer knowledge to local communities to advance their participation and utilization of appropriate tools that contribute to wildfire prevention, fire disaster preparedness and fire hazard mitigation.

In 2004 the working group developed into a global network and programme.

<http://www.fire.uni-freiburg.de>

Technological hazards

Technological hazards are related to quickly occurring, high-impact events such as hazardous chemical spills and nuclear accidents. They are therefore linked more with exposure rather than environmental degradation. In the case of hazardous materials – chemical and toxic waste or leakage – exposure is the critical factor.

That was the case in Bhopal, India, in 1984, where gas leaked to form a deadly cloud that killed and injured thousands of people. Most of these casualties came from poor families allowed to settle around the chemical plant. The fatal consequences of this chemical release were directly related to economic growth, as a complex and poorly managed industrial system threatened an unsuspecting and unprepared community.

Exposure to technological hazards is not exclusively an urban industrial issue. Virtually every modern product and process is disseminated to most countries and social settings. Of the 25 nations with operating nuclear power stations, at least 14 are in developing countries. Major oil spills and releases of nuclear radiation are associated predominantly with advanced energy and transportation technologies. Chernobyl, Exxon Valdez, Minimata and Bhopal are some unforgettable names of past technological disasters. These should underline the importance of reducing future risks.

Trends in physical vulnerability

Ninety per cent of the global population growth occurs in Least Developed Countries (LDCs). In these countries, exposure to hazards is already high through dense concentrations of population in often unsafe human settlements. Vulnerability levels are also exacerbated by socio-economic and environmental conditions.

In 1980, sub-Saharan Africa had a population of 385 million. This figure is expected to at least double by 2005. In some instances, food production represents 40 per cent of GDP, yet population growth is outstripping food production. What is more, food production could slow with less reliable rainfall patterns.

The long-term trends of demographic growth for LDCs are creating environmental, as well as political, refugees. As many as 10 million people have migrated during recent years but there may eventually be even greater redistribution of the African population in response to the deteriorating food situation. Some of this redistribution will likely concentrate even greater numbers in hazardous areas, or swell cities that are already poorly suited to address the needs of rapid growth.

Due to the urban concentration of population, the greatest potential for disaster exists in the 100 most populous cities. Over three-quarters of these are exposed to at least one natural hazard. No less than 70 of these cities can expect, on average, to experience a strong earthquake at least once every 50 years. The greatest concern is for the 50 fastest growing cities, all of which are located in developing countries.

Cities were often built on accessible locations with inherent risks such as coastlines, to facilitate transport, or floodplains because of their fertility with ample space for growth. Urbanization and increasing competition for land result in unregulated construction. This spills into adjacent high-risk areas such as hillsides, low-lying areas, industrial areas or floodplains.

Cities now hold disproportionate amounts of material wealth in terms of residential and commercial buildings and infrastructure. This infrastructure is critical to the economic activities of the city. The impact of disasters on cities can devastate national economies and limit access to industrial markets at an international level. This is especially important where one or two primary urban areas account for the major economic values and social vitality of a country.

Urbanization and rural displacement account for the rapid growth of informal, illegal settlements in the most risk-prone places near cities including Mexico City, Rio de Janeiro and Manila. Disaster risk concerns go hand in hand with other equally pressing urban issues, such as decaying infrastructure, poor housing and homelessness, hazardous industries, inadequate services, unaffordable and poor transportation links, and unemployment.

Table 2.3
15 largest cities in the world in 2000 and forecasts for 2010 (population in millions)

2000		2010	
26.4	Tokyo	26.4	Tokyo
18.1	Mexico City	23.6	Bombay
18.1	Bombay	20.2	Lagos
17.8	Sao Paulo	19.7	Sao Paulo
16.6	New York	18.7	Mexico City
13.4	Lagos	18.4	Dhaka
13.1	Los Angeles	17.2	New York
12.9	Calcutta	16.6	Karachi
12.9	Shanghai	15.6	Calcutta
12.6	Buenos Aires	15.3	Jakarta
12.3	Dhaka	15.1	Delhi
11.8	Karachi	13.9	Los Angeles
11.7	Delhi	13.79	Metro Manila
11.0	Jakarta	13.7	Buenos Aires
11.0	Osaka	13.7	Shanghai

Extract from *The State of the World's Cities*, UN-HABITAT, 2001.

Nearly 3 billion people, or almost half of the world population, live in coastal zones. Thirteen of the 15 largest cities in the world are also located by the sea. Not only is the exposure of people increased by their inhabiting hazard-prone areas, but a concentration of industrial infrastructure and critical facilities also worsen the situation. Communication and transportation networks, education and health infrastructure are increasingly vulnerable to the impact of natural hazards.

In some Andean countries, a trend is evident in the dynamic growth of the coastal areas. The Pan-American Highway links the main port cities of Lima, Guayaquil, Puerto Cabello and La Guaira. Rapid urbanization along this coastline contributes to increased levels of risk. Thirty-five per cent of the Peruvian population now lives between Lima and Callao.

The triangle formed by Quito, Guayaquil and Cuencas contains more than 70 per cent of the Ecuadorian population, inhabiting only 15 per cent of the national territory. The triangle formed by La Paz, Cochabamba and Santa Cruz accounts for 80 per cent of the total GDP of Bolivia, and about 70 per cent of the country's population.

In South Africa, it is expected that around 50 per cent of the population will live within 50 kilometres of the coast in the near future. While this affords economic and other opportunities, it also exposes millions of people to extreme weather events triggered by the Indian, Atlantic and Southern Oceans. Moreover, coastal development for tourism is being actively promoted in many countries, often located precisely in areas prone to tropical cyclones and tsunamis.

Another aspect of physical vulnerability is trade corridors. In Latin America there is the Central American Highway, the Quito-Guayaquil corridor, the Pan-American Highway in the Andean region, the Buenos Aires-Mendoza-Santiago-Valparaiso corridor, and Brazilian coastal corridors with maritime connections to Asian and European destinations. The development of trade corridors has political, economic, social and environmental implications. Their resilience to the impact of

Table 2.4
Urban population as a percentage of total population annual growth rate expressed as a percentage

	1970	1995	2015	1970-1995	1995-2015
Least developed	12.7	22.9	34.9	5.1	4.6
All developing	24.7	37.4	49.3	3.8	2.9
Industrialized	67.1	73.7	78.7	1.1	0.6
HDI: Human Development Indicator (UNDP)					
Low HDI	18.2	27.4	38.6	4.1	3.7
Medium HDI	23.0	37.7	52.7	3.9	2.8
High HDI	52.8	70.9	78.5	3.3	1.7

Extract from *The State of the World's Cities*, UN-HABITAT, 2001.

natural hazards is particularly important to maintain their economic value and to realize the intended sustainable development of cities and regions.

Vulnerability and trade corridors

An example of the high vulnerability to the recurrent impacts of natural hazards in the context of trade corridors is provided by the experience in Central America. During Hurricane Mitch in 1998, the Central American intra-regional market was interrupted for more than two weeks by damages to many parts of the Central American Highway. In Peru and Ecuador, the impact from El Niño in 1997-1998 disrupted the circulation of the Pan-American Highway in hundreds of sections.

Trends in socio-economic vulnerability

The relationship between disaster risk and development offers a good starting point to identify macro trends in socio-economic vulnerability. To some degree, socio-economic and environmental vulnerability is shaped by development processes and vice versa. Understanding how patterns of social change and development set the scene for future disasters becomes crucial to improving disaster risk assessment and analysis, and therefore is essential for disaster risk reduction as a whole.

Development and vulnerability

An analysis of disaster impacts shows that an estimated 97 per cent of natural disaster- related deaths each year occur in developing countries (World Bank 2001). Although losses are smaller in absolute figures, the percentage of economic losses in relation to the GDP in developing countries far exceeds those in industrialized countries.

Between 1985 and 1999, the world's wealthiest countries sustained 57.3 per cent of the measured economic losses to disasters, representing 2.5 per cent of their combined GDP. During the same years, the world's poorest countries endured 24.4 per cent of the economic toll of disasters, representing 13.4 per cent of their combined GDP.

Some vulnerability factors are closely associated with certain types of development models and initiatives. The links between disaster and development are elaborated in detail in the UNDP's 2004 report *Reducing Disaster Risk: A challenge for development.*

Poverty is a key issue in the analysis of vulnerability. In Southern Africa, poverty levels remain high, especially in rural areas. Thirty-seven per cent of Mozambicans, 64 per cent of Zambians and 36 per cent of Zimbabweans live on less than US$ 1 per day.

Per capita GDP for Zambia and Mozambique fall far short of per capita GDP in developing countries. In addition, high levels of foreign debt have discouraged investment and growth, with Zambia shouldering external debts that constitute 181 per cent of its GDP. Under these conditions, it is unrealistic to expect significant investments at household or national levels to mitigate the impact of natural or other threats.

Globalization

The impact of globalization on patterns of vulnerability is critical to identify new trends in disaster risk. The impacts of economic adjustment measures to encourage greater efficiencies and global competitiveness have commonly resulted in shrinking job markets.

Loss of income can render people more vulnerable to disaster risk. In South Africa, from 1996-2000 more than 500,000 formal sector jobs were lost. From 1997-2000, more than 140,000 miners lost their jobs and 50,000 primarily female workers lost their jobs in textile industries.

Traditional knowledge at risk

The pace of technological and cultural change poses a real threat to the wealth of local knowledge and related skills and resources preserved among indigenous people and in many rural communities. Economic vulnerability can increase as local livelihoods are transformed from relying on traditional forms of production to using more intensive or modern methods of agriculture and land-use systems.

In the past, people from Pacific islands used various techniques to cope with the impact of natural hazards. This included food preservation, harvesting wild foods, planting disaster-resistant crops, using hazard-resistant designs of traditional houses and construction, and relying on established social networks for extended community support.

Many of these traditions have become neglected as more people gravitate towards modern lifestyles, becoming increasingly disassociated from a sensitive consideration of natural conditions in the process. It has also been observed that crops, which formerly provided contingent food reserves in many countries at times of disaster, are now rarely planted.

Box 2.14

Traditional versus modern ways of coping – is it necessary to choose?

The traditional pattern of agricultural land use in the Sahel was well adapted to uncertain rainfall conditions. Generally speaking, the northern zone of Sahel having a mean annual rainfall of 100-350 millimetres was used for livestock. The southern Sahel, with a rainfall of 350-800 millimetres, was able to support rain-fed crops.

This system permitted a degree of flexible interdependence. Herders followed the rains by seasonal migration, while cultivators grew a variety of drought-resistant subsistence crops such as sorghum and millet to reduce the risk of failure. Fallow periods were used to rest the land for as much as five years in order to maintain the fertility of the soil. In the absence of a cash economy, a barter system operated between herders and sedentary farmers.

During recent decades, this system has collapsed for a variety of reasons. Population growth has exerted pressure on the land, resulting in soil erosion. In turn, the rangelands have been overgrazed with rapid degradation of the resource base. The need of national governments for export earnings and foreign exchange has produced a trend towards cash crops. These demands have competed for land with the subsistence requirements for basic grains and reduced the fallowing system.

Subsistence crops have been discouraged to the extent that produce prices have consistently declined in real value over 20 years. At the same time, the practice of maintaining food reserves has been seriously neglected under pressure of loan repayments to international banks. In addition, a lack of government investment to improve the productivity of rain-fed agriculture and a failure to organize credit facilities for poor farmers have tended also to undermine the stability of the rural base.

National governments have progressively campaigned against a nomadic lifestyle. In many instances, foreign aid has been earmarked for sedentary agriculture rather than to benefit herders. Increasingly, strict game preservation laws have been introduced which restrict the possibility of local inhabitants hunting for meat during drought. Traditional forms of livelihood, such as caravan trading, have declined as a result of the enforcement of international boundaries and customs duties, together with competition from lorries.

Adapted from: K. Smith, 1996.

2.3 Risk assessment

Risk assessment
A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend.

Risk assessments include detailed quantitative and qualitative understanding of risk, its physical, social, economic and environmental factors and consequences. It is a necessary first step for any serious consideration of disaster reduction strategies.

Its relevance for planning and development of disaster risk reduction strategies was explicitly addressed during the IDNDR. "In the year 2000, all countries, as part of their plans to achieve sustainable development, should have in place comprehensive national assessments of risks from natural hazards, with these assessments taken into account in development plans."

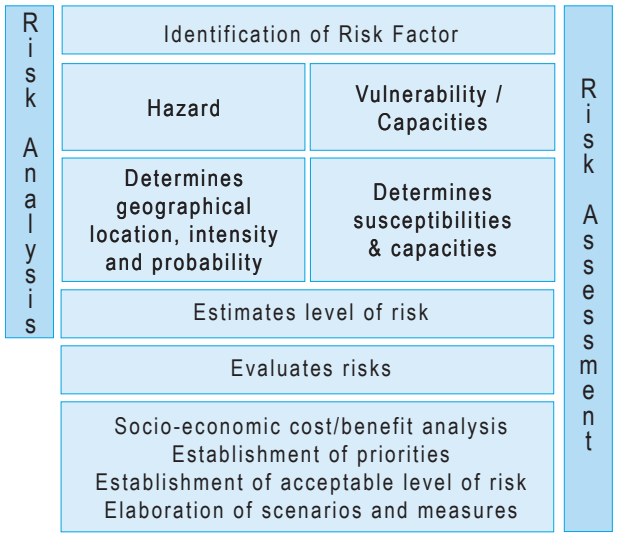
This was also outlined in Principle 1 of the 1994 Yokohama Strategy and Plan of Action for a Safer World. "Risk assessment is a required step for the adoption of adequate and successful disaster reduction policies and measures."

Risk assessment encompasses the systematic use of available information to determine the likelihood of certain events occurring and the magnitude of their possible consequences. As a process, it is generally agreed that it includes:

- *identifying the nature, location, intensity and probability of a threat;*
- *determining the existence and degree of vulnerabilities and exposure to those threats;*
- *identifying the capacities and resources available to address or manage threats; and*
- *determining acceptable levels of risk.*

Figure 2.10 shows the basic stages undertaken in a risk assessment process. The identification of hazards is usually the starting point for a systematic assessment of risk.

Figure 2.10
Risk assessment process



Both hazard and vulnerability/capacity assessments utilize formal procedures that include collection of primary data, monitoring of hazard and vulnerability factors, data processing, mapping and social survey techniques.

The distinction between risk assessment and risk perception has important implications for disaster risk reduction. In some cases, as in vulnerability/capacity assessment exercises, risk perception may be formally included in the assessment process, by incorporating people's own ideas and perceptions on the risks they are exposed to.

The increasing use of computer-assisted techniques, such as geographic information systems (GIS), may widen the breach between the information produced by technical risk assessments and the understanding of risk by people. Therefore, acceptable levels of risk may vary according to the relative views on objective risk versus perceived risk.

In the case of hazard assessment, where technical means are often employed for monitoring and storing data of geological and atmospheric conditions, the assessment activities typically involve scientific specialists. By contrast, vulnerability/capacity assessments make use of more conventional methods such as community-based mapping techniques, in which the community at risk should also play an active role.

Beyond these particularities, hazard and vulnerability/capacity assessments follow a set of procedures that are generally conveyed by the concept of risk analysis. Risk analysis constitutes a core element of the whole risk assessment process of providing relatively objective and technical information from which levels of risk can be projected.

The information produced by technical risk analysis allows for the determination of impartial government policy, resources needed for disaster preparedness and insurance schemes. In proceeding from the estimated levels of risk to the establishment of acceptable levels of risk, a different range of value judgments is usually taken into account.

Socio-economic cost/benefit analyses can highlight priorities that help calculate acceptable levels of risk. These will depend largely on combined government and community priorities, interests and capacities, ideally advanced through dialogue.

Hazard assessment

The objective of a hazard assessment is to identify the probability of occurrence of a specific hazard, in a specific future time period, as well as its intensity and area of impact.

For example, the assessment of flood hazards is extremely important in the design of engineering facilities and in zoning for land use. Construction of buildings and residences is often restricted in high flood hazard areas. Flood assessments should be developed for the design of sewerage treatment facilities, as well as for sites having industrial materials of a toxic or dangerous nature.

Certain hazards have well-established techniques available for their assessment. This is the case for

Table 2.5
Differences between risk assessment and risk perception

Phase of analysis	Risk assessment processes	Risk perception processes
Risk identification	Event monitoring Statistical inference	Individual intuition Personal awareness
Risk estimation	Magnitude/frequency Economic costs	Personal experience Intangible losses
Risk evaluation	Cost/benefit analysis Community policy	Personality factors Individual action

Adapted from: K. Smith. *Environmental hazards*, 1997

Box 2.15
The World Meteorological Organization (WMO) and hazard assessment

WMO and the IDNDR Scientific and Technical Committee promoted a project to further develop the concept of comprehensive, multi-hazard or joint assessment of natural hazards. It was recognized that society is usually at risk from several different hazards, many of which are not water-related or natural in origin.

More importantly, it was also noted that joint assessment of risk from these various hazards was in its infancy. Therefore the project focused on the most destructive and most widespread natural disasters, namely those of meteorological, hydrological, seismic, and volcanic origin.

An example of the development and application of such an approach to land-use planning was provided by Switzerland where the composite exposure to risks from floods, landslides and avalanches was considered. The project noted that an increased understanding of the hazard assessment methodologies of each discipline is required, as they varied from one discipline to another.

Source: *Comprehensive Risk Assessment for Natural Hazards*, WMO, 1999.

floods, earthquakes and volcanic hazards. Many of the analytical techniques useful for hazard assessments can be accomplished by using standard computers and widely available software packages.

For seismic hazards, ground shaking and ground movement are the two most important effects considered in the analysis. Dynamic ground shaking is a critical consideration for buildings and construction.

The objective of a statistical earthquake hazard assessment is to assess the probability that a particular level of ground motion at a site is reached or exceeded during a specified time interval. An alternative approach is to evaluate the ground motion produced by the maximum conceivable earthquake in the most unfavourable distance to a specific site.

Earthquake hazard assessment in areas of low seismic activity is more prone to errors than in areas with more frequent earthquake activity. This is especially the case if the time span of the available data is considerably smaller than the mean return interval of large events, for which the hazard has to be calculated.

In most cases, the overall activity of a volcano and its potential danger can be gleaned from field observations by mapping the various historical and prehistoric volcanic deposits. These deposits can, in turn, be interpreted in terms of eruptive phenomena, usually by analogy with visually observed eruptions.

Other hazards have less well-defined parameters. In the future, efforts must continue to increase our understanding and develop methodologies for the assessment of hazards such as heat waves and dust storms, in particular, with regard to the factors that influence their development, movement and decay.

Multi-hazard assessments are difficult to accomplish due to the different approaches in assessing individual hazards. But multi-hazard assessments are essential, for example, in the case of the multiple potential effects of tropical storms.

Box 2.16
Multi-hazard assessment in Turrialba, Costa Rica

In the framework of a UNESCO sponsored project in capacity building for natural disaster reduction, a case study was carried out on multi-hazard risk assessment of the city of Turrialba, located in the central part of Costa Rica. This city of 33,000 people is located in an area regularly affected by flooding, landslides and earthquakes. In order to assist the local emergency commission and the municipality, a pilot study was conducted to develop a GIS application for risk assessment and management.

The cadastral database of the city was used in combination with various hazard maps for different return periods to generate vulnerability maps for the city. In order to determine the cost of elements at risk, a distinction was made between the costs of construction and the value of building contents. These cost maps were then combined with the vulnerability maps and individual hazard maps for the different return periods, to obtain graphs of probability and resulting loss values.

The resulting database is an example of a tool for local authorities to assess the effects of different mitigation measures, and for which cost-benefit analysis can be conducted.

Source: International Institute for Geoinformation Science and Earth Observation (ITC), Enschede, The Netherlands, <http://www.itc.nl>.

These events cannot be considered in isolation and assessments should take account of the different components that actually represent the risks occurring either separately or in combination.

The use of GIS techniques has broadened the possibilities to undertake multi-hazard assessments. The following case study exemplifies the potential for multi-hazard assessment using GIS in urban areas.

Various hazards can be measured according to different scales, which can make comparisons difficult. An earthquake can be quantified based on the amount of energy released (Richter scale) or the amount of damage potentially caused (Modified Mercalli scale). A heat wave is measured using maximum temperatures and a windstorm is graded by using wind velocity.

Even without sophisticated assessment tools, it is possible for local communities to collect hazard information. Such steps are suggested in UNEP's *Hazard Identification and Evaluation in a Local Community*, consisting of basic checklists to identify and map major hazards.

Hazard mapping, awareness and public policy

Key dimensions of hazard assessments are the presentation of the results and assuring the understanding of the added value of hazard mapping and awareness by policy makers. Maps can be prepared manually using standard cartographic techniques or electronically with GIS.

Box 2.17
Hazard mapping and risk awareness

Several initiatives on hazard mapping were developed during the 1990s as part of the International Decade for Natural Disaster Reduction. One example was the Eastern Asia Natural Hazards Mapping Project, which started in Japan in 1994. The objectives of the project were to enhance awareness of natural hazards, in particular geological hazards, among planners and policy makers of national and regional development, as well as the general public in a given region. Also, the project aimed to promote scientific studies on geological hazards and to transfer technology on hazard mapping to developing countries through collaborative activities. The Eastern Asia Geological Hazards Map is one of the products available.

Source: Geological Survey of Japan, 2002.

Box 2.18
General flood risk maps in Sweden

Since 1998, two Swedish agencies have been conducting a general mapping of Sweden's waterways, aiming to cover 10,000 kilometres, or about 10 per cent of the total. Waterway maps highlight flood-prone areas for two probable levels according to statistical calculations based on a series of existing measures. The probability of flood occurrence is calculated for a century return-period. The calculation is made on a systematic combination of all the critical factors that contribute to a flood (e.g. precipitation, snowmelt, upper ground moisture, dimensions of dams and the filling of basins in governed waterways). The work is done with the use of GIS techniques and a digital elevation model database for the water level. The two probable flood models are mapped at a scale of 1:100,000 with useful background information including waterways, lakes, roads, railways, buildings and built-up areas. Further refinements are planned, like the production of 1:50,000 maps that will assess potential socio-economic damages from different flood scenarios.

Different types of hazards will require different mapping techniques. The importance lies in the easy understanding and clear intended purpose of the information generated.

For example, maps are the standard format for presenting flood hazards. Flood-hazard areas are usually divided according to severity (deep or shallow), type (quiet water or high velocity) or frequency. In Sweden, for instance, flood risk maps are used to highlight the areas under threat from floods during periods with high water levels and discharge.

In the case of volcanic hazards, the zoning of each direct and indirect hazard can be drawn according to the intensity, the extent of the hazard, the frequency of occurrence or in combination.

Composite hazard maps are important tools for joint hazard assessments. These combined hazard assessments need to be presented using simple classification, such as indicating high, medium and low risk, or no danger. One example of hazard mapping conducted for joint hazard assessment is provided by the Sri Lanka Urban Multi-Hazard Disaster Mitigation Project.

Hazard mapping is challenged by several constraining factors. First and foremost the lack of technological infrastructure can be a basic

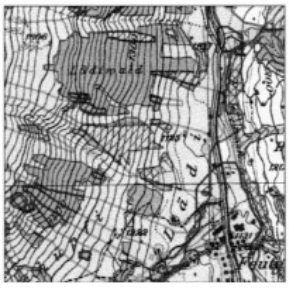
Box 2.19
Mapping risk in Switzerland

Since 1998, the canton of Bern, in Switzerland, has been using a planning tool which indicates potential risk areas. Maps are designed using computer modelling and GIS. The maps are not expensive and allow a complete overview of the canton based on a uniform set of criteria. The risk areas cover approximately 44 per cent of the territory, mostly in non-residential areas. However, about 8 per cent of inhabitants are in potential risk zones.

The maps indicate:

- exposed areas, which could potentially be affected by mudflows, avalanches, rock falls and landslides;
- vulnerable assets, include habitats, railroads, and all roads serving residential areas;
- potential impact zones, which overlap exposed areas and the vulnerable assets;
- protection forest, which provide an important protective role for residential areas and communication networks.

One particular hazard not modelled is flood risk, despite it causing severe social and economic impacts. The types of impact related to floods depend heavily on flows that are too low to be currently modelled satisfactorily.



Potential hazards

- Sector exposed to mud flows and other flash floods
- Sector exposed to avalanches
- Sector exposed to stone falls
- Sector exposed to deep landslides
- Sector exposed to average to deep landslides

Vulnerable assets

- Residential area
- Main roads
- Access roads
- Railroads

Forest

- Forest with an important protection function
- Forest with a protection function
- Other forests
- Exposed zones represented in a simplified manner

Source: Office des forêts du Canton de Berne, Switzerland, 1999.

limitation. Further, the importance of hazard mapping is not always as appreciated among decision makers and practitioners as it could be. It is not usually so visible and not a priority on many institutional agendas.

Additionally, inadequate training and insufficient communication or collaboration among relevant bodies also can adversely affect the hazard mapping process. For example, in Bangladesh, while many different entities are carrying out projects in risk and hazard mapping and land-use planning, there exists no common focal point for the coordination of these related initiatives.

Box 2.20
Hazard mapping in South Africa

In South Africa, various institutions are engaged in hazard mapping. While projects are sometimes conducted in isolation and the data is not widely used, there are other examples where the resulting information is beneficial to additional institutions beyond the one that collected it.

Most hazard maps are becoming available online and they often function as scaled image maps containing additional information about particular areas. The Agriculture Research Council, the National Disaster Management Centre, the Department of Water Affairs and Forestry, and the Department of Health are all using satellite data to compile hazard maps, which then become part of their much larger geographical information systems.

Use of the US National Oceanic and Atmospheric Administration (NOAA) satellite data further enables the generation of locally relevant geo-referenced maps. The National Botanical Institute of South Africa also embarked on the mapping of degradation patterns for the whole of the south of the country. These maps provide valuable information on the state of South Africa's ground cover.

Source: National Disaster Management Centre.

Vulnerability and capacity assessment

Vulnerability/capacity assessments are an indispensable complement to hazard assessment exercises. Despite the considerable efforts and achievements reflected in the improved quality and coverage of scientific data on different hazards, the mapping and assessment of social, economic and environmental vulnerabilities of populations are not equally developed.

Some aspects of the social nature of vulnerability/capacity pose different challenges to risk assessment. Gender-specific data and gender-balanced assessments are needed but often lacking. Women and men assessing disaster effects on livelihood resources, for example, may see very different problems and solutions simply because the gender division of labour situates them differently in the production process. The same is true with respect to women's and men's different social networks and personal coping skills.

Often, there is a huge gap in the understanding and application of vulnerability/capacity assessments between the technical or academic institutions undertaking these tasks and the local authorities and communities involved in the exercise.

A great deal of work has been focused on the assessment of the physical aspects of vulnerability. This has been done mainly in relation to more conventional hazardous phenomenon, such as windstorms, earthquakes and floods. The spatial overlapping of hazard zones with infrastructure such as airports, main highways, health facilities, and power lines is commonly used in the examination of the physical aspects of vulnerability.

The Organization of American States (OAS) has been one of the pioneers in Latin America and the Caribbean in using GIS tools for physical vulnerability assessment, focused on infrastructure and critical facilities.

A pilot project launched early in the 1980s has implemented more than 200 activities in 20 countries by integrating hazards, natural resources, population and infrastructure data.

Box 2.21
Community risk in Australia

One of the advantages of GIS techniques is the possibility to carry out multi-hazard analysis. Community Risk in Cairns is the first of a series of multi-hazard case studies by the Australian Geological Survey Organization (AGSO). It considers earthquakes, landslides, floods and cyclones.

The AGSO Cities Project undertakes research for the mitigation of the risks posed by a range of geo-hazards to Australian urban communities. GIS has been used extensively to drive the analysis and assessment. Risk-GIS, as it has been christened in the Cities Project, is a fusion of the decision support capabilities of GIS and the philosophy of risk management. An interactive mapping system of the Community Risk in Cairns project and an advanced mapping system for experienced GIS users are available on the Internet. <http://www.ga.gov.au/map/cairns>.

Source: Australian Geological Survey Organization.

As examples of the benefits, it was discovered that all of the main airports in Guatemala were located in high intensity seismic areas, and 670 kilometres of paved roads in Ecuador were located in a 30-kilometre radius of active volcanoes.

The Provincial Emergency Program (PEP) of British Columbia, Canada, has developed a complete step-by-step hazard, risk and vulnerability analysis tool kit. The purpose of the tool kit is to help the community make risk-based choices to address the potential impact of hazards. It is also a requirement mandated by the Local Authority Emergency Management Regulation of the British Columbia Emergency Program. The tool kit can be downloaded from the PEP web site <http://www.pep.bc.ca>.

The US National Oceanic and Atmospheric Administration (NOAA), in collaboration with the Federal Emergency Management Agency (FEMA), has produced a community vulnerability assessment tool, presented as a CD-ROM. It is called *Helping communities determine and prioritize their vulnerabilities to hazards*. This CD-ROM provides another step-by-step guide for conducting community-wide risk and vulnerability assessments.

It also provides a case study demonstrating the process for analyzing physical, social, economic and environmental vulnerability to hazards at the local level. The intended audience includes emergency managers, planners, building officials, and others who are responsible or interested in reducing the impacts of hazards.

Also included on this CD-ROM is a comprehensive case study on the application of the vulnerability assessment methodology. New Hanover County, North Carolina, was a pilot community for this methodology. As one of the original seven pilot communities for the FEMA Project Impact Initiative, this community embarked on a long-range hazard mitigation planning effort that included the development of a community vulnerability assessment.

Several initiatives leading towards comprehensive risk assessments are currently underway in the Pacific islands states. In the Cook Islands, risk assessments related to tropical cyclones and associated flooding have been conducted. These include hazard mapping, vulnerability assessments of infrastructure and critical facilities, and recording the social aspects of economic losses on communities.

Box 2.22
Risk assessment in Fiji

Examples of Fijian risk assessments include:

- the Suva Earthquake Risk Management Scenario Pilot Project, undertaken for the capital city of Suva (1995-1998) and involving an earthquake and tsunami exercise, SUVEQ 97 (based on the devastating 1953 Suva earthquake and associated tsunami)
- a comprehensive study of a potential eruption of the Taveuni Volcano which involved international scientists, senior government officials and infrastructure agencies
- a comprehensive flood mitigation study of known flood-prone areas on the island of Viti Levu.

The risk assessment information provided input for community early warning systems for tropical cyclones, as well as primary information for reports, plans and technical support materials.

In Fiji, in recent years, several comprehensive risk assessment projects also have been undertaken. These have always involved the relevant government departments and infrastructure agencies and include representatives from NGOs and the private sector. International agencies and consultants have participated to ensure that up to date methodologies were employed.

Risk assessments undertaken in Fiji have been based on detailed hazard and vulnerability assessments, integrating scientific geological and meteorological information with details about the built environment (building stock, infrastructure, critical facilities and lifelines) and the natural environment.

Modern methods have been employed, including ground surveys, remote sensing and GIS mapping. The results have had major implications for disaster management, such as in helping to formulate building codes and training emergency service personnel. These initiatives are being used as the basis of similar studies in other Pacific island states.

Methodological challenges

While hazard mapping has been improved by the wider use of GIS techniques, the inclusion of social, economic and environmental variables into GIS models remains a major challenge.

The need to assign quantifiable values to the variables analyzed in the spatial models used by GIS is not always possible for social and economic dimensions of vulnerability. Moreover, the diverse scales at which different dimensions of socio-economic vulnerability operate make the spatial representation through these techniques very difficult. In addition, the quality and detail of the data required by GIS analysis are in many cases non-existent, especially in LDCs.

On the other hand, well-conceived low-tech approaches can be a very good option to GIS-based techniques. The approach adopted for hazard mapping and risk assessment by the Kathmandu Valley Earthquake Risk Management Project is an excellent example of what can be achieved with simple and affordable but methodical techniques.

The use of GIS for vulnerability/capacity analysis is still at an embryonic stage in comparison with its wider use in hazard mapping. Several research initiatives are aiming to solve these current methodological constraints, especially those dealing with quantifying social aspects of vulnerability.

Assessing socio-economic vulnerability

Socio-economic vulnerability assessments rely on more conventional methods, which provide other opportunities and advantages, such as the active involvement of the communities at risk in mapping and assessment exercises.

The physical aspects of vulnerability assessment answer the questions: What is vulnerable? Where is it vulnerable? Socio-economic aspects of vulnerability answer the questions: Who is vulnerable? How have they become vulnerable?

Attributes of groups and individuals, such as socio-economic class, ethnicity, caste membership, gender, age, physical disability and religion are among the characteristics that differentiate vulnerability to hazards.

Conceptual frameworks and models provide a basis for vulnerability analysis in relation to specific hazards. The “pressure and release” and “access” models, developed in the 1990s, provided a good basis for the analysis and further identification of specific vulnerable conditions. These models have linked dynamic processes at different scales and access to resources with vulnerability conditions.

In most cases, the occurrence of a disaster has served to validate models of vulnerability analysis.

Box 2.23

Simplicity pays! The experience in the Kathmandu Valley, Nepal

In the approach adopted for hazard mapping and risk assessment in the Kathmandu Valley Earthquake Risk Management Project an emphasis was placed on utilizing the geological and seismological data already available rather than spending resources to generate new data or information by conducting special research.

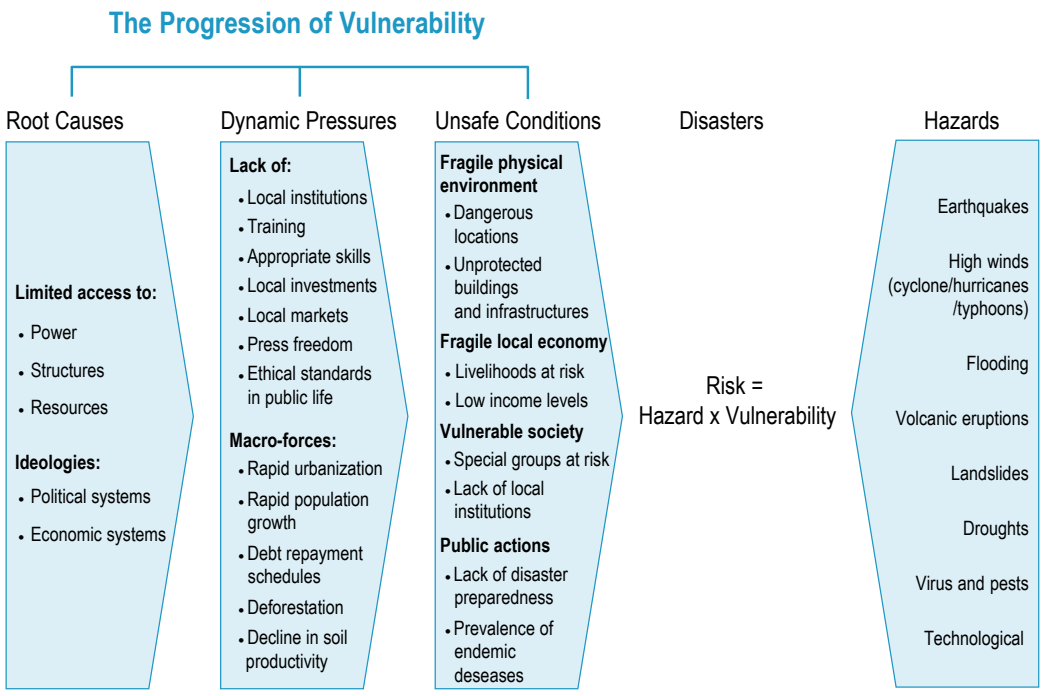
The only prior suitable example of an earthquake scenario developed in a developing country was that of Quito, Ecuador. The project built upon that methodology and adapted it to suit the conditions prevailing in Nepal.

The project consistently adopted simple technical approaches, which made the project cost-effective and understandable for the lay people involved. For example, simple plastic-laminated maps that showed the location of potential damage to infrastructure with names of localities and rivers were found most suited to convince managers of the potential losses of critical facilities.

During the whole process of evaluating the earthquake hazard or assessing the earthquake risk, the research team interacted closely with the management of the critical municipal facilities and the emergency response services. Thus different institutions accepted the earthquake scenario and the loss estimation easily without encountering much apathy. About 30 institutions participated in this process, and the earthquake damage scenario proved to be a great awareness-raising tool.

Source: Mani Dixit et al, “Hazard Mapping and Risk Assessment: Experiences from the Kathmandu Valley Earthquake Risk Management Project” in Regional Workshop on Best Practices in Disaster Mitigation: Lessons Learned from the Asian Urban Disaster Mitigation Program and other Initiatives, Bali, Indonesia, 2002.

Figure 2.11
Vulnerability analysis



Adapted from: Blaikie et al., 1994

The analysis of the damages experienced in disasters constitutes a major source of information for vulnerability/capacity identification.

As opposed to the inductive analysis used in GIS techniques – where level of risk is inducted by integrating layers of information – an historical analysis of disaster data provides the information to deduce levels of risk based on past experiences. In addition, historical disaster databases are essential to identify the dynamic aspects involved in vulnerability, providing the criteria to assign relative weights to different dimensions of vulnerability in risk assessment exercises. In this context, the refinement, maintenance and systematic feeding of disaster data sets are vital for risk assessment as a whole.

The insurance industry's approach to disaster risk is based on this kind of data. Some of these issues are being addressed by the Task Force through its working group on risk, vulnerability and impact assessment.

Droughts have proven to be a particularly difficult task for risk assessment. Risk assessment tools developed for food security provide conceptual inputs as well as primary data related to vulnerability to droughts.

The World Food Programme (WFP) and the Food and Agriculture Organization (FAO) work with other UN agencies, national governments, and NGOs to integrate vulnerability analysis and mapping techniques. The Disaster Risk Index (DRI), produced as part of UNDP's report *Reducing Disaster Risk: A challenge for development*, is studying ways to integrate drought data into a comprehensive risk index.

The Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters (RADIUS) provides a good example of hazard-specific tools that contribute to defining urban risk scenarios. The IDNDR Secretariat launched the RADIUS initiative in 1996 to promote worldwide activities for reduction of urban seismic risk.

In the Americas, vulnerability assessment and techniques workshops are being held under the auspices of OAS. They provide an opportunity to explore methodological challenges and applicability of risk assessments. The technical information and comments generated by this and similar activities support the policy work carried out by the working group on Vulnerability Assessments and Indexing of the Inter-American Committee for Natural Disaster Reduction, also a member of the Inter-Agency Task Force on Disaster Reduction.

The assessment of the economic impact of disasters on a society or local community is a very important input to the overall disaster risk assessment process. The Economic Commission for Latin America and the Caribbean (ECLAC) has a well-established methodology to assess the macroeconomic, social and environmental impact of natural disasters in the region.

A recent report from ECLAC looks at the disaster impacts on infrastructure and various productive sectors, and focuses on the methodological and conceptual aspects of disaster impact assessment. Policy implications of the ECLAC methodology of disaster impact are also explored.
<http://www.eclac.cl>

Box 2.24
ISDR working group on risk, vulnerability and impact assessment

The WG3 on risk, vulnerability and impact assessment is chaired by UNDP. Its main goal is to contribute to sustainable reduction in disaster risk by incorporating approaches, methods and tools for risk, vulnerability and impact assessment in risk reduction processes. The working group is subdivided into three sub-groups:

- **Sub-group 1: improving the quality, coverage and accuracy of disaster databases, chaired by IRI, Columbia University**
  This sub-group initiated a series of studies to compare existing disaster databases, in particular EM-DAT (maintained by CRED) and DesInventar LA RED. An other main area of focus is the potential for linking disaster and related data from different sources through a common unique identifying number (GLIDE) that would be assigned to each event.
- **Sub-group 2: review of indexes relevant for risk and vulnerability indexing, chaired by UNDP**
  This newly established sub-group covers the following topics: review of relevant indexes, examples of disaster risk indexes, disaster risk reduction framework and its potential indexing.
- **Sub-group 3: tools and best practices for risk and vulnerability analysis at the local and urban Levels, chaired by UN-HABITAT**
  This Sub-group is working in collection and organisation of an inventory of risk analysis and vulnerability mitigation tools, which can be easily, accessed both by UN/ISDR partners and the general public through the internet. The sub-group is presently in the implementation phase of the project, which is supported by UNDP and the ISDR Secretariat.

<http://www.unisdr.org/eng/task%20force/tf-working-groups3-eng.htm>

In 2002, Emergency Management Australia (EMA) produced *Disaster Loss Assessment Guidelines*, as a follow-up of the *Economic Costs of Natural Disasters in Australia*, published in 2001 by the Bureau of Transport and Regional Economics. These guidelines provide a comprehensive review of methods to assess the economic impacts of a disaster in a regional context.

Box 2.25
Vulnerability assessment products and services

The Unit of Sustainable Development (USDE) of OAS and NOAA have created several vulnerability assessment products and services available to development planners, researchers, and coastal resource and emergency managers, designed to help reduce vulnerability to the adverse impacts of natural hazards. These products and services include the Vulnerability Assessment Techniques workshop series, the Vulnerability Assessment Techniques and Applications web site and a related list server.

Vulnerability Assessment Techniques (VAT) workshops
The VAT workshop series has been created to provide a forum for networking opportunities and dialogue to explore new ideas and potential partnerships in the development, analysis and application of vulnerability assessments. VAT workshops bring together researchers and practitioners from government agencies, academic institutions, and the private sector in the Western Hemisphere, that share an interest in vulnerability assessment methodologies. Professionals are exposed to a variety of risk and vulnerability assessment techniques and their applications at local, state, national and regional levels of activity.

Vulnerability Assessment Techniques and Applications (VATA) web site
The VATA web site provides a central source for vulnerability assessment research, policy initiatives, links and resources, in addition to over 40 case studies presented during the VAT workshop series. This site supplies resources to support community-based decision-making to protect lives and property to sustain economic stability and to preserve the environment. One key feature of the VATA web site is the case study locator tool, which allows users to search the workshop case studies easily by geographic location, hazard type and development area. The NOAA Coastal Services Center and the OAS/USDE created and maintain the VATA web site <http://www.csc.noaa.gov/vata/>.

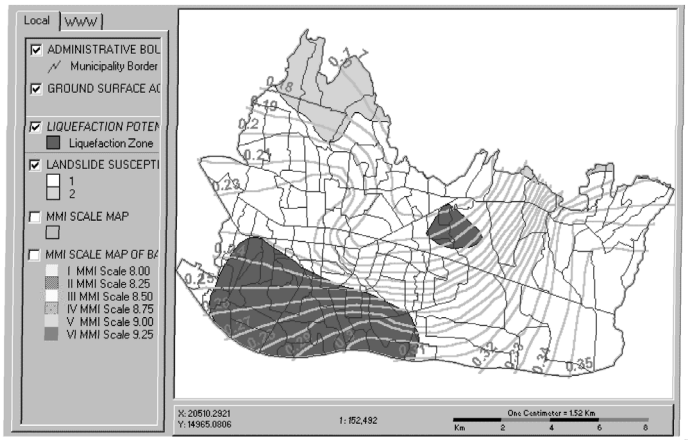
Vulnerability Assessment Techniques and Applications (VATA) list server
By special request, the NOAA Coastal Services Center has created the VATA list server so that people interested in the area of vulnerability assessments may easily communicate with each other. The stimulating discussions that occurred at the VAT workshops are continued through this list server <http://csc.noaa.gov/mailman/listinfo/vata>.

Box 2.26
The RADIUS initiative

The RADIUS initiative achieved four main objectives, since its launch in 1996:

- develop earthquake damage scenarios and actions plans for nine case study cities around the world;
- produce practical tools for estimation and management of urban seismic risk;
- raise public awareness of seismic risk;
- promote information exchange for seismic risk mitigation at city level.

The seismic damage scenarios developed describe human loss, damage to buildings and infrastructure, and their effect on urban activities for nine cities: Addis Ababa, Ethiopia; Antofagasta, Chile; Bandung, Indonesia; Guayaquil, Ecuador; Izmir, Turkey; Skopje, Macedonia; Tashkent, Uzbekistan; Tijuana, Mexico; and Zigong, China.



The action plans proposed new priorities for urban planning and for improvement of existing urban structures and emergency activities. The experiences of these nine cities were incorporated into a practical manual for damage estimation and guidelines for RADIUS-type projects, applicable to cities elsewhere.

With the tools, cities can conduct similar projects to estimate earthquake damage and prepare a risk management plan on their own. In addition, a comparative study was conducted to develop greater understanding of aspects contributing to seismic risk. Over 70 cities worldwide participated in this study called Understanding Seismic Risk around the World. More than 30 cities joined RADIUS as associate cities.

An evaluation of RADIUS found that significant progress has been made in the management of earthquake risk in RADIUS cities. There has been an important increase of public awareness about the need to reduce urban risk, and new risk management programmes are underway.

In several RADIUS cities, new risk management organizations have been created or existing ones have been restructured to monitor the implementation of the project recommendations. RADIUS reports are available on the Internet.

Source: <http://www.geohaz.org/radius>.

The US National Institute of Building Sciences developed Hazards US (HAZUS), a standardized methodology for estimating potential losses from earthquakes, wind and floods, under agreements with FEMA. Using GIS technology, HAZUS allows users to compute estimates of damage and losses that could result from an earthquake. To support FEMA's mitigation and emergency preparedness efforts, HAZUS is being expanded into HAZUS-MH , a multi-hazard methodology with new modules for estimating potential losses from wind and flood (riverine and coastal) hazards. <http://www.fema.gov/hazus>.

Participatory vulnerability/capacity assessment methodologies

The relationship between vulnerability and capacity has increasingly been expressed in risk assessment methodologies in terms of vulnerability and capacities assessments (VCA).

Work has been done to incorporate issues related to social inequity into risk management at the local level. This includes participatory diagnosis, training methods, and analytical frameworks such as the capabilities and vulnerabilities analysis, which examine people's strengths and abilities, as well as their susceptibilities. It makes up a significant part of the overall VCA.

As part of this system, the socio-economic and gender analysis looks at disadvantaged social groups, incorporating them into the development process as effective change agents, rather than as beneficiaries. IFRC is very proactive in promoting the vulnerability/capacity approach.

Box 2.27
Vulnerability and capacity assessments and the International Federation of Red Cross and Red Crescent Societies (IFRC)

Vulnerability and capacity assessments (VCA) are a key tool used by the IFRC for risk analysis with more than 40 country-specific assessments completed.

The use of VCAs is based on the premise that they are not solely for disaster preparedness but intended to advance overall capacity-building. It is an interdisciplinary approach involving health, organizational development, and related Red Cross and Red Crescent programmes.

In 2002, this formed the basis for programme implementation in five North African countries, Mongolia, and other countries in East Asia. More VCA activities are planned and a training workshop has been developed by the IFRC in order to use VCAs on a wider basis.

Source: *Vulnerability and Capacity Assessment*, IFRC, 2002.

Table 2.6
Community risk assessment based on vulnerability and resilience

Contextual aspects	Analysis of current and predicted demographics. Recent hazard events; economic conditions; political structures and issues; geophysical location; environmental condition; access/distribution of information and traditional knowledge; community involvement; organizations and management capacity; linkages with other regional/national bodies; critical infrastructures and systems
Highly vulnerable social groups	Infants/Children; frail elderly; economically disadvantaged; intellectually, psychologically and physically disabled; single parent families; new immigrants and visitors; socially/physically isolated; seriously ill; poorly sheltered.
Identifying basic social needs/values	Sustaining life; physical and mental well-being; safety and security; home/shelter; food and water; sanitary facilities; social links; information; sustain livelihoods; maintain social values/ethics.
Increasing capacities/reducing vulnerability	Positive economic and social trends; access to productive livelihoods; sound family and social structures; good governance; established networks regionally/nationally; participatory community structures and management; suitable physical and service infrastructures; local plans and arrangements; reserve financial and material resources; shared community values/goals; environmental resilience.
Practical assessment methods	Constructive frameworks; data sources include: local experts, focus groups; census data; surveys questionnaires; outreach programmes; historical records; maps; environmental profiles.

Source: IFRC, 2002.

Box 2.28

Ecociudad – participatory risk assessment in Peru

Lima is situated along the boundary of two tectonic plates, making it highly prone to earthquakes. There is an ever-present risk of the fires, landslides and flash flooding that result in death and destruction every year. These risks have been increasing as a result of uncontrolled urban growth. The experience of the Peruvian NGO Ecociudad highlights a number of high-risk concerns in the local community:

- Houses are located on the banks of a river exposed to the threat of collapse in the event of a flood or landslide
- Human settlements are situated in numerous areas prone to landslides and subject to periodic earth tremors
- Informal markets and more established commercial centres are densely crowded and highly vulnerable to fire.

Community meetings have been convened to map the threats, vulnerabilities and capacities based on participation of the inhabitants and their local knowledge. This process has led to the establishment of volunteer brigades specialized in emergency rescue. Other settlements located along the river are being relocated by a neighbourhood committee collaborating with the government.

The work carried out by *Ecociudad*, a Peruvian NGO, provides another example of vulnerability/capacity mapping, where communities have participated with enthusiasm. Working with environmental management issues related to disaster risk reduction, *Ecociudad* has supported community-based risk mapping in Caquetá, a neighbourhood in Lima with a very hazardous landscape <http://ciudad.org.pe/eco>.

Emergency Management Australia released the findings of a study on the assessment of personal and community resilience and vulnerability in 2001, in conjunction with a number of related agencies.

The need for such a report followed a series of events including the 1997 wildland fires around Melbourne, and the 1998 floods in East Gippsland. The study outlines comprehensive guidelines on the concepts and processes of vulnerability and resilience for practical application in community risk assessment.

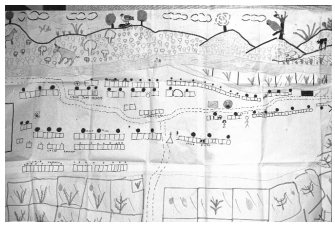
Box 2.29

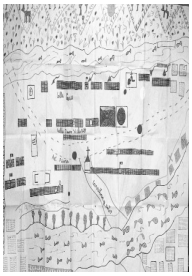
Preparing risk maps – community tools that build awareness and invite participation

As part of the 2001 World Disaster Reduction Campaign, a risk mapping contest was launched. This was one of the ISDR awareness and promotion activities in keeping with the year's theme, "Countering Disasters, Targeting Vulnerability".

The winners of the contest were:

Local Communities Category
First: Daw San Yi U Tin Ko Ko, Myanmar
Second: CTAR Piura, Comité Regional de Defensa Civil, Piura, Peru





Children's Category
First: Shree Bal Bikash Secondary School, Kathmandu District, Nepal
Second: Instituto Nacional de Berlin, 1er Año de Bachillerato Tecnico Vocacional, Usulutan, El Salvador

A risk map is a map of a community or geographical zone that identifies the places and the buildings – homes, schools, health facilities and others – that might be adversely affected in the event of hurricanes, earthquakes, tsunamis, floods, volcanic eruptions, landslides, and other natural hazards and related technological or environmental disasters. The production of a risk map requires consideration of areas and features at risk within the community or geographic zone, consultation with people and groups of varying expertise, and the discussion of possible solutions to reduce risk.

The purpose of the risk mapping contest was to challenge people to produce a risk map for their local geographic zone or community. The exercise provided an opportunity for schoolchildren, teachers and local communities to read, research and learn key concepts of disaster reduction, as well as consider vulnerability and the potential threat of natural hazards to their local surroundings. By increasing public awareness about disaster reduction, more disaster management measures could be developed and implemented in all sectors of society.

The risk mapping contest encouraged participants to consult and interact with the various actors in natural disaster reduction such as public authorities, health-care workers, NGOs and environmental experts. Communication and interaction between different people allowed for more effective collaborative efforts towards building a culture of prevention from natural disasters.

The risk mapping contest was an integral part of the overall 2001 World Disaster Reduction Campaign, and made a valuable contribution in its capacity to reach its target audience, schoolchildren and local communities.

These efforts demonstrate that risk assessments prepared by people working together can become powerful educational tools raising the level of public awareness about shared disaster risks.

Future challenges and priorities

Risk assessment

The notions of hazard, vulnerability and capacity are the foundation for an effective strategy of risk reduction and the operational basis for a culture of prevention. While identification and monitoring activities related to hazard assessments have been improved, some aspects of the overall risk assessment process remain weak.

In particular, incorporating people's risk perceptions, and the socio-economic and environmental contexts where they live, is essential in the identification of risk scenarios. New trends in hazards and vulnerability also challenge the procedures and conventional methodologies and call for an integrated and comprehensive risk assessment.

Recognition and analysis of the changing nature of hazards and vulnerabilities is needed. The influence of ecological imbalances such as climate change is affecting the frequency and intensity of hazardous natural phenomenon. Additionally, environmental degradation is exacerbating the impact of natural hazards.

Risk assessments need to reflect the dynamic and complex scenarios to properly feed into disaster risk reduction strategies. Multiple hazards and comprehensive vulnerability/capacity assessments that take account of the changing patterns in disaster risk are starting points for raising risk awareness.

The emergent trends in hazards and vulnerability described in this chapter pose major challenges to the overall risk assessment process. These changes affect not only the formal procedures of risk assessment in place, but also the prevailing patterns of risk perception.

Community knowledge of hazards has been challenged by complex and new forms of danger. The repercussions of environmental degradation on current vulnerability and hazard patterns and the increasing exposure to technological hazards raise a different range of concerns. An integrated and effective process of risk assessment needs to engage these challenges to truly provide the foundation for disaster risk reduction in the 21st century.

Special areas of concern in relation to risk awareness and assessment are the following:

Data and methodology

Data is the primary input for identifying trends in hazards and vulnerability. For many countries, relevant data is unavailable or inaccurate. Often, information collected by governments and at the local level is not gender-specific although gender is indeed a primary organizing principle before, during, and after disasters. There is a need to work towards the standardization of all issues related to the technical soundness, political neutrality, methodologies and processes related to the collection, analysis, storage, maintenance and dissemination of data.

In terms of methodologies, there are many different conceptual models attempting to examine the same things. Still, one of the major issues is how hazard, vulnerability, and risk assessments can be used to reduce risk. Mechanisms of integration are needed so that issues and proposed remedial initiatives are not fragmented when presented to decision makers.

Improved visibility and higher priority to reduce vulnerability and strengthen capacity

Reducing vulnerability to risk still falls mainly under the responsibility of the public authorities. Data regarding disaster impact, especially concerning small and medium scale disasters, as well as the social and environmental considerations of impact, are still lacking. Political authorities usually see economic considerations as highly influential in their decision-making. Without a quantitative measurement of risk it is difficult for political decision makers to factor risk reduction into legislative agendas and development planning efforts. Following this, fiscal commitments need to be specified in national budgets.

An enhanced conceptual framework must be expressed to emphasize capacity as a key factor in the disaster risk formula, including the incorporation of vulnerability and capacity in tools such as risk indexes. UNDP's Global Risk Vulnerability Index and the framework to guide progress on disaster risk reduction being developed by ISDR are good examples of timely efforts leading to that objective.

Culturally relevant and gender-inclusive analyses of capacities and vulnerabilities in disaster contexts are more likely when communities undertake their own assessments. A number of models for gender-sensitive and participatory vulnerability/capacity assessments at the community level are now available.

An overall challenge is to review and document how risk assessments have contributed to modify risk and how they are being utilized in the decision-making process.

Chapter 3

Policy and commitment: the foundation of disaster risk reduction

3.1 National institutional frameworks: policy, legislation and organizational development

"The world is increasingly interdependent. All countries shall act in a new spirit of partnership to build a safer world based on common interests and shared responsibility to save human lives, since natural disasters do not respect borders."

Yokohama Strategy and Plan for Action for a Safer World, 1994

Disaster risk management must be the responsibility of governments. However, its success also depends on widespread decision-making and the participation of many others. Policy direction and legal foundations assure legitimacy but it is the professional and human resources available, on the ground, that are a true measure of success.

There must be a systematic approach to relate local decision-making processes with larger administrative and resource capabilities such as those devised in provincial or national disaster plans and risk reduction strategies.

The various roles which policy, law and organizations play in creating a sustained public administration environment sensitive to the identification and management of risk are reviewed in this section.

As both conditions and needs vary with geography, as well as with a wide range of professional interests involved, some examples of selected institutional frameworks are presented regionally while others are presented according to subject matters.

In each case, the institutional processes involved and organizational lessons cited may hold a much wider appeal and relevance to emerging initiatives elsewhere. This chapter will discuss the following:

- *introduction to institutional frameworks for disaster reduction;*
- *policy frameworks in practice;*
- *national planning processes, with multisectoral responsibilities;*
- *risk reduction plans linked to specific responsibilities, policies and practices;*
- *some important limitations in institutional and policy frameworks; and*
- *means for overcoming limitations.*

Introduction to institutional frameworks for disaster reduction

The programme of the International Decade for Natural Disaster Reduction (IDNDR) not only provided an institutional framework for countries, but also introduced basic concepts of disaster reduction to administrators and other specialists who may not have identified their work within the larger context of disasters. It began to shift policy emphasis from post-disaster relief and rehabilitation to a more proactive approach of disaster preparedness and mitigation.

This began a new era in disaster and risk reduction concepts, with an important role assigned to national planning and legislation. Many countries prepared national action plans for disaster risk management and presented them to the World Conference on Natural Disaster Reduction held in Yokohama, Japan, in 1994. Subsequently, countries have been able to report on their activities at regional or sectoral meetings and at the concluding IDNDR Programme Forum in 1999.

For a long time, the state was considered the centre of all authority as well as action in dealing with disasters. Communities were considered generally unaware of the hazards they faced. As a result, disaster management was most often understood as providing relief to victims, aiding recovery

following an event, and rebuilding damaged infrastructure. This *modus operandi* was perpetuated by those international funds and local emergency allocations that typically became available more readily after a disaster rather than before.

Historically, few resources have been devoted to routine hazard identification or to support sustained risk management strategies in areas prone to natural hazards. This may result from an institutional disregard of the economic value of risk reduction in contrast to the cost of replacing lost assets.

Alternately, it may reflect the persistent difficulty in demonstrating cost-efficiencies involved in saving lives and public property from disasters before they occur. Nonetheless, it remains that the relative economies of disaster reduction are most commonly aired in public discussions following disasters.

While disaster management and response coordination can benefit from centralized command, there is a need to decentralize disaster risk reduction efforts. Where the decentralization of power and devolution of governing authority is pursued, risk reduction at the local level also needs to be encouraged and supported. Responsibility for risk reduction has to be coordinated by municipalities, townships, wards or local communities.

This may require altered structural arrangements in which the mutual understanding of rules and regulations should be explicit, transparent and uniform. National authorities, UN and development agencies and financial institutions need to implement projects in risk reduction not only with national governments but also those in which local authorities, the private sector, academic institutions and community-based organizations have major roles to play.

However, in many countries there are currently few local institutions engaged in or which have adequate capacities to oversee risk reduction strategies on a continuous basis. Almost all countries and most local communities have a designated authority responsible for responding to crisis situations when they happen; many fewer have a recognized office monitoring potential risks and motivating public and private action to minimize their possible consequences before they occur.

A change in the emphasis of government functions requires that a consensus be developed on the roles of government agencies, technical institutions, commercial interests, communities and individuals themselves. Governments have vital roles to play in disaster risk management, ideally serving as a "central impulse" and serving to support sustainable efforts, but there is now widespread recognition that they also must focus their limited resources and serve as coordinating bodies if they are to become more effective. If they are to be relevant in such a role, there is a corresponding responsibility for subsidiary competencies and increasingly localized capabilities to come into force.

Box 3.1
Risk reduction and government action

The following functions are important means by which governments can integrate disaster risk awareness into official responsibilities:

- Disseminate basic public information about the most likely hazards to affect a country or community, along with measures on how to reduce risk.
- Develop integrated institutional capacities to assess and respond to risk in the context of social, economic and environmental considerations of the society.
- Support opportunities that enable scientific and academic institutions to contribute to risk management policies in a manner that is accessible to the whole community.
- Initiate partnerships with local networks, community organizations and advocacy groups knowledgeable about how to organize locally to reduce hazards and increase resilience.
- Encourage the combined participation of government agencies, technical specialists and local residents in the conduct of risk assessments.
- Ensure public understanding of standards and codes designed for the protection of private and public assets and critical infrastructure.
- Promote and encourage public participation in the design and implementation of risk and vulnerability strategies at local and national levels.

Policy frameworks in practice

Asia

Disaster risk management is a concept that is interpreted differently in various Asian countries. This reflects either the predominant hazards threatening individual countries or stems from an historical outlook of what has commonly constituted disaster management responsibilities. For example, in India, the national authority for disaster management had been with the Ministry of Agriculture for many years, reflecting that country's historical concerns with flood, drought and famine. Elsewhere other government institutions tended to concentrate on the emergency services associated with post-disaster rescue, relief, reconstruction and rehabilitation, as well as maintaining public law and order during times of crisis.

Broader concepts of risk management have begun to take hold more recently in some Asian countries at national levels. Thailand has revamped its disaster management system in 2002 and set up a new department of disaster management in the Ministry of Interior.

In addition to Viet Nam, discussed below, elsewhere in South-East Asia both Cambodia and Lao People's Democratic Republic have established or reconfigured their national disaster management offices with support from the UNDP. Cambodia particularly has made considerable progress in structuring national policies increasingly focused on disaster risk awareness and management, with accompanying national training programmes led by the Cambodian Red Cross Society.

The Philippines is considering new legislation to widen the scope of its Office of Civil Defence and the National Disaster Coordinating Council. Following the establishment of its Disaster Management Bureau in the renamed Ministry of Disaster Management and Relief in 1992, the government of Bangladesh implemented a comprehensive disaster management programme in 2000-2002.

Increasingly, more Asian countries are also including some reference to disaster risk reduction in their national development plans. Over the last decade, UNDP has supported capacity-building projects for disaster risk management in more than ten Asian countries.

Case: Viet Nam

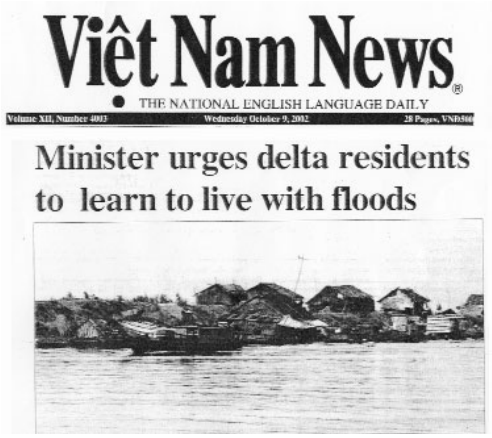
Viet Nam provides a particularly useful example of a sustained commitment to improving its attention to disaster risk reduction. Since 1993, it has pursued a methodical strategy of enlarging its consideration of hazard and risk factors in relationship to national development objectives. At the same time it has proceeded to expand its institutional capabilities.

Proceeding from the recognition that its geography will continue to expose the country to floods, storms, tropical cyclones, marine hazards and less frequent inland droughts, the country has done an admirable job of creating and continually expanding the capabilities of a national Disaster Management Unit (DMU).

While the DMU is entrusted with the responsibilities of emergency warning and management, the overall strategy is motivated by a foremost consideration of identifying, preparing for, and managing hazardous risks. It is no accident that these most common hazards are associated with water, as historically water both on land and off-shore, has been a critical resource for centuries of Vietnamese society.

The country has more recently made a sustained commitment in formulating a 20-year strategic plan for disaster risk management. Of particular note it has embarked on a strategy for inhabitants of the Mekong River delta to "live with the floods". A series of measures has been employed that range from relocating particularly vulnerable communities to safer ground, to altering the cropping calendar.

An innovative programme that is possibly unique in the world introduced the concept of opening temporary "emergency kindergartens" where parents can leave their children under supervision at the time of emergency, when parents are otherwise preoccupied with securing personal possessions and other resources crucial for their livelihoods.


Viêt Nam News
THE NATIONAL ENGLISH LANGUAGE DAILY
Minister urges delta residents to learn to live with floods

"Flood waters have indundated the [Cuu Long (Mekong) delta] area for the past three seasons - this is a long enough period to review our approach. We need to reconsider policies related to security and food security for people living in flood stricken areas. If we make local people dependent on relief, we'll kill their self-reliance which in turn will destroy development."

Lê Huy Ngo, Minister of Agriculture and Rural Development, Viet Nam, 2002

These efforts are showing positive results, encouraging the government and the people to continue working in this direction. They have been largely influenced by in-country expertise and analysis following each hazardous event with additional encouragement being provided by international support. These increasingly sophisticated activities have been supported over several years by international organizations including UNDP and the International Federation of Red Cross and Red Crescent Societies (IFRC), bilateral assistance organizations including the United States Agency for International Development (USAID), and in the case of environmental measures, by NGOs such as the World Conservation Union (IUCN).

Many ministries have been involved too, included those of agriculture and rural development, defence, police, fisheries, construction, transportation, health, as well as the national committee for search and rescue. Meetings are organized to exchange and integrate the benefits of their experiences and to plan for future flood and storm preparedness and mitigation practices.

Further measures are planned to develop the policy of Living with Floods to be implemented in association with the socio-economic development underway in the Mekong River delta. While local authorities will be constructing more residential areas, particularly attention is being given crucial to infrastructure of water supply, drainage and sanitation.

Flood-prone provinces are now required to plan for the more appropriate use of land and to take account of crop schedules better suited to the likelihood of floods. This approach is a good example of the beneficial effects of combining natural resource management activities with agricultural, forestry and fisheries initiatives to reduce flood damage at the same time as enhancing local production, sustainable livelihoods and development.

A further developmental benefit of this approach is that both local authorities and the general population have become more aware of how closely related flooding is to the socio-economic conditions that determine their well-being. The previously more vulnerable population is now beginning to change their earlier reliance on response capabilities to ones now motivated more by preventing the damaging consequences of floods.

They are even seeking to benefit from the natural occurrence of annual floods along the Mekong River. In addition to restructuring production activities and making improvements in physical infrastructure to minimize flood damage, additional plans are underway to take advantage of flooding by expanding aquatic methods of production and increasing fishing and related marketing opportunities. The social sector has not been overlooked as efforts have also been made to institute various collective community services to meet people's immediate needs during the time of threat or crisis.

Case: Republic of Korea

In 1997, the government of the Republic of Korea created the National Institute for Disaster Prevention (NIDP), to update its national disaster management and prevention policies. Organized under the Ministry of Government

Administration and Home Affairs, the primary mission of NIDP has been to perform its own research and then to apply those findings to develop independent design capabilities for disaster management and prevention systems.

With 30 full-time researchers, NIDP is responsible for collecting, compiling, and analysing information on disasters. This material then provides the basis for improved disaster impact assessment, improved mitigation practices, better integrated disaster management policies, and the promotion of wider international cooperation.

Activities have included the development of an online management system for areas exposed to specific hazards, evaluating recovery and response systems and developing a comprehensive management system. NIDP has also completed the compilation of disaster impact assessment standards, and conducts an annual International Disaster Prevention Cooperation Seminar to maintain public, policy and professional interests in disaster risk reduction.

Box 3.2
Learning the lessons, after Typhoon Rusa

In one day from August 31 to September 1, 2002, Typhoon Rusa devastated the middle and eastern coastal areas of the Korean peninsula. It was the most severe natural disaster in the modern era of Korean history causing more than US$ 4.3 billion of property damage, with more than 27,000 buildings destroyed and 31,000 hectares of agricultural land inundated. Nearly 250 people were dead or missing.

Most of the casualties were caused by slope failures, landslides and flash floods. In addition to extraordinarily heavy rainfall, equal in some places to almost two-thirds of the average annual, reckless development was considered to be one of the primary factors that increased the prevailing conditions of vulnerability in the urban areas affected.

The government of the Republic of Korea amended the Natural Disaster Countermeasures Act within a matter of days to provide the basis for the declaration of a special disaster area. Subsequently, the government has drawn on the experience of Typhoon Rusa to make several improvements in its disaster management system.

Significantly, a task force was established under the office of the prime minister to undertake the planning of comprehensive flood mitigation countermeasures. Additional measures were employed by the government to introduce a natural disaster insurance programme. Recognizing the relationship between local development over recent years and the changing nature of risks, it was decided essential to strengthen the national disaster impact assessment procedures which had been in force since 1996.

In order to illustrate some of the strategic changes and favourable developments in disaster risk reduction in Asia, both India and China have embarked on comprehensive national programmes. Together these countries account for almost one-third of the world's population, and they also share many of the same hazards. For centuries they have taken risk into account in a variety of technical and administrative ways. More recently, both countries have reoriented national disaster management strategies to take greater account of disaster risk reduction. Their efforts are summarized in the following case examples.

Case: India

The Indian government has shown great interest in strengthening organizational planning to lessen disaster impacts. It is dedicated to developing a more comprehensive national strategy to link risks with development objectives and environmental concerns that go far beyond more effective relief services.

The severe repercussions of the 1999 cyclone in the state of Orissa and the 2001 earthquake in the state of Gujarat have intensified commitments to alter the long-standing relief commissioner system and to revise national policies of risk reduction. Technical agencies, educational institutions, commercial interests, international finance and insurance investors are all being included in the development of a major reorientation of how the country perceives risk and intends to monitor and manage it in the future.

Initiatives have been continuing to revise disaster policies and to adopt more comprehensive approaches to identifying and managing risks in various state governments. Following the devastating Latur earthquake in 1993, and supported in part by the World Bank, the state of Maharashtra totally revamped its disaster risk management policies by drawing on both international and national expertise in the design of improved administrative legislation and building standards.

Having also suffered badly from earlier earthquakes in the mid-1990s, the state of Uttar Pradesh embarked on a similar programme encouraged by the Asian Development Bank in 1999. The creation of the new state of Uttaranchal in 2000 has provided the opportunity to consider the most appropriate forms of disaster management structures for its mountainous topography.

State governments are being encouraged to update their legislation, strategic plans, disaster management codes, manuals and procedures on the basis of experience gained and taking account of technological developments.

Most notably, a tangible result of this process has been the decision taken by the Indian government in 2002 to alter almost 50 years of practice by relocating all disaster and risk management issues, with the sole exception of drought concerns, from the Ministry of Agriculture to the Ministry of Home Affairs.

This reflects an important departure from the previous association of natural disasters only with the more narrowly focused concerns of food security. While droughts still occur, to a significant extent through practiced management capabilities, India has banished the likelihood of famine from the country.

The important Ministry of Home Affairs is directly responsible for the coordination of the operational aspects of government. Its influence proceeds from the national direction of the civil service, through various state jurisdictions, down to local government's implementation of policies. As such, in broadening its responsibilities to include the many other risks that threaten the country and peoples' livelihoods the relocation is an important step to integrate disaster and risk management more fully into the national, state and local planning and administrative processes.

A High Powered Committee on Disaster Management (HPC) was constituted by the national government to review all existing preparedness and mitigation arrangements initially for natural risks and subsequently for human-induced risks. With a broad multidisciplinary approach, the committee includes technical specialists, respected academics and key civil servants, in addition to eminent public and political figures. It was mandated to recommend measures for strengthening organizational structures, as well as to propose comprehensive models for all aspects of disaster management responsibilities at national, state and district levels.

The HPC has made many wide-ranging recommendations that deal with the constitutional and legal frameworks of disasters in the country. They range from matters of creating new organizational structures and institutional mechanisms, and means to promote the realization of cultures of preparedness, quick response, strategic thinking and prevention.

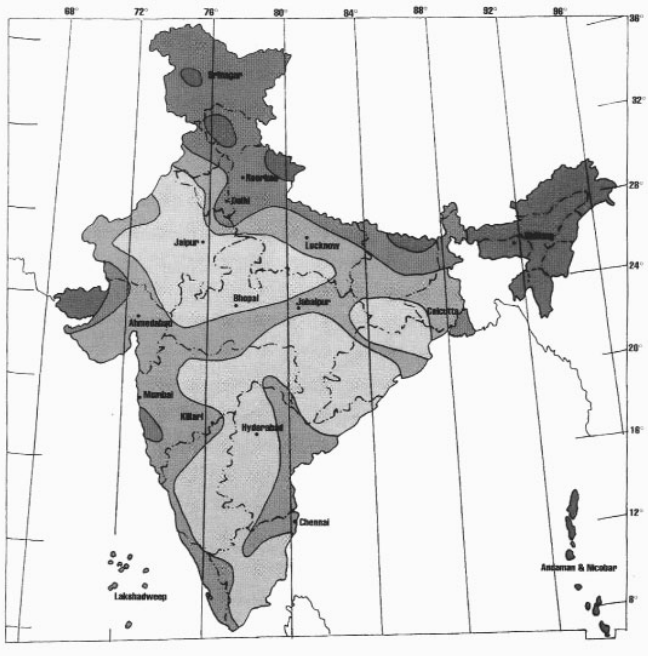


Fig. 1 Seismic Zoning Map of India, 1998 (under print by BIS)
Major changes from map of IS: 1893-1984
1. Zone I of IS: 1893-1984 abolished and merged in II
2. Zone II extended Eastward between Latitude 14°-20° N
3. Zone III in Bellary area abolished and merged in II
4. Zone III on East Coast extended south of Latitude 16° N

Source: Vulnerability Atlas, India

The organizations responsible for implementation have been identified and time frames proposed for the realization of each recommendation. The HPC has dealt with a wide spectrum of issues that hinge directly on disaster management aimed at bringing about measures that ultimately become a part of the national psyche. Important recommendations of the HPC include:

- Identify disaster management as a listed responsibility in the national constitution to be shared by national and state government authorities.
- Legislation at the national and state levels – drafts of a national act for calamity management and a model state disaster management act have been prepared and submitted to the government for consideration.
- Maintain a sustained focus by constituting a Cabinet Committee on Disaster Management.
- Create an all-party national committee for disaster management, chaired by the prime minister, renamed the National Council on Disaster Management with an expanded scope to include human-induced disasters. The council and its designated working group will be institutionalized as permanent standing bodies of government.
- Create a nodal Ministry of Disaster Management for sustained and focused efforts in the areas of disaster preparedness, mitigation and management.
- Establish a National Centre for Calamity Management (NCCM) for strategic and policy formulation at the earliest opportunity, with a structure as evolved as HPC.
- Establishing a National Institute for Disaster Management as a national centre for the creation of knowledge and its dissemination, working through complementary linkages with other institutions for the purposes of training and capacity-building.
- Establish state of the art emergency control rooms, linked in a network between national and state capitals, with additional headquarters placed in particularly disaster-prone or vulnerable districts.
- Integrate disaster reduction strategies with development plans.
- Designate at least 10 per cent of budgeted reserved funds at the national, state and district levels be earmarked and apportioned for schemes that specifically address disaster prevention, and preparedness measures or activities.
- Develop and provide precision Geographic Information Systems (GIS) and digital maps of all states, districts and urban centres with essential spatial and non-spatial data at appropriate scales.

Reports of the HPC and its National Disaster Response Plan have been circulated widely throughout India and among many international organizations, already triggering additional action by them. The state governments of Madhya Pradesh and Gujarat have developed comprehensive policies on disaster management, in the latter case backed up by the passage of an act on disaster management.

Additionally, the states of Assam, Bihar, Karnataka, Orissa, Uttar Pradesh, Uttaranchal, and some others also are finalizing legislative bills relating to local frameworks for disaster management. Elsewhere, at local levels of administration, states are undertaking exercises for capacity-building and the greater involvement of community participation through the local Panchayati Raj which are elected organizations working at the grass-roots level.

The HPC has now been converted into the working group on disaster management, envisaged to provide background material and analyses to enable the National Committee to formulate recommendations after taking account of many viewpoints. Three sub-committees were constituted to:

- formulate a national policy framework and determine an agenda for priority initiatives over the next few decades;
- establish immediate actionable points for both the national and state governments, including legislative and institutional measures; and
- develop the defining parameters of a national calamity.

Two additional sub-committees were convened to provide specific recommendations on the management of trauma and the development of disaster management plans at community levels.

The process outlined here has acted as a very effective catalyst, and has generated important developments in many states. It has defined the functions and responsibilities of various authorities, official agencies and professional organizations. The methodical approach to implementation provides the basis for a structured system of accountability related to the responsibilities of all participants.

In this spirit, the National Committee on Disaster Management has been constituted with members of

major political parties to suggest the necessary institutional and legislative measures needed for a mutually agreed national strategy for effective and long-term disaster management.

In addition to addressing the specific steps required for the reconstruction and rehabilitation in Gujarat following the 2001 earthquake, this effort marks a milestone in broadening national consensus among all the political parties with the intended goals of dealing with major future disasters and setting parameters to define a national calamity.

The driving motivation has become one to stem the premature and needless loss of financial and social capital, which sets back national development by years. These measures require that more time and energy be devoted to prevention and mitigation measures, in order to prepare the country to face disasters without loss of precious resources and social capital.

In 2003, the National Committee on Disaster Management prepared an agenda note and submitted it for the consideration of the prime minister. The presentation noted that there were unattended issues in disaster management which required immediate attention for a comprehensive disaster management strategy to be in force. This collective policy highlighted paths leading towards comprehensive disaster management, and emphasized the importance of transcending reactive response to more proactive prevention and mitigation strategies, given the increasing frequency, complexity and intensity of disasters.

The prime minister has been urged to consider disaster management as an agenda of the entire government, and for it to become a movement across the country. Recommendations need to be implemented to inculcate a culture of prevention and to proceed towards realizing the objective of a disaster-free India.

Case: China

During the course of the IDNDR, the Chinese government recognized that working for disaster reduction would require a long-term commitment and it has worked with dedication and political commitment at the highest levels of responsibility to fulfil those objectives.

Following the introduction of ISDR in October 2000, the Chinese government established the Chinese National Committee for International Disaster Reduction (CNCIDR), consisting of 30 agencies. These included representatives from the state council, ministries, national committees and bureaus, the military services and additional social groups.

As an inter-ministerial coordinating institution headed by a state councillor, CNCIDR is responsible for designing a national disaster reduction framework. In this capacity it develops guiding policies, coordinates relevant departments in the conduct of specific programmes and supervises disaster reduction work undertaken by local governments. The office of CNCIDR and its secretariat are located in the Ministry of Civil Affairs.

An additional advisory group of 28 senior specialists in related fields has been formed to provide guidance to the national committee. Particular attention has been given to applying science and technology in disaster reduction initiatives.

By embracing the importance of disaster reduction activities, China has proceeded to integrate the subject into overall national economic and social development planning. The core element of this process is the progressive implementation of the National Disaster Reduction Plan of the People's Republic of China (NDRP), scheduled to run from 1998 to 2010.

The NDRP was launched by the Chinese government, formulated on the basis of the overall national development policies reflected in the Ninth Five Year Plan for

It is very important for China to form an overall legislative system that relates to disaster reduction, and the experience of other countries would be invaluable. To do this will require financial and technical support from UNDP and other channels.

China response to ISDR questionnaire, 2001.

National Economic and Social Development, and the 2010 Prospective Target Outline for national accomplishments. The design of the plan received important support and technical assistance from UNDP, further demonstrating the essential links between disaster risk reduction and national development interests.

The NDRP was based on several fundamental policies that demonstrate both the breadth and the depth of interests that have been marshalled to implement a national strategy for disaster reduction. The primary one is to serve the advancement of national economic and social development. In this respect, the top priority is assigned to disaster reduction activities, while recognizing that there will still be the requirement to combine these with disaster response and emergency relief efforts at the time of crisis. However, the measure of success can only be gauged by an obvious reduction in the direct economic losses caused by natural disasters.

The roles of science, technology and education are considered to be of particular importance in working together to build disaster reduction into a national concept. Public awareness and knowledge about disaster reduction are an important component in realizing this aim. It also remains important for China to be involved closely with international developments in the subjects concerned, and therefore it must strive to strengthen its own efforts of international exchange and multinational cooperation.

Objectives outlined by the NDRP include efforts to:

- develop projects that advance the social and economic development in China;
- increase the application of scientific and technical experience in disaster reduction work;
- enhance public awareness about disaster reduction;
- establish comprehensive institutional and operational structures to realize disaster risk management; and
- reduce the direct economic losses associated with natural hazards.

The NDRP has also outlined key activities that should be pursued nationwide. One of these is to implement the plan at provincial levels and then at local levels of responsibility. The provinces of Guangdong, Jiangxi, Yunnan, and Shanxi have all issued plans for disaster reduction. In others, such as in Heilongjiang, the national government is working closely with the provincial authorities to initiate a local strategy.

Table 3.1
Administrative and legal arrangements for disaster risk management in Asia

Country	Focal point for disaster management	National action plans	State and provincial disaster reduction plans
Bangladesh	Ministry of Disaster Management and Relief, Disaster Management Bureau	• National Disaster Management Plan • Standing Orders on Disaster	• Operation Sheba: relief and rehabilitation plan for districts of Chittagong, Cox's Bazar, Noakhali, Feni, Laxmipur, Rangamati, Khagrachhari, Bandarban. • Flood Action Plan
Bhutan	Ministry of Disaster Management and Relief, Disaster Management Bureau	• No plan exists. Disaster management issues are contained to a limited extent in the National Environmental Strategy of 1989 and in Bhutan Building Rules of 1983.	
Cambodia	National Committee for Disaster Management	• No plan exists except the five year strategy plan for the development of the National Committee for Disaster Management.	

Country	Focal point for disaster management	National action plans	State and provincial disaster reduction plans
China	China National Committee for International Disaster Reduction	• The National Natural Disaster Reduction Plan of the People's Republic of China • Laws of People's Republic of China on Protecting against and Mitigating Earthquake Disaster • Hong Kong Contingency Plan for Natural Disasters	
India	National Committee on Disaster Management, Ministry of Home Affairs	• High Powered Committee Disaster Management Plans • National Contingency Action Plan • Drought Contingency Plan 2000	• Action plan for reconstruction in earthquake affected Maharashtra. • Anti-disaster plan for the State of Tamil Nadu. • Cyclone contingency plan of action for the State of Andhra Pradesh. • Action plan for reconstruction in earthquake-affected State of Gujarat. • Contingency plan for floods and cyclones in Chennai. • District disaster management action plan for Nainital. • Village Contingency Plan, 2002 (OXFAM Trust, Hyderabad).
Indonesia	National Natural Disaster Management Coordinating Board (BAKORNAS PB), Ministry of Peoples' Welfare and Poverty Alleviation Focal point for disaster management	• National Action Plan	• Forest fire and haze disaster in Mount Merapi disaster management. • Tsunami disaster in Banuwangi.
Iran	Ministry of the Interior		• UN System Disaster Response Plan (involves several ministries and the Red Cross & Red Crescent).
Japan	Cabinet Office	• Disaster Countermeasure Basic Act, (basic plan for disaster reduction)	• Operational plans for disaster reduction, local plans for disaster reduction.
Kazakhstan	Emergency Agency of the Republic of Kazakhstan	• National Plan	
Korea, DPR	Ministry of Government Administration and Home Affairs		
Korea, Rep of	Korean National Disaster Prevention and Countermeasures Headquarters	• Natural Disaster Countermeasure Act • Fifth Basic Disaster Prevention Plan	
Kyrgyzstan			
Lao PDR	National Disaster Management Office, Ministry of Labour and Social Welfare	• Disaster Risk Management Plan	

Country	Focal point for disaster management	National action plans	State and provincial disaster reduction plans
Malaysia	Central Disaster Management and Relief Committee, Inter-Ministerial Committee	· National Haze Action Plan · Flood Action Plan	
Maldives	Ministry of Home Affairs, Housing and Environment and National Council for Protection and Preservation of the Environment	· National Action Plan	
Mongolia	State Permanent Emergency Commission	· Civil defence law · Law on environmental protection · Law on water · Law on air · Law on hydrometeorological and environmental monitoring	
Myanmar	Central Committee for Disaster Prevention and Relief, Ministry of Home and Religious Affairs		
Nepal	Ministry of Home Affairs	· National Action Plan for Disaster Management	· Emergency preparedness and disaster response plan for the health sector
Pakistan	Disaster Preparedness and Relief Cell in Cabinet	· National Disaster Plan · Karachi Emergency Relief Plan	· Model district plan - disaster relief cell · Punjab provincial flood action plan · Earthquake plan for towns and cities in the seismic regions · Sind provincial disaster plan · Disaster preparedness plan Kasur Tehsil
Philippines	National Disaster Coordinating Council, Office of Civil Defence, Ministry of Defence	· National Calamities and Disaster Preparedness Plans	· Contingency plan for Taal volcano · Regional disaster preparedness plan for Tacloban City · Contingency plan for Mayon volcano
Singapore	Ministry of Home Affairs, Singapore Civil Defence Force and Singapore Police Force	· Civil Defence Act · Emergency or Contingency Plan · Fire Safety Act · Civil Defence Shelter Act	
Sri Lanka	National Disaster Management Centre, Ministry of Social Services and Housing Development	· National Disaster Management Plan	· Coastal environmental management plan for the west coast of Sri Lanka · Major disaster contingency plan
Tajikistan	Ministry or Emergency Situations and Civil Defence	· Joint plan with Russian Federation until 2005	
Thailand	National Civil Defence Committee, Ministry of Interior	· National Civil Defence Plan	

Country	Focal point for disaster management	National action plans	State and provincial disaster reduction plans
Turkmenistan			
Uzbekistan		· Disaster Management Plan	
Vietnam	Department of Dyke Management and Flood Control of the Ministry of Agriculture and Rural Development. Secretariats of the Central Committee for Flood and Storm Control responsible for emergency responses to disastrous events.	· Strategy and Action Plan for Mitigating Water Disasters in Vietnam	

Source: Asian Disaster Preparedness Centre, Bangkok.

The Americas

Prior to 1990, both official and public opinion about disasters in Latin America and the Caribbean concentrated almost exclusively on developing humanitarian response and improving preparedness capacities linked to civil defence or military institutions. In North America, the predominant activity was for government agencies to provide funds for local communities and individual residents to rebuild after a disaster had occurred.

Several important institutional changes in emphasis and priorities started to develop though. This began in 1985 in Mexico following the major earthquake that badly damaged parts of the capital, Mexico City. In Colombia in the same year, a major volcanic eruption obliterated the town of Amero with the loss of 25,000 people.

From this time until the mid-1990s, some official disaster organizations created prevention offices in name, but their roles were still largely limited to strengthening efforts in disaster preparedness, conducting basic hazard mapping and promoting early warning systems at the national level. Few human or financial resources were committed and existing legal and institutional arrangements impeded any major changes.

It was also during this time that the US Federal Emergency Management Agency (FEMA) departed from its earlier preoccupations of providing emergency assistance and reoriented its own activities towards vulnerability and risks. It began to give more attention to providing disaster mitigation information and to seeking incentives for making safer and more disaster-resilient communities.

A major shift is now taking place in many other countries in the Americas, from the north to the south, and throughout the Caribbean. The changes have also been supported by a process of regional cooperation. Even more impetus was provided by the combination of extremely severe social, economic and environmental consequences of several disasters in the final years of the 1990s. Taken together, these events provided stark and unavoidable lessons to leaders in the region.

Linking risk reduction with development policies and environmental concerns is becoming more common in several Central American countries, especially where the severe effects of Hurricane

Box 3.3
A shift in political approach

Following the eruption and mudslide of Nevado del Ruiz in 1985, Colombia has been a pioneer in promoting a systematic approach to integrated disaster management. The 1989 creation of a National System for Prevention and Response to Natural Disasters demonstrated a shift in institutional responsibility for natural disasters, from a strong focus on response to one of more preventive action.

Mitch decimated earlier investments made in national development. Some of these are reflected in the policy frameworks outlined in the following case examples.

Case: Guatemala

In 1996, Guatemala reformed its disaster legislation and created the National Coordinator for Disaster Reduction (CONRED) with an expanded range of responsibilities. Comprising a supervisory council of representatives from different development departments, disaster response agencies, and civil society it has provided a better sense of focus on risk issues for a wider circle of interests.

By working with the Ministry of Planning, a national risk reduction system is being established and efforts are underway to incorporate multisectoral risk reduction strategies into the country's National Poverty Reduction Plan. These activities complement a longstanding disaster response division in government and the maintenance of an emergency operations centre.

Case: Nicaragua

More recently, Nicaragua too, has expanded its national programme for risk reduction. Aided by UNDP, it has designed a new disaster risk management strategy. Studies have been commissioned to analyse the suitability of the Nicaraguan legal framework for disaster management requirements and to evaluate the implications for the government, municipalities, the private sector and citizens.

Early in 2000, the Nicaraguan National Legislative Assembly passed a new law creating the National System for Disaster Prevention, Mitigation and Attention and officially established the National Risk Reduction Plan as a primary operational instrument.

The institutional concept is built upon a broad and comprehensive approach to risk reduction issues and is intended to be implemented on a decentralized basis. The strategy and the legislation are considered by some commentators to be the most advanced examples for disaster reduction in the region at the present time, drawing as they do on both the administrative authorities of the national civil defence organization as well as the more analytical and technical capabilities of the professionally-regarded Nicaraguan Institute for Territorial Studies.

Both Swiss bilateral development assistance and World Bank support have been enlisted to strengthen the provision of technical abilities and to augment human resources. The key to future success will be the extent to which productive relationships can be forged among other government departments and development agencies to highlight their respective roles in risk reduction.

Case: Costa Rica

In 2000, the Ministry of Agriculture in Costa Rica created the Risk Management Program in the Agricultural Planning Secretariat. Concern for agricultural losses increased with the impacts of El Niño in 1997-1998, and with the recurrence of flooding and drought. The creation of the programme was also motivated by decisions taken at the Central American Presidential Summit held in 1999, where disaster and vulnerability reduction dominated the agenda.

This development reflects the importance given to disaster and risk reduction by the Central American Integration System's (SICA) specialized agricultural sector organizations, the Regional Advisory Board for Agricultural Cooperation and the Central American Agriculture and Livestock Advisory Board.

Case: Dominican Republic

Following the destruction caused by Hurricane Georges across the Caribbean in 1998, the Inter-American Development Bank (IADB) and the World Bank provided almost US$ 100 million to the Dominican Republic for reconstruction work. After the further severe social and economic consequences of Hurricane Mitch, in 2000 the IADB provided an additional US$ 12 million to the Office of the Presidency specifically for the development of disaster reduction programmes.

These funds were targeted to help modernize the country's strategic approach and institutional frameworks for disaster risk management. The following year, three consulting consortiums developed a national hazard and vulnerability information system, trained trainers in community-level risk and environmental management, and conducted training in modern risk management techniques for civil servants.

They also advised on the development of national public awareness campaigns and on the design of revised legal and institutional frameworks for risk management. Finance was provided to acquire materials and equipment needed by risk and disaster management organizations and associated scientific institutions.

Case: Canada

Following an assessment of the national consequences of a particularly severe ice storm in 1998, and other events which highlighted serious questions about the vulnerability of the country's infrastructure, in 2001, Canada created the Office of Critical Infrastructure Protection and Emergency Preparedness (OCIPEP).

The office was established to enhance the protection of Canada's critical infrastructure from disruption or destruction and to act as the government's primary agency for ensuring civil emergency preparedness. The minister of national defence is responsible for this organization which supersedes Emergency Preparedness Canada (EPC). With a necessarily broader mandate than the EPC, OCIPEP takes an all-hazards approach, recognizing that different hazardous events can have similar impacts.

OCIPEP provides national leadership to enhance the capacity of individuals, communities, businesses and governments to manage risks to their environment, including cyberspace. Through the former EPC, a great deal of experience in preparedness, response and recovery activities has been gained, resulting in Canada's increasingly comprehensive ability to cope with emergency situations.

There have always been efforts across the nation to mitigate disasters, including land-use zoning guidelines and structural protective features such as the Red River Floodway in Manitoba. However, it was recognized that a need existed to address hazard mitigation in Canada in a more systematic way.

A National Mitigation Workshop was hosted by EPC and the Insurance Bureau of Canada in 1998, attended by academic, private sector and government representatives. It concluded that a comprehensive national mitigation initiative would be a positive step towards the long-term goal of reducing vulnerabilities to, and losses from, disasters.

These ideals have been reinforced by participants of the ongoing Canadian Natural Hazards Assessment Project (CNHAP) in which a community of scientists, scholars and practitioners in the natural hazards and disasters field came together in 2000 to conduct a major new examination of the national understanding about the causes and consequences of natural hazards and disasters.

As a part of the process of such multidisciplinary discussions regarding emergency management and disaster reduction, the government announced in June 2001 that OCIPEP would lead consultations on the development of a National Disaster Mitigation Strategy (NDMS). These consultations have similarly included all levels of government, private sector and non-governmental stakeholders, in order to solicit their input and participation in defining the framework for this new national strategy.

OCIPEP has used discussion papers to stimulate a national dialogue about the NDMS in order to solicit views from various stakeholders about the best-suited scope, policies and mechanisms for coordinating and implementing a national strategy.

Meanwhile, the federal government continues to conduct interdepartmental discussions about federal mitigation activities, through an Interdepartmental Mitigation Coordinating Committee. Participants include representatives from all relevant federal departments who are reviewing preparedness and mitigation initiatives and conducting analysis to identify areas where additional attention is needed.

Case: Colombia

The National Plan for the Prevention of Disasters, released in Colombia in 1998, gave little attention to risk reduction practices during non-crisis situations. More recently, however, the National Council for Social and Economic Policy has incorporated disaster reduction measures explicitly into individual sector responsibilities of the National Development Plan.

The 1999 earthquake in the coffee belt of Colombia, and the creation of the Fondo para la Reconstrucción y el Desarrollo Social del Eje Cafetero (FOREC) for the reconstruction effort, provided the opportunity to further enhance institutional and technical capabilities. FOREC is a relevant model and success story useful as a reference for similar situations in other places.

The National Council then proceeded in 2001 to develop a strategy for the short- and medium-term implementation of the National Disaster Prevention and Management Plan. By citing the work to be accomplished during the next three years and outlining the first steps for the consolidation of the National Plan in the medium-term, the resulting strategy has become an improvement to the earlier National Plan for the Prevention of Disasters.

This national effort also seeks to meet the goals of ISDR and to comply with the initiatives expressed in the Meeting of the National Council for Social and Economic Policy. It cites four goals that have to be met if the strategy is to be implemented successfully:

- strengthen public awareness campaigns on natural disasters;
- initiate regional and sectoral planning for disaster prevention;
- institutionalize the national disaster prevention and management plan; and
- communicate the national plan to the public and to the authorities.

By identifying explicit objectives of work to be done and indicating the individuals responsible for their achievement, it is anticipated that the strategy will expedite the mitigation of natural disaster risks in Colombia. This national effort seeks to accomplish the goals of ISDR and to comply with the initiatives expressed in the Meeting of the Americas conducted in the Framework of the Andean Community.

Case: Bolivia

In Bolivia too, a comprehensive national policy for prevention and risk management has been established. Consistent with the intentions of the Andean Regional Programme for Risk Prevention and Reduction (PREANDINO), the minister of sustainable development and planning is committed to incorporating disaster prevention in the planning system through the National Plan for Prevention and Risk Mitigation.

It is anticipated that necessary legislation will enable the introduction of risk reduction factors into various sectoral initiatives. This can then enable a more readily perceived relationship between the objectives of risk reduction and sustainable development. The government has already been pressing ahead with several national programmes aimed at incorporating risk management practices into development activities.

These include a Programme for Risk Prevention and Reduction financed by UNDP and the World Bank. Another programme, financed by the German Agency for Technical Cooperation (GTZ), is the Local Risk Management Programme. In the housing sector, the National Housing Subsidy Programme financed by employer contributions includes a prevention and risk mitigation component.

The Ministry of Agriculture, Livestock and Rural Development is implementing a national food security monitoring and early warning system which will monitor the impact of natural hazards on agricultural production. UNESCO, working jointly with the same ministry, is also progressing in its support for a programme that links development and risk issues with the El Niño phenomenon.

Table 3.2
Disaster institutional frameworks in Andean countries of Latin America

Country	Institutional Framework	High-level programmes for promoting prevention	Prevention plans	Prevention in development plans and control mechanisms
Bolivia	A national policy for prevention and risk management was established in 1999 and modified in 2003. The new law stablishes the execution of prevention measures to the Minister of Defense (MD). At the same time, Ministry of Sustainable Development is responsible for formulating prevention policies and incorporating them in the planning processes. Prevention policies and Official statements on prevention at national level are ad hoc and relate mainly to prevention programmes during rainy periods or associated with health and agricultural campaigns. With reference to the Regional Andean Programme for Risk Prevention and Mitigation (PREANDINO), the minister of sustainable development and planning (MDS) has announced the government's commitment to formulate policies and strategies that incorporate prevention into the planning system. Formal decisions: The MDN has been made legally responsible for execution of prevention measures and MDS for development of prevention policies and the incorporation of them within planning and investment processes.	The government has recently advanced several national programmes to incorporate prevention into development practices, such as the Programme for Risk Prevention and Reduction financed by UNDP and the World Bank.Another Programme financed by GTZ is the "Local Risk Management Programme". In housing, the National Housing Subsidy Programme, financed with 2 per cent of employer contributions, includes the Prevention and Risk Mitigation Sub-Programme. The Ministry of Agriculture, Livestock and Rural Development is implementing the National Food Security Monitoring and Early Warning System, which is responsible for monitoring the impact of natural disasters on agricultural production. PREANDINO promotes the coordination of all initiatives, for which it is supposed to establish frames of reference through the national plan, by identifying policies, programmes and projects of national interest and defining policies to frame national measures. Actually, PREANDINO-CAF, GTZ and MDS have signed an agreement to develop these processes at national, sectoral and local level.UNESCO, jointly with the MDS, is supporting a programme in connection with El Niño phenomenon. Recently has been aproved an important BID prevention loan that includes prevention plans elaboration.	There are plans in the health and agricultural sectors but they are focussed mainly on relief. In the health sector, there is a preparedness and response plan and in agriculture, the ministry has drawn up an agricultural emergency plan. National and sectoral plans initiated within the context of PREANDINO are being prepared. Under PREANDINO-GTZ-MDS agreement, sectoral and local pilots prevention and mitigation plans are in process. This programamme includes development of methodologies for the elaboration of prevention and mitigation plans at national, sectoral and local level.	Proposals for prevention have been incorporated in the Comprehensive National Plan for development (encompassing the economic and Social dimensions) and in National Plan to reduce desertification. There is a draft of the National Planning System standards that includes risks reduction. Guidelines are being prepared to incorporate prevention into local development plans.Also, there has been progress with land use plans. MDS has prepared policy guidelines for land use with risk consideration. This Ministry develops methodological guides for regional and local land use plans considering risk reduction.Some sectoral measures, as in agriculture, include proposals for reducing vulnerability. They have not, however, been integrated into plans for development..The development of the agreement between PREANDINO, GTZ and MDS includes the strengthening of this kind of incorporation processes.
Colombia	Official statements: There has been a national policy on prevention and risk management since 1989, encompassed in Presidential Directive No. 33 of 1990 and Education and Health Ministry Orders No. 13 of 1992 and No. 1 of 1993. Formal decisions: The National Plan for Disaster Prevention and Management was established in Decree 919 of 1989 and Decree 93 of 1998. The prevention decision is a state decision. The policy is maintained even though national governments change. Land use plan for municipalities (Law 388) stablishes the due consideration to prevention.	Until very recently there was no commitment at high political levels to promote the preparation of departmental and municipal disaster prevention and management plans. Presently, in the context of PREANDINO, there is considerable commitment by the National Planning Department and some deputy ministers. This is reflected in the National Economic and Social Policy Council and in plans which will provide for a national effort to consider prevention in development plans and actions. In higher education, risk management issues are being promoted as an element of the basic syllabus.	Colombia has prepared the first prevention plan in the Andean Subregión, but it was not implemented during more than a decade.There are specific plans, such as the pan for the El Niño phenomenon and specific contingency plans. Little attention is given to undertaking planning exercises during periods of no apparent threat. Plans are more typically considered in new situations when a phenomenon is imminent.Some cities, such as Bogota, Medellín and other have developed a big experience in prevention plans.	The present government's national development plan includes a chapter on prevention and risk mitigation. Within individual sectors, energy and health has been shown progress, in the latter case, mainly at decentralized levels. Most departments and capital cities included the subject in the government plans during changes of administration in 2001. Many references are, however, strictly rhetorical declarations. Presently all the institutions are implementing the National Economic and Social Policy Council, with specific prevention proposals being considered in each development area .Municipal land use plans include risk consideration. Recently more than 60 plans were review to improve the critiria for elaboration.

Country	Institutional Framework	High-level programmes for promoting prevention	Prevention plans	Prevention in development plans and control mechanisms
Ecuador	Official statements: In recent years, official statements have been made showing the government's commitment to furthering prevention and risk management policies, mainly at presidential, vice-presidential and some decentralized levels, in connection with the problems of disasters and within the context of PREANDINO.Formal decisions: There are no formal decisions on prevention, but there are decisions associated with PREANDINO initiatives. Within that framework, the national government has decided to strengthen the process of incorporating prevention in development through the participation of national, sectoral and decentraliced working groups.	There has been no official promotion of prevention programmes but only direct action of the National Planning office. However, there is support for high-level initiatives promoted by international organizations, including PREANDINO.	Under PREANDINO framework, the President's Planning Office has finished a draft of National Prevention Plan. The Health, Water Suply and Energy sectors have also prepared a preliminary version of its prevention plans. Actualy they have been reviewed.At this moment other five sectors are starting the process of plan elaboration.	The President's Planning Office has integrated prevention issues into the national planning system. Although the National Plan was drawn up prior to these efforts, its incorporation is being promoted for inclusion in the plans of decentralized jurisdictions. This includes terms of reference for provincial development plans, which already include risk prevention aspects in the strategic planning process. However, plans are yet to be finalized. Decentrralized piltot are advancing in this matter (Quito)
Peru	Official statements: There have been no official statements on prevention during the past decade. Only prior to the 1997-98 El Niño episode were a few statements issued about actions taken to prevent damage. Currently, the subject has not been mentioned in official speeches. Formal decisions: There is not a legal framework for disaster reduction but a proposal for a General risk management law has been prepared. Official decision has been taken for prevention within sustainable development. Under PREANDINO framework, the government has created The Multisectoral Comision of the National Strategy for Development Risk Reduction (CMRRD) in 2002, dependig of the Chair of the Council of Ministers, which is in charge of the elaboration of the national strategy for disaster reduction within development processes.Organizations in nine sectors have been invited to participate, and individual sectors formally decided to establish sectoral committees. There has been a National Civil Defense System (INDECI) since 1972 with responsibility for prevention, emergencies and rehabilitation. In 1997, the government decided to reactivate the multi-sectoral ENP Study Committee, a body that coordinates scientific institutions. This has been maintained and the decision has proven to be a good one. In 1998, the government transferred responsibility for mitigation work on rivers from INDECI to the ministry of agriculture. After this INDECI recovered its initial responsibilities.	The Executive Committee for El Niño Reconstruction launched an Urban Mitigation Study Programme. Although lacking in legal endorsement, fifteen cities were studied with UNDP support until February 2001. This programme was transferred to INDECI. PREANDINO also aims to incorporate prevention in national and sectoral development planning. Due to the fact that there is not a Ministry in charge of Planning, the Chair of the Council of Ministers leads PREANDINO in Perú.CMRRD, GTZ, PREANDINO-CAF and BID have made an agreetment to make sinergies supporting the activities of CMRRD under a common programme at national, regional and local levels.	CMRRD has been advancing in the elaboration of the national strategy for risk reduction into development process. Actually this Comision has finished the diagnosis of hazard, vulnerabilities and risks and have identified some political proposals. PREANDINO committees are also preparing diagnostics for sectoral plans.	There have been some very limited attempts to incorporate prevention issues within specific sectors. An institutional limitation is the country's lack of national planning bodies, although other channels have been identified through the public investment structures working with individual projects. There are local experiments in planning and the development of projects, for example, in the basin of the River Rimac where Lima and eight other district municipalities have mitigation plans, emergency contingency plans and risk studies with microzoning maps. These municipalities regularly update their plans and keep the public informed in what is the most advanced experiment in local work.Actually, CMRRD, PREANDINO and GTZ decentraliced pilots oriented to incorporate risk reduction in local plans are in progress.

Country	Institutional Framework	High-level programmes for promoting prevention	Prevention plans	Prevention in development plans and control mechanisms
Venezuela	Official statements: Following the devastating mudslides in Vargas State in 1999, reference to prevention concepts are being incorporated as part of development policy. It began to appear in national and municipal statements. The subject was also one of the main concerns of senior government spokesmen involved with reconstruction programmes. Formal decisions: Important steps are being taken to incorporate prevention in development processes. This is most evident in the Education sector which has been attentive to these matters for some time, and has set up a maintenance programme for incorporating changes in school buildings. Immediately after the Vargas events in 1999, the ministry of science and technology (MCT) formally institutionalized a disaster risk management policy with tools for its implementation. Financing was provided to support risk management, preparedness and disaster relief strategies. The national government joined PREANDINO to coordinate and promote these activities at all levels, and is now working within that framework to define strategies. The informal National Committee for prevenction and Mitigation has prepared a legal proposal for risk management which has been summitted to the National Assembly . Some municipal bodies, such as those of Chacao, Sucre, Baruta, Maracaibo, Valencia and Alcaldia Mayor, as pilots of the PREANDINO, have formally decided to proceed with the incorporation of prevention in development management.	The MCT has set up the Risk Management and Disaster Reduction Programme which takes an integral approach to support the inclusion of risk management into development planning and sectoral and local actions, despite its emphasis on scientific development and the introduction of technologies into all risk management and disaster relief processes. PREANDINO implemented a global programme in December 2000 with objectives to coordinate the handling of disaster risks, to incorporate risk reduction issues into development policies and to support national, sectoral and local exchanges among countries. There are other sectoral programmes such as one to reduce vulnerability to socio-natural disasters in the education sector and another in the ministry of the environment and natural resources to prepare risk maps for land use planning.	There are no prevention plans but national and sectoral plans are in the process of being completed with the support of CAF cooperation. There are some territorial initiatives at PREANDINO pilots but no prevention plans exist for many municipalities.Only Vargas state has elaborated studies and proposals for disaster risk reduction in the area supported by national and local institutions.	A start has been to incorporate prevention issues in the National Development and Social Sector Plan as well as in a few regional plans. Initiatives in the utilities sector have partially incorporated prevention within certain subsectors such as hydroelectric power generation and in thermal power generation. Only very few municipalities have seismic microzoning and geodynamic risk maps for use in new techniques for municipal planning.JICA is supporting an interesting study for three municipalities of Caracas Metropolitan Area oriented to mitigation and prepardeness. It has been coordinated with PREANDINO Pilot.

Africa

The African continent is highly vulnerable to disasters from natural causes, particularly from hydrometeorological ones that regularly result in drought and floods. Equally important, the vulnerability to hazards is high, and rising. With the exception of a few examples, such as the Ethiopian Disaster Prevention and Preparedness Commission, historically throughout much of the continent, disaster management has focused on responding to recurrent emergency conditions and disasters rather than engaging in more sustained prevention activities

A major shift is now taking place in many countries, particularly in those that have been affected seriously, again, by drought or floods. The increasing impacts of climate change and variability on both the social and economic dimensions of African societies have also demanded more political attention.

The severe earthquake that shocked Algeria in May 2003 is a reminder of the real threats posed by earthquakes, especially in Northern Africa. This event particularly highlighted the necessity of a sustained risk management strategy composed of legislation and building codes that can reduce the impact of such a rapid-onset event that is not so easily predictable.

Despite their irregular frequency and relatively low level of impact, volcanic risks in Africa have demonstrated complex emergency situations. In the case of Nyiragongo in the Democratic Republic of the Congo, the consequences of the volcanic eruption were compounded by conflicts and political instability among the affected population. This very complex situation highlighted the need for disaster preparedness and prevention measures.

However following the event, a contingency plan has been prepared in collaboration between the provincial authorities in the Democratic Republic of the Congo and officials in neighbouring Rwanda. The municipal authorities of the city of Goma have also started thinking about creating a local civil protection capability, backed up by a legal framework in the immediate region. UNDP, the UN Office for the Coordination of Humanitarian Affairs (OCHA), ISDR and the Council of Europe are all working towards developing interagency collaborative efforts to address the most critical medium to long-term disaster reduction needs of Goma.

Other issues in disaster risk management still remain major challenges for many African countries. These include the need to decentralize the authority and the operational capabilities to deal with hazards and risks at the sub-national and local levels. There is a continuing requirement to engage public participation and the social or institutional elements of civil societies in the decision-making and implementation of risk reduction practices, especially within local communities. At most national levels of responsibility, there is much that can be done to integrate disaster risk management into countries' social and economic development plans.

Subregional organizations can be very useful in supporting national initiatives to build capacity to identify and manage risks. They can be instrumental in sharing experiences among countries, as well as developing practical means of building cooperation among the various professional and academic institutions through sharing information, undertaking joint activities, and by complementing each other's professional abilities.

East Africa

Throughout many parts of East Africa, and more especially in the area of North-Eastern Africa, sometimes referred to as the Greater Horn of Africa, drought and famine are common. As a result, strategies to provide protection from famine through drought-resistant forms of food production and other related forms of technical assistance and emergency aid characterized the 1970s and 1980s. Currently emphasis is given to food security through agricultural production, improved rural access to food and markets, and the protection or management of pastoral animal herds. Taken together these measures strive to focus on developmental issues and seek broadly based forms of economic activity that can make livelihoods more sustainable in an often harsh and challenging environment.

Limitations remain with often absent and even existing legislation in many of the countries concerned. One major drawback in dealing with recurrent hazards is that much of the attention given to severe or threatening conditions focuses heavily on responding to already bad situations, rather than implementing strategies that anticipate possible risks and seek to minimize or prevent the worst consequences of a disaster.

Uncertainty may also be created within existing legal frameworks because of the different levels at which decisions can be made, or without a consistent application of coordination.

While efforts are underway to varying extents, countries can promote the adoption of national policies, update or expand legislation, and construct financial modalities and agreements. It may be an even more productive use of scarce resources if these issues can be undertaken increasingly on a regional basis to support common policies and mechanisms, especially as the hazardous events and many of the inhabitants too, often range beyond a single country's borders.

The experiences of two countries in the Greater Horn of Africa – Ethiopia and Kenya – demonstrate how each has managed past disasters and the initiatives they have taken based on that experience to improve their respective capacities in disaster risk management. In both cases the subjects of hazards and risk management have become associated much more closely with national development goals, objectives and programming initiatives, backed up with legislated frameworks.

Case: Ethiopia

As droughts and famines have been recurring phenomena in Ethiopia for many years, the country has developed a notable system of hazard monitoring and emergency response capabilities. In the wake of the famine episodes of 1970s the government established its Relief and Rehabilitation Commission (RRC) in 1974. An early warning system was created in 1976 that initially concentrated on relief efforts related to food security. Later, having recognized the limitations, the RRC broadened its approach to address the management of additional risk factors. The highly centralized nature of the system was also seen to hamper its early warning effectiveness.

However, even with its own organizational modifications and improvements over ten years, the country still suffered immense losses from drought conditions in 1984-1985. The problems encountered highlight the importance of a wider set of relationships essential to disaster risk management. There was a failure to respond to early warning reports which had been publicized, because of mistrust between the government and international donors about the authenticity and accuracy of the information. This led to multiple, uncertain or disputed interpretations of conditions, and resulted in inaccurate estimates of both consequences and immediate needs by international agencies. While delays worsened the extent of the crisis, there was also a protracted recognition of the inadequate logistical capacity available to respond to the ever more pressing needs.

Based on these past experiences and mindful of the linkages between drought, food shortages and famine, the government established a more comprehensive strategy. The National Policy on Disaster Prevention and Management (NPDPM) was created in 1993 with a primary focus on sustained economic and agricultural development. Attention was also given to the practical details of coping with food scarcity, relief procedures, decentralized early warning systems, and maintaining seed and fund reserves, schemes for efficient food deliveries to those most in need, and programmes for livestock preservation.

A key feature of the Ethiopian NPDPM was its linkage of relief issues to more basic and ongoing development activities. All line ministries were required to incorporate disaster reduction measures into their development goals and programmes, as well as to relate them to any eventual relief operations. The policy assigned specific responsibilities to various officials at different levels.

These policies evolved into the National Disaster Prevention and Preparedness Commission (DPPC) in 1995, addressing the wider aspects of disaster prevention, preparedness, emergency response and rehabilitation. It was established at

national level, having overall coordination of disaster prevention and preparedness activities. There are committees established at various levels of administration through which disaster tasks are performed.

Box 3.4
Ethiopian National Policy on Disaster Prevention and Management

The regard for the Ethiopian National Policy on Disaster Prevention and Management (NPDPM) achievements was based on the driving principles of its policies:

- No human life shall perish for want of assistance in time of disaster.
- Provision of relief shall protect and safeguard human dignity and reinforce social determination for development.
- Relief efforts shall reinforce the capabilities of the affected areas and population, and promote self-reliance.
- Adequate income shall be assured to disaster-affected households through employment generating programmes that provide access to food and other basic necessities.
- Contribution to sustainable economic growth and development shall be given due emphasis in all relief efforts.
- All endeavours in relief programmes shall be geared to eliminate the root causes of vulnerability to disasters.
- Disaster prevention programmes shall be given due emphasis in all spheres of development endeavours.
- The quality of life in the affected areas shall be protected from deterioration due to disaster.
- The assets and economic fabric of the affected areas shall be preserved to enable speedy post-disaster recovery.
- Best use of the natural resources of the area shall be promoted.

The ways by which NPDPM worked illustrates the importance given to maintaining a strong relationship with the social and economic values of the community. The community was encouraged to play the leading role in the planning, programming, implementation and evaluation of all relief projects. The role of line departments in this regard was to be subservient. Clearly defined focal points for action for different tasks were distributed among different levels. Such coordination centres needed to be properly empowered and to have necessary resources to undertake their responsibilities.

Precedence was given to areas where lives and livelihood were more seriously threatened. Relief was directed to the most needy at all times, and no free distribution of aid was to be allocated for able-bodied members of the affected population.

Ethiopia has constructed an elaborate institutional framework for natural disaster and risk management, incorporating preparedness, prevention and mitigation measures. This is a major departure from the past, when relief operations were the dominant focus of disaster management. The country has established four levels of focal points for coordination of disaster and risk management through disaster prevention and preparedness committees, at national, provincial, zone, and local (Woreda) levels.

The National Disaster Prevention and Preparedness Committee (NDPPC) is the overall body charged with the responsibilities at the national level for all matters regarding disaster prevention and management. The national office is replicated at the other levels and contains a similar membership composed of the following representatives:

- a chairperson designated by the government;
- Ministry of Finance;
- Ministry of Agriculture;
- the head of the regional affairs sector in the office of the Prime Minister;
- Ministry of Health;
- Ministry of Defence; and
- Ministry of Planning and Economic Development and External Economic Cooperation.

Other members include the presidents of regional councils (or provincial, zone councils at subordinate levels) and the Disaster Prevention and Preparation Commission (DPPC). Other agencies drawn from donors and civil society are included on an ad hoc basis depending on the nature of the disaster.

Four other government bodies are also associated with the work of the NDPPC at national level:

- Emergency Food Security Reserve Administration;
- National Disaster Prevention and Preparedness Fund;
- National Early Warning Committee (replicated at the provincial, zone and Woreda levels); and
- Crisis Management Group (replicated at the provincial, zone and Woreda levels).

Case: Kenya

More recent developments in Kenya have motivated a similar approach, but with different emphasis to reflect the needs of the country. The devastating impact of floods during the El Niño climatic variation in 1997-1998 re-emphasized the need for a disaster management coordination agency in Kenya. This led to strengthening of a National Disaster Operations Centre administered by the office of the president. A series of coordinated activities has been considered, and currently the following institutions operate in association with the office of the president:

- National Disaster Operations Centre;
- Arid Lands Resource Management Project;
- Department of Relief and Rehabilitation; and
- National AIDS Control Council.

In addition, there are other units which operate within various government ministries which have specialized roles. These include such functions as rescue and evacuation, fire fighting, contingency planning and management, research, crowd control and conflict resolution, and activities to combat terrorism.

A national policy on disaster management has been drafted and proposes a framework to coordinate all of these institutions dealing with the different aspects of disaster and risk management. Following extended consultations, a final draft policy framework proposes several new institutions.

The National Disaster Management Authority (NADIMA) would become a crucial coordinating body, with members drawn from relevant ministries and departments, the private sector, NGOs, social and religious bodies. Some international agencies may also be invited to participate. NADIMA's major functions and powers would include:

- authority over disaster management throughout the country;
- reviewing and updating all relevant policies;
- creating and managing a national disaster trust fund; and
- establishing special committees.

A secretariat would be composed to collaborate with sectoral ministries, local government authorities, district committees, and partner agencies. It would service the various committees of NADIMA and conduct the daily activities of the authority. The secretariat would be responsible for consolidating all disaster management related information, and then plan and coordinate all aspects of disaster management. This would entail the preparation of disaster management plans and their related budgets, as well as drafting individual contingency plans for specific types of hazards and risks. It is also anticipated that ongoing roles would include monitoring, evaluating and documenting of lessons learned and applying them to improve performance.

A department of planning and research is expected to undertake the crucial function of advising on future policies and areas that have a bearing on the broader aspects of disaster and risk management. It would pursue programmes for preparedness, early warning, prevention, research, and information management. A different but related department of operations would address the operational aspects of providing relief assistance, responding to acute phases of an emergency, mitigation of hazards, mobilizing resources, monitoring and evaluation.

Southern Africa

In general, Southern Africa has not regularly recorded massive losses from sudden-onset disasters besides periodic floods that have however brought considerable localized losses. Primarily, the major risks that have affected the region have been slow-onset disasters related to drought, epidemic and food insecurity.

In addition, prior to the early 1990s, perceptions of risk in the region were shaped predominantly by armed conflicts and their destabilizing consequences. As a result, the first political engagements with natural disaster reduction in Southern African countries were driven by the protracted ravages of drought or the disruption of livelihoods caused by other emergencies.

To a significant extent since that time prevailing disaster management capabilities have been more

narrowly focused on monitoring agricultural conditions and food availability, or planning emergency relief contingency measures focused almost exclusively on droughts. There are a few regional disaster reduction initiatives now in place, with their antecedents dating back to the 1980s (see chapter 3.3).

Presently, concern is now being expressed more widely across the region about the persistence of drought conditions, unusually heavy precipitation and flooding at other times, and a renewed consideration of climatic variation on livelihoods and food security. As a result, individual countries in Southern Africa are reassessing national needs related to disaster risk management and reorienting earlier national strategies more closely to developmental objectives.

Case: South Africa

A methodical, if protracted, effort to develop a comprehensive national strategy for disaster risk management has been pursued in South Africa by reforming organizational structures and creating new legislation concerning disaster risk management.

As so often happens, it was after a severe crisis – flooding in the Cape Flats of Capetown in 1994 – that the government resolved to assess South Africa's ability to deal with disaster risk management. This initially involved a complete review of disaster management structures and policies.

One year later, the cabinet recommended that a formal structure for disaster management be established. An initial National Disaster Management Committee was formed in 1996 with the intended function of coordinating and managing national disaster management policy. As that body never came into being, in mid-1997 the government approved the formation of an alternate Inter-Ministerial Committee for Disaster Management (IMC).

A Green Paper on disaster management was produced as the first tangible step to establish a formal disaster management policy for the country. It was tabled in February 1998 and provided an important conceptual framework for public dialogue about disaster management and risk reduction at local, provincial and national levels of interest.

A year later, a policy White Paper was developed by South Africa within the framework of the IDNDR. Key policy proposals included:

- integration of risk reduction strategies into development initiatives;
- development of a strategy to reduce community vulnerability;
- legal establishment of a national disaster management centre;
- introduction of a new disaster management funding strategy;
- introduction and implementation of a new disaster management act;
- establishment of a framework to enable communities to be informed, alert and self-reliant; and
- establishment of a framework to coordinate training and community awareness initiatives.

Importance was also given by South Africa to contributing to joint standards and common practices along the same lines with neighbouring countries and other member states of the Southern Africa Development Community (SADC).

Meanwhile, in order to address South Africa's immediate needs, an interim disaster management authority was composed with representatives from ten national departments. This was later converted into a National Disaster Management Centre (NDMC). However, despite the fact that it has been operational since 1999, it has yet to become a statutory institution.

An Inter-Departmental Disaster Management Committee (IDMC) was also established in the same year to ensure better coordination among government departments at national level. This, however, was intended as an interim measure until such time when the planned statutory structures became functional under a disaster management act.

In 2000, the first disaster management bill was published for public comment. However, the initial enthusiasm and momentum shown by the government seemed to decline with numerous postponements of the tabling of the bill. After another severe crisis – this time, the devastating

floods in parts of Southern Africa in 2000 – political priorities changed as the importance of disaster management policy and legislation resurfaced. The National Council of Provinces called a disaster management conference to consider disaster risk management issues on a regional basis in May 2000, and following that the bill was finally tabled.

During the review process the disaster management bill moved away somewhat from the earlier policy emphasis expressed in the Green and White Papers and focused more attention on intra-governmental institutional relationships and related operational arrangements. The rationale behind the bill was to ensure that unambiguous guidelines could be given through regulations once the legislation was promulgated. The bill provided guidance with respect to the legal establishment of the NDMC, the duties and powers of national, provincial and local instruments of government and funding for post-disaster recovery and rehabilitation.

The bill also provided for an Inter-Governmental Committee on Disaster Management to consist of cabinet members involved in disaster management, members of the executive councils from the nine provinces of the country and representatives of local government.

A further structure proposed in the bill was that of the National Disaster Management Framework, to outline coherent, transparent and inclusive policies on all aspects of disaster management including training and capacity-building.

The bill stipulated the establishment of disaster management centres at all levels of government. As one of the primary functions of the centres would be the assessment of disaster risks, the bill also established procedures for the collection and dissemination of risk assessment information. Emphasis has also been given to measures that could reduce the vulnerability of people in disaster-prone areas. The final disaster management bill was unanimously accepted by parliament and the National Council of Provinces in their final sitting at the end of 2002 and was enacted by the president in January 2003. Following its promulgation, the disaster management act is expected to generate greater involvement by provincial and local government authorities to undertake risk assessment activities.

Case: Mozambique

One of the principal challenges for consecutive governments in Mozambique has been responding to disaster emergencies. Since its independence in 1975, considerable resources have been used for disaster management and institutions have continually evolved to deal with new and challenging conditions. This hard-won experience has produced numerous seasoned disaster and risk management officials throughout different government departments and a well-developed inter-ministerial structure for the coordination of disaster and risk management.

It is much to the government's credit that for some time it has recognized the importance of shifting its emphasis in disaster management from immediate response to long-term mitigation and risk reduction. In the last few years, there has been a dedicated effort by the highest levels of government to establish formal arrangements and procedures that can build capacities for improved disaster risk management in the future.

From as early as 1981, the government was attentive to the need to address the consequences of risk on the society. A Department for the Prevention and Combating of Natural Calamities (DPCCN) was established with the objective of promoting early warning and mitigation activities. During a period of complex national emergency from 1982-1994, DPCCN became a principal conduit for international aid to people displaced by conflict and the victims of repeated floods and droughts, with logistics becoming its predominant activity.

Following improved conditions and changing needs of the country, in 1996 a process began with the support of the World Food Programme (WFP) to formulate a coherent national disaster management policy and to reorient disaster management towards risk reduction activities. During the closing years of the 1990s, this involved sustained efforts to reinvent institutions and revise policies created in the prolonged period of permanent emergency.

As expressed in current national policies, the primary objective has been to break the vicious cycle of continually expending scarce resources for emergency response and reconstruction, only then

to become vulnerable and unprepared for the next catastrophic event. This has required particular efforts to stimulate a change of attitudes both within government and in the population as a whole.

In 1999, the government created new institutions to give greater coherence and a clear mandate for government structures dealing with disasters. The Coordinating Counsel for Disaster Management (CCGC) was composed at ministerial level as the principal government body for coordinating disaster management in all its phases. A National Institute for Disaster Management (INGC) was

Source: Instituto Nacional de Gestão de Calamidades, Maputo, 1999

created to serve as its permanent technical support unit, with the director of INGC chairing an additional multisector Technical Committee for Disaster Management (CTGC) to assure strong coordination and collaboration in planning, mitigation and response activities.

A proposed law on disaster management will serve as a legal mandate for the implementation of policy, with the principal objective stated in the first article, "to avoid the occurrence or minimize the effects of disasters". In particular, it gives the National Disaster Management Plan, as approved by the Council of Ministers, the force of law.

The national policy entails a framework for the coordination of government entities, the participation of civil society and collaboration with the private sector in all aspects of disaster and risk management. In addition, the law will establish sanctions for individuals or organizations violating the provisions of a declared state of emergency.

The CTGC has a mandate to ensure that national policies are translated into concrete actions and that norms are codified in the disaster management legislation. The members of the CTGC are expected to carry out historical analysis of disaster vulnerability and assessments of current conditions of risk in an annual process of contingency planning. This exercise, led by the INGC, is intended to assure that authorities are addressing risk concerns throughout the planning cycle. At the national level, a report is produced which focuses on preparedness and prevention measures in vulnerable areas.

While the expressed intentions have been clear, institutions are not easily reformed and individuals not so readily retrained, as future events were to illustrate equally among international agencies and local NGOs. In October 1999, the government of Mozambique released its contingency plan for the up-coming rainy season, noting the high probability of floods in the southern and central regions of the country. At that time it requested international assistance of US$ 2.7 million for immediate preparedness and mitigation activities.

The response to this appeal was poor with less than half of the requested funds pledged by the international community. Yet only six months later, in the wake of terrible flooding, the international community and NGOs gave US$ 100 million in emergency assistance and relief. Subsequently, international pledges for rehabilitation activities following the floods exceeded US$ 450 million.

Beyond the international dimensions, there may be reasons for concern at the individual levels too. There is some indication that some segments of the population have become dependent on emergency assistance and therefore have a strong incentive to maintain their vulnerability. Given

such a disproportionate application of available resources historically between relief assistance and risk reduction, it is not difficult to see why effective reform may prove difficult to sustain.

West Africa

In terms of policy and public commitment to disaster risk management, some national capabilities exist in West Africa to varying degrees. However, as occurs elsewhere, much of the attention is given to responding to single emergency or crisis events, and too often, only at the immediate time when they occur. There is considerably less attention or resources committed to sustained disaster reduction strategies, whether they pertain to the prevention, preparedness or mitigation of hazards.

The efforts demonstrated in disaster management so far involve inter-ministerial and cross-sectoral interaction throughout the area, and to a lesser degree the participation of civil society or local communities. However, with a single exception, no other countries in West Africa incorporate disaster risk management in their poverty reduction programmes. Ghana recently developed explicit programmes to mitigate the impact of hazards and to prevent disasters affecting the poor, having included them in its 2002-2004 poverty reduction strategy for the vulnerable and the excluded.

The aftermath of the Jola boat capsizing disaster off the coast of Senegal in 2002 has raised the awareness of the importance of disaster prevention. Several initiatives have ensued, as the Ministry of Interior has developed guidelines for prevention by all sectors and levels of society from the national level to local communities.

Case: Senegal

Statutory responsibility for managing national institutions for disaster management in Senegal lies with an inter-ministerial committee coordinated by the Ministry of Interior. There is also an office of civil protection, acting through the Superior Council for Civil Protection, established in February 1999 responsible for prevention. Emergency response is managed under the Organization des Secours (ORSEC) National Plan for Organizing Assistance in Case of Catastrophes, established in March 1999.

Civil protection activities in risk reduction and disaster management are decentralized in all 11 regions and 34 departments of the country with the regional commissions headed by the governors, while the prefects head the local department commissions. ORSEC is also decentralized to the regional level and operates through four committees: assistance and safety; police and information; medical and self-help; and works and transport.

Historically there had been several pieces of legislation for the different agencies involved in disaster management. However, these various legal instruments had not been harmonized, nor was there a more integrated approach to disaster and risk management in the country. As several NGOs seemed unaware of their existence and did not participate in their development, they do not seem to have particularly wide public exposure.

Separate plans for prevention and protection have been developed at the national level, as well as for individual functions or components of agencies, such as contingency plans for responding to industrial accidents or hazardous material accidents.

The aftermath of the Jola boat disaster has generated an increased awareness of the importance of disaster prevention. This has sparked a flurry of activity within the government, but also in the familiarity of safety and protection outlooks among the public.

The Ministry of Interior has compiled a risk map and composed a menu of prevention measures for each department and region in the country. These are important steps in that they identify the location, nature, means of prevention and responsible institutions for each type of risk that has been identified. The Ministry has also developed guidelines for prevention action that can be taken by all sectors and levels of society from the national level down to local communities.

Each of the ministries, as well as the office of the president, has newly-designated responsibilities for

disaster risk prevention and management. In addition, a programme is being developed to organize sensitization and training courses on disaster protection in educational institutions throughout the country.

A unified plan is being formulated for prevention that consolidates earlier regional and departmental plans. Under the new guidelines for ministries, the Ministry of Finance and Economy is tasked with integrating disaster prevention in social and economic planning policies to ensure sustainable development. This includes endeavouring to provide adequate financing to reinforce the administrative structures and local capacities for risk prevention. Resources are also being allocated for the development of a facility to train civil protection staff and functionaries in disaster management and, especially, risk prevention practices.

The Senegal experience demonstrates how a national tragedy can motivate renewed commitment and broader political, professional and public involvement in creating a safer and more disaster resistant society.

North Africa

Attention to natural hazards and the related risks they pose to Northern African countries is typically focused on managing the acute phases of an emergency, or the need for emergency relief assistance after the declaration of a disaster, such as a drought or famine.

Natural disasters most often figure in national governmental socio-economic planning in terms of drought. Most of the countries in Northern Africa consider that drought is a structural feature of their socio-economic profiles affecting livelihoods, as well as the national economies.

There are some technical structures in place and institutions dedicated to drought and monitoring specific food security indicators throughout most of the countries of Northern Africa and the arid Sahel region that runs across the continent.

At national levels of interest, there are examples of government institutions involved in the hydrometeorological aspects of hazard monitoring. Typically these include authorities responsible for meteorology, water resources management, agriculture, environment and natural resources.

Similarly, legislation relating to hazard and risk issues is frequently fragmented over different domains such as those of land planning, public works, environmental management, and various other government institutions in charge of single sectoral interests.

There is evidence of some general awareness such as the design and construction of transportation infrastructure in zones vulnerable to flooding and desertification or the management of hydraulic works and river basins in the public domain. However, more fundamental practices related to natural disaster risk management such as risk assessment and early warning systems are not yet routinely integrated into existing legislation.

Most countries have some form of a civil protection authority, but none of the Northern African countries has a national authority dealing specifically with the management of risks overall, nor of natural disasters. Such a limited institutional approach can impede a sustained commitment to managing risks before an acute emergency occurs, or can limit the possibilities for effective coordination at times of serious needs.

The integration of more comprehensive strategies to identify and then monitor risk factors in association with national development objectives remains in early stages in almost all of these countries. Since 2002, several devastating storms or floods have occurred in Morocco, Algeria, Mauritania and Sudan, while severe earthquakes have affected Cairo, most recently in 2002, and Algiers quite seriously in May 2003. These events demonstrate that there is justifiable concern for a more systematic approach to disaster risk management.

Pacific

Pacific small island developing states (SIDS) are diverse in their physical and economic characteristics and exemplify many different cultures, languages and traditional practices. Most of these island states comprise tiny areas of land widely dispersed throughout the Pacific Ocean, so that even within single countries, the distance between islands can be enormous.

Their small size, scattered distribution and relative isolation of many communities characterize development activity differently from that in other parts of the world, and further result in it being quite costly. Human settlements range from traditional rural villages where most people live, to rapidly growing commercial cities.

While there are many forms of land tenure throughout the region, most are based on communal land ownership through which joint community control is exerted over the use of land and many of the decisions that regulate the exploitation of natural resources.

Despite a popular portrayal of the South Pacific as a region of islands with serene beaches, blue lagoons, and an idyllic lifestyle, SIDS have very fragile ecosystems. There is great concern about the consequences of climate change and rising sea levels.

For these reasons, Pacific SIDS are committed to the implementation of development projects to reduce risks to people and property. They have worked to strengthen their national and regional resilience to hazard impacts. The historical record of specific disaster reduction initiatives also shows that Pacific island states have adopted positive approaches in both traditional and more contemporary ways to enable Pacific islanders to maintain a respect for their chosen cultural values.

However, as some major hazards occur only rarely, governments and communities can find it difficult to maintain a high level of awareness and preparedness for specific or individual events alone. The resources available for disaster mitigation have changed over time, too.

Box 3.5
Capacity-building in Pacific island states

A foundation of disaster risk reduction throughout the Pacific is that island communities have inherited a resilient social system. The strength of this system is in its extended family values and communal mechanisms that link to national systems. It requires only a little restructuring and advocacy to integrate these into a practical organizational framework that will foster ownership and promote joint participatory approaches to mitigation management between government and other stakeholders.

The challenges for island states arise from the expanding progress of development on an essentially limited volume of natural resources. This has forced development to encroach on the environment, rapidly increasing community vulnerability to natural disasters. Increasing awareness of mitigation measures through science and technology alone cannot foster preparedness. Links between science and society have to be forged.

Mitigation for Pacific disaster managers means being good facilitators. It calls for skills to build operational networks to make effective use of local resources. It requires building collaboration and technical competence. It means partnership among stakeholders.

In the past years, Pacific island states established strong national coordination units. Importantly, each state has developed a national disaster management plan that establishes the management structures and allocates responsibilities among key organizations. The support plans and operational procedures are critical for including the community in a system that works in partnership with government.

Mitigation pilot projects that can be conveyed through this management approach are providing the building blocks that successfully incorporate mitigation planning into national systems.

Source: A. Kaloumaira, 1999.

In Tonga, local communities need the initial support and direction of government to be active in disaster reduction. They are aware of what is at risk but cannot implement measures on a community basis because of a lack of resources.

Tonga response to ISDR questionnaire, 2001.

Governments became involved in disaster assistance early in the colonial era, taking over responsibilities at independence, often by providing relief assistance and rehabilitation materials following a disaster. Such aid came to be understood by both donors and recipients as unencumbered assistance. As the amount of external or official disaster relief assistance has increased sharply over recent years, so too has community dependency.

A study by a Fijian, A. Kaloumaira (SOPAC-DMU, 1999), illustrates the state of capacity-building for Pacific island states in terms that reflect the basis for the incorporation of disaster mitigation frameworks into national policy outlooks and popular understanding. The relevance and therefore the efficacy of disaster risk reduction is heavily dependent upon the extent to which it reflects prevailing social, cultural and environmental interests of the people it is intended to serve.

Case: Cook Islands, Fiji, Vanuatu

Examples of the ways in which some Pacific small island developing states have sought to incorporate disaster risk management measures into their national development strategies are summarized in Table 3.3. The examples drawn from the Cook Islands, Fiji and Vanuatu focus on the organizational frameworks and policy aspects those countries have pursued with respect to incorporating disaster risk reduction into larger national interests. These indicative examples should not be considered as being either comprehensive or exhaustive in themselves, nor of the region as a whole.

Table 3.3
Disaster institutional frameworks in the Pacific

Country	Institutional frameworks	High-level programmes for promoting prevention	Prevention plans	Prevention in development plans and control mechanisms
Cook Islands	NDMO coordinates disaster management. National and Island Disaster Management Plans call for the National Disaster Management Council to be responsible for policy issues. Establishment of a US $30,000 disaster reserve within the Ministry of Finance. The Island Disaster Management Plan stipulates local government to be responsible for local disaster management activities. Red Cross disaster preparedness programme and first-aid training goes hand in hand with broader preparedness plans.	Introduction to disaster management training course implemented in every island of the Cooks reaching at least 35 per cent of the population of each island. Principles of disaster management integrated in the social science curriculum of the education system, so each child learns of these principles in their school years. Coastal Protection Units protecting the airport from being inundated and minimize tidal energy from surging into hotels on the beaches. Radios placed in emergency centres in the northern islands receive national broadcasts from Rarotonga, enabling communities in the Northern Cook Islands to monitor weather and emergency warnings for the first time. Foreshore Protection Committee. EMWIN early warning system for tropical cyclones is in operation. Rarotonga Tourism Vulnerability Pilot Project	Cook Islands Building Code: a report on promoting codes, and their application was completed in April 1999. A Building Control Unit has been set up for compliance and enforcement by the introduction of commercially experienced construction personnel. Disaster Management Work Plan: • National Disaster • Management Plan for Cyclone Response Procedures • Tsunami Response Procedures.	Development is being undertaken at the national and political levels through an advocacy strategy, with comprehensive sectoral and societal involvement: • Ministry of Transport in the prevention and response to oil pollution • Government Environment Services Unit in climate change • Natural Heritage Unit responsible for community consultation and promotion of biodiversity • NDMO in prevention, mitigation and preparedness activities. Outer Island Development Projects (forestry on Mangaia Island, water reticulation systems, communication systems). Cook Islands government has ratified at least 25 environmental global conventions.

Country	Institutional frameworks	High-level programmes for promoting prevention	Prevention plans	Prevention in development plans and control mechanisms
Fiji	In 1990, the government designated the Ministry of Regional Development and Multi-Ethnic Affairs responsible for natural disasters and the Ministry of Home Affairs for human-caused disasters. NADMO at the Ministry of Regional Development and Multi-ethnic Affairs, manages and coordinates all activities. The national coordination policy is documented in the National Disaster Management Plan 1995 and the Natural Disaster Management Act 1998. Established a National Training Advisory Committee. Fiji Meteorological Service, Mineral Resource Department and the Public Works Department are responsible for monitoring and detecting hazards affecting Fiji. The National Disaster Management Council established the Disaster Management Committee at National Divisional and District levels (DISMAC).	Suva Earthquake Risk Management Scenario Pilot Project (SERMP). Taveuni Volcano Risk Project: updates eruption information for use in preparing risk maps and in developing guidelines for development planning and emergency risk planning. Volcano Hazard Risk Mitigation in Fiji: mapping and understanding volcano hazards on the islands of Kadavu, Koro and Rotuma to develop risk maps, development planning and volcano response plans. Ba Flood Preparedness: providing flood information and preparing flood response plans, conducting local education and awareness activities.	National Disaster Management Plan Disaster Management Work Plan A National Building Code formulated in 1990, but yet to be legislated and implemented. Work is underway to accomplish. Support plans for Cyclone Operational Support Contingency Plan for Taveuni Volcano. Cyclone Preparedness at Community Level: Foundation for the Peoples of the South Pacific "Fiji's Awareness Community Theatre Cyclone Preparedness Programme" uses video and drama to better inform village communities.	A proactive approach to disaster reduction continues to be the cornerstone of Fiji's national effort. A major issue is the restructuring of the NDMO within the Ministry of Regional Development and Multi-Ethnic Affairs. Construction of disaster resistant infrastructure: mitigation measures and strategies are considered at national level (Ministry of Regional Development and Multi-ethnic Affairs), and local levels (District and Divisional Development Committees). This risk management approach adopted throughout the country. PICCAP: Greenhouse Gas Inventories and Vulnerability and Adaptation Assessments. Climate change is integrated into disaster reduction agenda.
Vanuatu	National Disaster Management Act No. 31 of 2000. The National Disaster Management Act provides more power for NDMO to undertake its national responsibilities and for the six provincial councils to become more proactive in disaster management. NDMO coordinates disaster management. It is an information resource for the country at all levels of government (national, provincial, municipal councils, village councils), NGOs, the private sector and communities. Provincial governments must have disaster mitigation as a policy as per the National Management Act.	Professional development programme. Community resilience programmes (CHARM) Community-based volcanic risk reduction. Involvement of the private sector (Telecom Vanuatu, Unelco - power and water facilities). Building cyclone preparedness. Flood mitigation projects. NDMO have initiated a very active program on public education through the Teachers College in Port Vila and several high schools.	National Disaster Management Plan. Disaster Management Work Plan. National Building Code (not yet enacted). Support plan for Ambae Volcano Operations.	In conjunction with the SOPAC-DMU CHARM Programme, Vanuatu is developing a new structure for its NDMO office. In 2002 the NDMO office will be relocated from the Department of Police and linked with the line ministries of the Government. Further important areas of public policy are now in progress, including the review and revision of the National Disaster Emergency Plan, development of support plans, institutional support for the NDMO and training and education programmes.

In Canada, provincial and municipal jurisdictions have legislation, programmes and activities that may not necessarily interface with national level disaster reduction issues. However, the implementation of disaster reduction measures is likely to occur at the municipal level, including legislation and enforcement.

Canada response to ISDR questionnaire, 2001.

In Germany, the most important risk reduction issue to be addressed concerns the harmonization of duties, responsibilities and legislation between the state government and the different local bodies. The key national issues are:

stronger commitment of the federal government to the coordination of civil protection activities;

stronger integration of disaster mitigation in regional planning by legislation; and

stronger support for interdisciplinary scientific research centres for disaster prevention.

Germany response to ISDR questionnaire, 2001.

National planning processes with multisectoral responsibilities

Authority and external resources normally flow from the apex of political power, while knowledge of the situation, information, local resources, and leadership all rise from the local community. Disaster planning will always be ineffective if confined strictly to a process of central planning and command and control practices. However, it must equally be recognized that various national approaches have to be tailored to the structures and practices prevailing within different countries' needs and conditions.

In order to achieve effective local disaster plans it is essential that provincial, district and local level officials be given power and resources to manage disaster protection activities. However, such systems require national disaster risk reduction plans that are fully compatible with local level provisions. In many countries where power has been devolved to local levels of administrative responsibility, there can be unhelpful discrepancies between policies and practices at various levels of government.

Tools are required to create a culture of prevention against all forms of hazards within local communities. This requires the knowledge of practical and low-cost methods which address hazards that can be conveyed to participants including local leaders, community groups, merchants, commercial and financial interests and local government employees.

Europe

Case: Switzerland

In Switzerland, a long-standing federal forest law recognized the importance of forests with respect to reducing water runoff. Forests also were recognized as a means of protection against avalanches as early as the 19th century, when extreme events revealed the catastrophic effects of large-scale timber cutting, especially in the pre-alpine and alpine regions.

The unhindered felling of trees came to an abrupt end. Simultaneously, many major river training works were commenced, completed or renewed as an emphasis was then placed on protective measures of river engineering.

Natural hazards continued to play an important role in modifying Swiss policies in the 20th century. The risk situation was aggravated further by development in hazardous areas. The social and economic consequences of avalanches, floods and windstorms exerted an impact on policy considerations, but Switzerland has also recognized that absolute safety cannot be achieved by any means.

Great strides have been made in the past years as the country has proceeded from the earlier conventional protection from hazards to develop more integrated risk management. This approach is based on a balanced equilibrium of disaster prevention, response and reconstruction measures. Residual risk which is based on social, economic and ecological criteria must therefore be deemed to be accepted.

In order to establish coherent procedures that take account of the country's cultural, geographical and linguistic diversity, Switzerland gives considerable importance to the "subsidiary principle". This principle is constituted as one on the inviolable rights of the lower hierarchies of official authority and public responsibility.

It establishes that the upper hierarchical levels only exert a degree of political power and only take over those administrative duties that the lower levels of responsibility are not able to cope with, or accept, themselves. Hazard and risk management in Switzerland follows this subsidiary principle also in the political sphere, as there is a distribution of responsibility between federal, cantonal (state) and communal authorities. This equally extends to

individual land and property owners as well as to other various public institutions and organizations.

While the three cornerstones of prevention, response and reconstruction have comparable importance in Swiss disaster management strategies, they relate in a somewhat reverse subsidiary relationship to each other. Great emphasis is placed on prevention. Response must be efficient and smooth in the face of catastrophic events. Reconstruction has to take place subsequently, and to a degree which is necessary, feasible and compatible with far-reaching considerations about the environment. The ultimate aim of the Swiss strategy has been to achieve sustainable development in all aspects of natural disaster reduction.

Beyond its own borders, Switzerland maintains and promotes the exchange of experience with other countries in regard to disaster reduction. It supports international collaboration in sustainable development and the provision of humanitarian assistance when required.

Guided by these principles, the National Platform for Natural Hazards (PLANAT) was created by the Swiss Federal Council in 1997. This extra-parliamentary commission is made up of representatives of the federal government, the cantons, research and professional associations and the economic and insurance sectors. The terms of reference for the first period of its activities from 1997-2000 were to:

- develop a national strategy for dealing successfully with natural hazards;
- coordinate all parties involved in disaster reduction; and
- create more awareness about natural hazards and replace the conventional approach to protection with an enlarged understanding of risk management.

Plans for the second period of activities from 2001- 2003 gave priority to:

- promotion of public relations;
- initiation and support for projects which further integrated risk management;
- support for third party projects that share similar aims; and
- better utilization of synergies among various sectors.

Building awareness about risk reduction through information exchange and education is increasingly considered important by virtually all players in Swiss risk management. An interesting development in this field is the virtual campus initiated by several Swiss universities and research institutes, called the Centre of Competence on Natural Disaster Reduction. Students, researchers and other practitioners working with natural hazards can access courses and risk-related information on their website (also see chapter 4.4). <http://www.cenat.ch>

Moves are also underway to upgrade the Swiss National Alarm Centre, recognizing that communications are important for the routine exchange of information in times of calm as well as during times of crisis.

It is recognized that more finances need to be allocated to build greater awareness for disaster risk reduction among the public and policy makers. It is a bitter fact that individuals and politicians have a short memory, which explains why things normally only start to move in the wake of a disaster such as occurred during the severe winter storms at the end of 1999.
As financial resources are always limited, they must be allocated in the most productive manner. Several changes are underway to ensure their most effective use. These include:

- giving preference to non-structural preventive measures, such as the maintenance of watercourses rather than river-engineering;
- shifting resources from reconstruction to preventive measures;
- reallocating resources to increase inter-cantonal collaboration and to avoid duplication; and
- improving the coordinated use of government subsidies and similar incentives for local authorities and communities.

In other cases of national frameworks and policy commitments, impetus may come from different sources. Risk reduction plans may be linked to specific events or designated responsibilities, policies and practices as the following examples drawn from elsewhere in Europe illustrate.

In Portugal we should be prepared for disaster and thus develop adequate policies, including:

defining safety policies;

informing and educating the public concerning risks and the development of a civil protection culture;

improving risk mapping;

promoting the study of seismic impact and other risks facing communities and their social economic patterns;

improving the scope of emergency planning;

defining a national land-use policy;

developing a strategy to strengthen building structures;

providing the financial resources to facilitate compliance with existing codes; and

protecting cultural assets.

Portugal response to ISDR questionnaire, 2001.

Case: Russian Federation

Russia has a comparatively long history of disaster reduction and emergency response with a set of institutional initiatives introduced during the past decade. During 1992-1993 the national Unified State System of Early Warning and Disaster Mitigation, subsequently, the Russian System on Disaster Management (RSDM) was established.

In 1994 the status of the State Committee on Emergencies and Natural Disasters was elevated and became a federal ministry, the Ministry of the Russian Federation for Civil Defence, Emergencies and Elimination of Consequences of Natural Disasters (EMERCOM). The institutional coordination of government efforts in disaster reduction was provided through an interagency commission for disaster reduction organized in 1995.

Since its creation, EMERCOM has demonstrated its expanding activities in the field, simultaneously recognized as a state authority in the Russian Federation that has been able to acquire public respect while gaining prestige among other government institutions. It has worked to develop and install a national institutional framework for natural disaster reduction in Russia. It encompasses major elements of legislation, administrative structures at the national level, coordination and implementation mechanisms, and national programmes aimed at emergency prevention and mitigation.

As Russia proceeded into a new period of economic and political development marked by an extended transition to a market economy and democracy, the country has redefined its approaches to environmental security. It has designed new schemes for responding to environmental change and insecurity. In the latter half of the 1990s, Russia adopted a broader concept of national security that shifted from a more traditional security perspective focused mainly on military defence, to a more integrated concept reflecting a greater emphasis on human security.

The revised concept included a wider and more dynamic approach to considering national risks, such as those emanating from economic instability, organized crime, nuclear contamination, infectious diseases, or food and water insecurity. The mitigation of natural hazards or prevention of potential disasters became an integral part of Russia's national policies for enhancing environmental and human security. These issues were unambiguously placed at the forefront of national agendas after the consequences of the Chernobyl disaster were fully recognized.

New and additional commitments were made to increase the capacity-building process for performance of national policies for natural disaster reduction. This resulted in constructing a diversified institutional framework, including legislation, administrative structures, national programmes, response capabilities, and specific practices in the mitigation of hazards.

Current national disaster reduction policies emphasize three related dimensions: monitoring, forecasting and risk assessment of natural hazards; measures to prevent associated risk of natural hazards; and disaster risk management practices that can mitigate them or alleviate eventual damages that may be associated with them.

Major commitments of national policy include the compilation of an inventory and related databanks on territorial vulnerability to individual natural risks, as well as monitoring and forecasting their potential occurrence. This requires coordination and close cooperation among existing national hydrometeorological, seismological, agricultural, environmental and space monitoring networks. Major problems remain to be tackled to fully synthesize a variety of earlier monitoring networks and to improve the quality, quantity and regularity of data

measurement. Although crucial, monitoring and the related aspects of forecasting have remained weak elements in the national strategy.

National prevention and mitigation policies envisage that physical adaptation measures be undertaken in the areas vulnerable to particular risks, such as the use of hydro-engineering protective measures and by reinforcing seismic stability of buildings. Similarly, the expanded application of zoning measures, improved early warning practices, increased public awareness and more direct public participation in risk reduction are important policy or procedural actions being pursued.

Shifts in national disaster reduction policies have taken place as lessons have been learned from the effectiveness of recent experience with natural disaster mitigation. There is a strong requirement to move from the historical priority of emergency response towards potential risk identification, assessment and the reduction of risks by management and operational practices that can alleviate the severity of potential disaster impacts. There is a growing understanding that it is more economical to prepare properly for the inevitable hazards so as to prevent disasters.

The focal point to accomplish this strategy for disaster reduction in the Russian Federation is EMERCOM. It is a federal body of the executive governmental authority responsible for the implementation of official policy in disaster prevention and mitigation. It is also responsible for the operational management and coordination of government actions in case of emergency.

As technological hazards also constitute a threat to human security in addition to natural hazards, EMERCOM combines responsibilities for the prevention and mitigation of both natural and technological risks, commonly referred to generically as emergencies.

EMERCOM combines a broad range of competences that pertain to national policy formulation. It manages the operational aspects of emergency response, undertakes disaster reduction measures, forecasts and monitors natural and technological risks. Its major goals are the following:

- realization of state policy and undertaking measures to protect the population and territories from emergencies;
- provision of regulation, licensing, control and verification in emergencies prevention and mitigation;
- government management and coordination of activities of federal executive authorities in disaster reduction; and
- collection and processing of information for disaster reduction.

A Commission on Emergencies of the Russian Academy of Sciences elaborates strategies and details specific measures for the assessment of risks and disaster reduction. There is also a special working group on emergencies under the authority of the national president. EMERCOM

Box 3.6

Ministry of the Russian Federation for Civil Defence, Emergencies and Elimination of Consequences of Natural Disasters

The main functions of the Ministry of the Russian Federation for Civil Defence, Emergencies and Elimination of Consequences of Natural Disasters (EMERCOM) include:

- elaboration of proposals and initiatives for national disaster reduction policy and legislation;
- maintenance of the Russian System on Disaster Management (RSDM);
- coordination of activities of governmental authorities at all levels in disaster reduction, including control and supervision of their efforts in emergency response;
- coordination of activities for emergencies forecasting, event modelling, and regional risk assessment;
- public education and training, training of government officers in disaster prevention and response, organization of public information and warning, control over establishment of warning systems;
- research on disaster reduction, development of seismic monitoring and forecasting;
- operational management and coordination of emergency rescue operations and application of disaster response methods in large-scale disasters and catastrophes;
- management of rescue forces, of civil defence and their training;
- coordination of rehabilitation of locations affected by disasters, enhancing social support and public security for the affected population, and provision of humanitarian support;
- management of reserve funds, including government reserves for emergency responses; and
- international cooperation in disaster reduction and humanitarian assistance.

Source: <http://www.emercom.gov.ru>.

coordinates horizontal and vertical relationships within the Russian government in disaster and risk management. A sophisticated communications and reporting structure is maintained among the various operational bodies.

Working across sectors, EMERCOM supervises activities of the various line ministries and agencies by working through a coordination body, the Interagency Commission on Emergencies Prevention and Mitigation. This includes representation from various government agencies, including the hydrometeorological service, Ministry of Natural Resources, Ministry of Fuel and Energy, Ministry of Nuclear Energy, Ministry of Agriculture, Ministry of Health, and the state technical inspection service.

This commission exercises major responsibilities to ensure the operational capabilities of the RSDM. It has sectoral and regional branches in all Russian regions. It combines a management structure with emergency task forces and the resources of both federal and territorial executive bodies designated to be responsible for emergencies and disaster reduction.

EMERCOM's vertical structure incorporates six regional centres (central, north-west, northern Caucuses, Volga-Ural, Siberian, and Far-East) with the territorial disaster management bodies in 89 subordinate jurisdictions. According to national legislation, it is the responsibility of territorial authorities to elaborate their respective regional laws to comply with national policies in maintaining task forces for emergencies mitigation and enhancing human security and performing rescue operations. They are also required to provide necessary resources and an accompanying permanent management structure to address disaster and risk management within their respective territories.

National legislation of the Russian Federation in disaster reduction consists of the basic federal law on the protection of population and territories from natural and technological emergencies, adopted in 1994. This is elaborated further by a set of corresponding federal legislation consisting of directives and regulations, as well as laws and acts of subordinate jurisdictions.

The basic federal law provides the legal foundation for disaster prevention and mitigation efforts. It defines the main notion of emergency situations and a set of expected response measures that incorporate principles of protection for the population and territorial assets. It stipulates the expected competencies of state authorities and governmental bodies in taking actions to avoid or limit adverse effects of natural hazards and to enhance human security. It further provides detailed division of responsibilities between federal, regional and municipal authorities. It regulates activities of the public and official rescue forces in emergency activities, and provides additional direction for public preparedness.

Disaster reduction legislation has been expanded considerably at both national and regional levels in Russia during recent years. In 2001, federal authorities introduced four federal laws, 24 governmental legal acts, and 55 directives for federal ministries that directly or indirectly relate to disaster reduction. These have been supplemented by the adoption of additional measures, including 23 legal acts and 1,024 normative regulations and directives.

Most of the regions throughout Russia have adopted territorial legislation that consists typically of general legal frameworks on preparedness, disaster mitigation and prevention. Additional acts have also been promulgated in specific sectors of disaster management and to promote various elements of human safety.

Special federal and regional programmes for public protection and disaster reduction are among the main instruments of governmental policies. The federal programme for natural and technological risks reduction and alleviating their impacts is in place until 2005. It is conducted jointly by EMERCOM; the ministries of industry, science and technologies, natural resources and nuclear energy; the Russian Academy of Sciences; and other bodies. In 2002, about 22 coordinating organizations and 73 participating institutions took part in its implementation.

Table 3.4
Legal acts and directives on disaster reduction adopted by regions of the Russian Federation in 2001

Main subjects of legal acts and directives	Number of laws, directives
General issue of preparedness and mitigation of natural and technological hazards	334
Target science and technology programmes and strategies on disaster reduction	38
Maintenance of administrative structures, emergency response and rescue task forces, and public preparedness	297
Development of evacuation schemes and rescue operations, and liquidation of hazards impacts	41
Maintenance of information, communication and early warning systems	63
Formation of financial and material resources and supplies, of special reserves (material, food, medical)	180
Government control, verification, and impact assessment	60
Social support for affected population, humanitarian actions in the areas of emergencies	11
Total	1024

Source: State report on protection of population and territories of the Russian Federation from natural and technological disasters in 2001, EMERCOM.

The main goals of this programme include:

- elaborating measures to counteract natural and technological emergencies;
- creating methodological basis for disaster risk management;
- developing norms and directives for enhancing governmental control and institutional responsibilities in disaster reduction;
- improving systems for emergency risk identification, prediction and monitoring;
- developing information management, communication and early warning systems;
- designing measures to enhance human security and risk alleviation; and
- improving public education and specialist training for hazard and risk mitigation.

The programme has elaborated government concepts that are conducive to implement strategies for disaster risk reduction. This has involved efforts to compile regional inventories and databases on technical and financial resources necessary for mitigation, the introduction of new information and communication techniques, and developing improved methods for the forecasting and monitoring of hazards. Additional technical activities have addressed technology for atmospheric monitoring, means for breaking ice obstructions, and advanced technologies that can measure the seismic stability and resistance of buildings and infrastructure.

A recent assessment conducted by the government noted activities devoted to emergency services and the practical measures employed to identify emergency risks to the national system were quite effective. However, it also underlined that there were still some shortcomings in terms of developing broader institutional frameworks in natural disaster risk management (M. Kasianov, speech at the meeting of the high-level officials of EMERCOM, 20 November 2002).

One particular area noted for further attention was the persistent underestimation of the need for preventive measures, and a corresponding level of more limited attention to preparedness, monitoring and emergency warning among local populations. Further clarification and division of responsibilities between federal and local authorities was recommended. The situation was aggravated due to the violation of standards, and construction permits being issuing by local administrations and municipalities with insufficient regard given to disaster-prone zones, regardless of existing legislation.

As a result of such ongoing assessment of national policies, renewed emphasis is now being placed on improving monitoring capabilities, and seeking to increase the effectiveness of natural hazard forecasts. The overriding goal is to strengthen the communication of information, forecasts and preparedness components within the context of all disaster risk management activities. This should spur greater attention to structured programmes of public awareness and more local participation. There is also a demonstrated need to develop more opportunities for insurance and similar risk-sharing strategies to be employed.

Further information on the nature of problems encountered, as well as measures being taken in the Russian Federation to update national capabilities in disaster risk management can be reviewed on the EMERCOM web site. <http://www.emercom.gov.ru>

Case: Greece

Like several other European countries, Greece has managed emergency and preparedness plans under the framework of civil protection responsibilities. A new law on civil protection was adopted in 2002, however, to take account of the experiences following recent disasters in the country. This law increases the responsibilities of local authorities and municipalities in disaster management, promotes the wider integration and use of scientific and technical knowledge, and places greater emphasis on the role of public participation in civil protection activities.

Specific national prevention measures have also been adopted, directed primarily towards reducing earthquake risks. Seismic codes that have been in place and periodically updated have become the main tools of earthquake prevention and are mandatory for all new construction. However, despite national efforts for land-use and urban planning that have been expressed for disaster protection and specifically earthquake safety since 1983, the pressure of rapid urbanization has contributed to a lower degree of implementation than expected in some areas.

Against such a background, the lessons learned from the 1999 earthquake which struck Athens and the nearby Attica region of Greece have received considerable public and therefore political attention. They have been drafted within the framework of the Natural and Environmental Disaster Information Exchange Systems (NEDIES) project of the European Union Joint Research Centre, and can be reviewed in full on the Internet. <http://nedies.jrc.it>

Political leaders took notice of this particular event because it was the most expensive earthquake in modern Greece, with losses estimated at 3 per cent of the country's GDP. While many buildings performed relatively well in the earthquake, other important lessons were drawn for the future.

Seismic risk assessment would have to become more widely used in order to obtain a better understanding of the possible effects of future earthquakes and to support a viable decision-making system for earthquake protection.

While this applied particularly to the economically important area of Attica, more effort needs to be expanded for land-use and urban planning with respect to seismic safety. This necessarily would have to include geological and geotechnical analysis as well as micro-zoning studies, which are well-established in the technical disciplines concerned.

A project on establishing criteria and procedures for vulnerability assessment of public buildings and bridges was in progress when the earthquake occurred. It continues, focusing on existing buildings of critical or public use. A database will be created regarding the characteristics of more than 200,000 buildings as the earthquake confirmed that future consideration must be given to retrofitting existing buildings.

The earthquake also confirmed that seismic safety has much to do with the overall design of buildings. Thus, requirements in respect to seismic safety should be included in the general building code and related codes for the design of non-structural elements.

The earthquake opened a window of opportunity for upgrading the built environment and to promote other measures for seismic safety, but there was also strong pressure for quick reconstruction and a rapid return to pre-earthquake conditions. Municipalities with pre-existing plans and projects are better equipped to take advantage of such opportunities. Special measures for land-use planning and the protection of industries and businesses have been implemented after the earthquakes, including geo-technical studies of the Attica Basin, urban planning, and a proposed relocation scheme.

Earthquake education also pays dividends. Many training and public awareness initiatives were set up after the earthquake. Training seminars were conducted for teachers and public volunteers. Training materials such as CD-ROMs and books about earthquake protection were distributed, and web sites created, in local communities and among the youth of the area.

In many cases children reacted better than their parents during the aftershocks, thanks to the training they had received at school. Therefore, more public education is required involving all members of the community.

Informing the media is especially important, with further encouragement needed for closer work between the media and the scientific community on an ongoing basis, before any disaster occurs.

Risk reduction plans linked to specific responsibilities, policies and practices

Case: Iran

Iran is highly exposed to seismic hazards throughout the country. It became evident that a long-term vision was required to reduce the level of risk for the population. The development of a national policy of disaster risk reduction was promoted largely by scientific groups and technical interests.

Their example demonstrates that the evolution of risk reduction frameworks need not originate only from civil administration or political initiatives. Scientific interest groups exerted a major role in driving policy relevance and were able to implement actions in different segments of the society.

There were a number of problems to be tackled before a comprehensive and sustainable national framework to reduce seismic risk could be created. Following the 1990 Manjil earthquake, the International Institute of Earthquake Engineering and Seismology (IIEES), located in Teheran, began work with other technical institutions to develop a multidisciplinary strategic national research and mitigation plan for seismic risk reduction.

The resulting Iran Earthquake Risk Mitigation Program (IERMP) has been implemented by IIEES, the Building and Housing Research Centre, the Geophysics Institute of Teheran University and the Geological Survey of Iran.

With the added support of the Earthquake Committee of the Iran Research Council and Iran's national IDNDR committee, the programme members adopted the following objectives:

- increase the scientific knowledge required for earthquake risk mitigation;
- reduce the risk of all structures by promoting the need to build safer structures;
- increase public awareness and promote a collective prevention culture; and
- develop plans for post-earthquake activities.

Politically, the first need was to promote a better understanding of seismic risk among senior policy makers and to translate that awareness into political commitment at all levels of government. This was pursued by emphasizing that elements of a risk reduction strategy were integral to national development objectives. Resources had to be reoriented from a predominant use in responding to immediate needs towards their investment in long-term objectives. Importantly, policy makers had to be encouraged to accept a policy of deferred benefits.

In an operational and technical context, emphasis was given to strengthening, and where necessary, retrofitting structures with particular attention given to lifeline facilities and the physical infrastructure. This became particularly crucial in highlighting a challenging incompatibility that existed between a developmental perspective that encouraged investment in seismic design, in contrast to the more prevalent thinking in the private and public sectors of incurring less expenditure on construction.

With the involvement of the engineering profession, backed up by its code of professional training, opportunities were identified to use technical knowledge in everyday life. This included a wider use of seismic design and construction techniques and a more serious approach to the implementation and enforcement of building codes. Perhaps most importantly, the engineering profession became an institutional champion to promote risk reduction.

IERMP developed a plan for government officials, scientists, engineers, builders and the public to define acceptable and achievable levels of risk by working together. This led to two parallel requirements, making seismic safety a priority

Table 3.5
Iran Earthquake Risk Mitigation Program

Type of resource	Before (1980-1989)	After (1990-2000)
Seismic researchers	Less than 40	More than 265
Seismic graduate students	Less than 20355	Seismic stations1545
Strong motion stations	270	Approx. 1000
Research laboratories	2	7
Books and technical reports	Less than 100	More than 460
Budget	Over 10 years, less than 700 million Rials (US$ 402,000) In 1989 alone, about 104 million Rials (US$ 59,727)	Over 10 years, more than 128,000 million Rials (US$ 73.5 million) In 2000 alone, more than 37,000 million Rials (US$ 23.3 million)
Investment for laboratories	US$ 3.1 million	US$ 11.5 million

The following table summarizes the increase in resources allocated to seismic risk reduction during the course of the Iran Earthquake Risk Mitigation Program.

policy through revised legislation, and creating internal mechanisms to change existing engineering practices.

A High Council on Risk Reduction was created in the Ministry of Planning and Management to supervise the implementation of the new programme. It concentrated on preparing the proper frameworks, budgeting, coordinating, and taking necessary decisions to ensure that the objectives were achieved.

The following are some of the actions pursued through the IERMP in policy areas:

- Shifting attention from responding to earthquake damage to introducing means that reduce the risk of damage to vulnerable structures and lifelines before earthquakes occur.
- Establishing a special government fund to strengthen important public buildings, including schools and hospitals, public infrastructure and lifeline facilities.
- Providing financial incentives for private and commercial sectors interested in upgrading their existing structures.
- Encouraging more industrialization in the construction field so as to ensure better quality control.

The following are some of the actions pursued through the IERMP in technical matters:

- Translating scientific knowledge into a usable format, using practical knowledge to promote risk reduction.
- Developing guidelines for conducting vulnerability assessments.
- Establishing detailed technical databases to document the necessary requirements to strengthen public buildings, setting priorities to do so, based on available resources.
- Determining the most appropriate and cost-effective means of strengthening different types of masonry, concrete and steel buildings.
- Promoting the use and enforcement of codes, quality control and inspection for all types of construction.

The following are some of the actions pursued through the IERMP to increase public understanding:

- Increasing public awareness and motivation using an earthquake information system.
- Motivating the participation of the public in prevention and mitigation activities.
- Promoting the use of do-it-yourself construction techniques suited for simple dwellings in rural areas.

Case: Kazakhstan

Kazakhstan often experiences earthquakes, floods, landslides and coastal floods. Only recently has the importance of natural disaster reduction been recognized officially. In May 2000, Kazakhstan's Emergency Situation Agency published the Plan of Preparedness of Kazakhstan for Natural Disasters with the cooperation of the Kazakhstan Red Cross and UNDP.

The plan cites the considerable financial losses incurred by the country because of disasters and urges all organizations to take proper action to reduce their negative impact on the country's development. The report provides guidance on preparedness activities for disaster reduction, response scenarios for disasters, legislation, and implementation of measures to reduce risk.

The last earthquake to devastate Kazakhstan took place in 1911, less than 30 kilometres south of Almaty. The memory of this event has faded from the country's collective consciousness. Recognizing that the Armenian earthquake of 1988 occurred along seismic faults that had shown little movement for over 3,000 years, the Emergency Situation Agency has worked to increase public awareness about earthquake risks.

This activity is deemed to be crucial as most apartment blocks in Kazakhstan are similar to those that collapsed in the Armenian earthquake and in the Sakhalin earthquake of 1995. Even though the government's Institute of Seismology has been working since 1976 to monitor seismic movement, the institute also undertakes risk assessments, evacuation scenarios, and the analysis of ground conditions as part of its research activities.

The country also faces other risks. Due to the rising water levels of the Caspian Sea over the past 20 years, the Kazakh shoreline has grown by 20-40 kilometres and water has encroached about 70 kilometres inland. The national Water Resource Committee has reported that total costs for preventing losses from these increasing water levels will exceed US$ 3-5 billion.

The northern slope of the Tengshan range near Almaty is exposed to floods, mud and debris flows, avalanches and landslides. In particular, landslides threaten areas where more than 150,000 people live. In May 2002, southern parts of Kazakhstan were affected by storms and heavy rainfall that caused serious flooding in cities.

Although disaster awareness issues are being raised in scientific and official circles, there is still a lack of general public awareness. The Emergency Situation Agency has prepared many brochures, pamphlets and videos to expand awareness of these hazards, and the public seems to be responsive.

A newspaper advertisement for a new apartment building referred to the structure as being seismic-resistant, a comment that evoked noticeable interest. On the other hand, people have not yet understood that investment in disaster reduction is a sound long-term investment.

Case: Romania

With its geographical diversity, Romania has many natural hazards, such as earthquakes, landslides, floods and weather extremes, especially in the Carpathian Mountains. The floods of 2002 seriously affected more than half of the country's territory. Technological hazards also are frequent, as demonstrated by the cyanide pollution of the rivers Somes, Tisa and Danube in January 2000, or the pollution two months later in the Vaser and Tisa rivers.

Each of these incidents has underlined the fact that an entire range of social and human factors influence the occurrence, nature and severity of natural hazards. Because of this, more attention is being given to assessing unacceptable stress exerted on the environment through deforestation, improper land use and the unsuitable location of industrial activities.

The focal point for disaster management in Romania is the Civil Protection Command within the Ministry of Interior. Several plans relevant to disaster reduction exist within civil protection arrangements. These include the operational plans and regulations for defence in the event of floods, severe weather and accidents of a hydrotechnical nature in the context of hydrographical basins, hydrotechnical works or within local communities.

While two dated laws and several governmental decisions define the Romania national policy for risk reduction and seismic resistance, current actions are framed by a government ordinance that provides measures for the mitigation of the seismic risk on existing buildings. There is also a planning framework to reduce, or where possible to prevent seismic effects and landslides.

A government committee for disaster defence is led by the prime minister, and an operational centre for the notification, warning and intervention is part of the Civil Protection Command structure. Notification and warning procedures are established by the disaster defence regulations and are implemented by the central and local public administration. In addition, nine central committees strive to apply the various policies for different types of hazards, and related technical secretariats also form part of the system.

In recognizing the threat posed by technological hazards on the environment, the Romanian National Committee for Global Environmental Change and the Ministry of Waters and Environmental Protection conducted a workshop on the subject in 2002. Particular attention was given to the long-term impacts of mining in the Somes and Tisa river basins, with the intention to develop environmental protection and management strategies. The meeting discussed risk factors associated with floods and drought but also considered the rehabilitation of waterways with a view to striking a balance between sustainable economic development and environment protection.

Case: Algeria

In November 2001, unusually heavy rain fell in the Algerian capital, Algiers. Flash floods and mudslides swept through many parts of the city, killing more than 800 people. At the time it was suggested that disaster management structures and the population were woefully unprepared for such an event.

It turned out that some common public practices and unsuited official policies with regard to human settlements may have contributed to the severity of the disaster. Due to the scope of the disaster and its location in the centre of the capital, all levels of government were seriously shaken. Senior officials experienced, first hand, the lack of coordination of the various parties concerned with emergency response, as well as having to accept their own failure of foresight.

Since this disaster, there has been a new way of thinking about disaster management in Algeria, particularly in urban areas. This has been demonstrated through several initiatives that started only months after the disaster. For the first time ever, the head of state ordered all the ministries to consider risk factors in their work and to include disaster risk reduction measures in their programmes.

The prime minister also discussed the matter during the council of the government, and called for a permanent coordinating structure of all the actors involved in disaster management. The Ministry of Interior is developing a permanent structure which will coordinate all phases of disaster management including risk reduction measures, response and rehabilitation.

The General Directorate of Civil Protection is shifting its attention towards prevention activities. Senior party officials are soliciting expert advice from scientific and technical advisors in preparing their programmes.

Since the floods, international organizations have joined forces to help in risk reduction projects. The mayor of Paris paid a visit to the affected areas and signed a memorandum of cooperation between the Wilaya (province) of Algiers and the Atelier Parisien d'Urbanisme for a programme to promote better urban planning in Algiers. Early in 2002, another French organization, Architecture-Urgence, signed a convention for cooperation with the Wilaya of Algiers to work together on urban planning to reduce disasters.

The UN office in Algiers is also working on disaster reduction and engaged an Italian specialist to discuss the matter with Algerian authorities. UN-HABITAT proposed a cooperation project in disaster reduction with the Algerian government. A World Bank delegation has also visited Algeria to discuss a long-term project in disaster risk management.

An expert in urban planning from USAID visited Algiers less than a month after the disaster to discuss eventual cooperation in disaster reduction in urban areas with many Algerian institutions. USAID expressed an interest in preparing a project proposal for that purpose.

Within the first six months after the disaster, several seminars or conferences related to disaster reduction were either held or being planned. An Algerian-French colloquium on sustainable development and disaster reduction took place in Algiers only weeks after the disaster. Similar colloquiums were planned for other regions of the country. All of these actions demonstrate that Algerian authorities at all levels have become more aware about the risks they face.

Some important limitations in institutional and policy frameworks

Administrative arrangements and legislation only provide a basic framework for disaster risk reduction. Despite the implementation of policies, acts and regulations by official departments, they do not alone reduce the vulnerabilities of people exposed to the risk of natural hazards.

Challenges remain to provide a wider understanding of the risks, and the coordination of multidisciplinary efforts needed to manage them at national, provincial, district or even municipal and village levels. Crucially, members of the public also have to become involved themselves, in their own interest.

In terms of policies, many countries assuredly advise that they have prepared various emergency contingency plans, while some do not have any national disaster risk management strategy at all. In others, disaster management is still conducted on an ad hoc basis, sometimes even overriding existing contingency procedures at the time of crisis "because of the seriousness of the situation", too often voiced from political corners.

In some countries, disaster and risk management information has been classified or restricted as a matter of public security. Even when information may be accessible generally, it still may not pass easily from one group of people to another. There are few standard criteria by which to document the consequences of disasters, and even fewer means to record or monitor progress towards reducing risk factors.

Competitive interest or different priorities can easily characterize the work of various ministries. Specialized and sometimes isolated departments maintain a persistent emphasis on emergency response capabilities.

Senior positions of authority in matters of risk reduction, in contrast to emergency assistance, are frequently occupied by career administrators who may or may not have any professional expertise in risk management. Frequent inter-agency transfers of civil service officials further impede opportunities for national organizations to develop institutional memories, resulting in the loss of valuable experience.

In recent years, national building codes have been drafted in some countries for the first time. Yet, there and in other countries with long-standing codes, compliance and enforcement may remain problematic. Thousands of buildings are constructed annually in known seismic or flood-prone areas without incorporating any established appropriate resistance techniques. Population pressures or economic necessities, too easily transformed into contentious local political issues, can impede the consistent application of flood or landslide protection zoning.

Incidence of corruption or the lack of enforcement of existing policies and regulations are more evident than officially acknowledged, even though such administrative laxity has an important bearing on the effectiveness of any risk reduction programme. It is only when legislation can place legal responsibility on specific officials whose decisions or lack of effective action perpetuate continuing conditions of vulnerability that risk reduction will be measured meaningfully.

A lack of uniformity in policy approaches regarding the various aspects of disaster and risk management among adjacent countries also poses additional hindrance for improving regional or sub-regional cooperation. This represents a serious and growing impediment as many natural hazards affect more than one country, or involve the skills and technical abilities of many professions which not all countries may possess. This underlines the

challenges posed when decisions taken in one location can easily impact the scale of consequences in neighbouring countries.

In many countries, more informed and considered efforts are required to bring various professional specialists and civil authorities together, other than through occasional international meetings, if a coherent disaster risk management strategy with local public relevance is to be realized in practice.

Means for overcoming limitations

A useful summary of disaster risk management functions that can be structured within a national policy framework was presented in the Pacific regional report prepared for the ISDR Secretariat. It quotes the work of Te'o I.J. Fairbairn (UN DHA-SPO, 1997) as it illustrates the key issues involved when trying to assimilate disaster reduction into accepted government policy. The actions cited were originally drawn with specific reference to island state requirements, but as they are presented with a conceptual clarity they derived may prove useful for other states as well.

The following paragraphs are taken from Fairbairn's material cited in the Pacific regional report. Supplemental listed information that has been added by the editors of this publication appears in square brackets.

There must be a commitment to implementation of particular measures of risk reduction measures incorporated within the ongoing practices of national economic planning and development.

Certainly a major requirement, if not even the primary one, is to promote a clearer understanding among policy makers – and the general public – of the often severe and potentially far-reaching economic consequences of natural disasters. It is crucial that policymakers in particular comprehend how such events seriously can undermine longer-term growth prospects and threaten the social dimensions of individuals' well-being. Failure to appreciate these consequences can exact eventual or irreparable political costs.

A second crucial prerequisite is to ensure that disaster management issues are integrated within the overall national development planning framework. Such an embodiment of risk awareness and evaluation can ensure that those issues are applied across sectoral, ministerial, and jurisdictional lines of interest or responsibility, are multidisciplinary in nature, and are properly included in the design of major development projects. Taken together, the interaction of multiple commitments can also contribute to risk reduction becoming a non-partisan issue, with its constituencies transcending any short-term political interests or the lifespan of individual governments.

Other major requirements for enhancing a country's commitment to disaster mitigation capabilities include the following mechanisms:

- Strengthen the institutional and organizational frameworks at both national and community levels for managing and coordinating disaster-related issues.
- [Strengthen national institutions by increasing their exposure to, and collaboration with, relevant regional and international entities].
- Adopt appropriate procedures for monitoring and evaluating disaster events, especially in relation to analysing their social and economic [and environmental] consequences over time.
- [Adopt appropriate procedures for monitoring and evaluating the consequences of developmental choices on disaster impacts].
- Increase available information and facilitate database access about the social and economic [and environmental] aspects of natural disasters, as a potentially valuable tool for planning and management purposes.
- Promote greater uniformity in the methodology and techniques used to assess both the direct and longer-termed economic [and environmental] costs of disasters to countries throughout the region.
- Develop comprehensive and integrated land use and water management strategies capable of alleviating flooding, promoting water conservation and environmentally sound land-use practices.

- Diversify agriculture through such practices as planting hardy crop varieties, early maturing crops, and encouraging the continued cultivation of various traditional root crops.
- Encourage the [identification and] use of traditional mitigation and coping practices as means for achieving greater community self-reliance in dealing with disasters.
- Facilitate the post-disaster recovery of the private commercial sector through measures that provide tax and related financial incentives.
- Establish effective mechanisms for enlisting the joint support of external donors to strengthen national disaster reduction capacities, in addition to assisting with post-disaster relief and rehabilitation needs.

Future challenges and priorities

National institutional frameworks: policy, legislation and organizational development

Comprehensive approaches to building coherent institutional frameworks at national and other levels of responsibility are essential if one is to speak of a sustained commitment to disaster risk reduction. This includes the need for collaboration among different sectors of society, and particularly the engagement of a wide circle of people with skills and attributes ranging from educational practices to many forms of technical expertise.

While governments need to direct and support these efforts, the vitality and effectiveness of the organizational frameworks and operational capabilities remain based on the understanding and motivation of public interests.

Acceptance of the necessity of risk management, coupled with coordination and backed by resources, are the hallmarks of institutionalized capabilities. Following are some primary criteria to accomplish these goals:

- Government authorities must understand the distinctiveness of disaster risk management and the value of investing in risk reduction to protect the well-being and the assets of society.
- It is essential that resources be allocated based on collective judgment. Understanding the relative costs and benefits of anticipatory protection must be emphasized in contrast to sustaining much greater avoidable losses.
- The primary challenge is to begin by assessing national capacities at all levels of interest. While this can be done by using self-determined criteria, abundant expert guidance and specialist knowledge is available throughout the world.
- Communities need to assess variations in the intensity and the extent of hazards, evaluate local priorities and determine the relative degrees of risk involved. This in turn will determine the requirements for sound institutional frameworks.
- Examples cited display the importance of transcending the theoretical expression of policy frameworks and legal instruments and realizing their effects, in practice.
- National authorities and local leaders need to embrace policies that

    - are realistic for the case at hand;
    - are linked to regulatory mechanisms that are enforced or effect change;
    - have an obvious benefit understood by local communities;
    - have obvious political advantages for the politically influential;
    - have economic advantages for the private and commercial sectors; and
    - can be implemented with available resources.

The extent to which disaster risk reduction is identified as integral to fundamental political responsibility can encourage greater sustained commitment in support of long-term national development objectives. It is essential that policy direction and operational capabilities be developed in multiple areas of governance and civil society if a culture of prevention is to be cultivated and extended to future generations.

3.2 Local authorities

As disaster risk management strategies are being pursued in more countries, the primary emphasis is often given to national initiatives and organizational structures focused around the authorities and activities of national agencies. Less seldom does one see an initial recognition of the importance of targeting the vulnerabilities, needs and opportunities presented by cities of all sizes and their local authorities. Similarly, fewer resources are committed at local levels of responsibility to routine hazard identification or to support sustained community-based risk management strategies, despite some evident advantages in seeking to do so.

Because of the great influence that local authorities exert on all societies, this section will provide a review of experience pertinent to their particular needs and interests related to disaster risk management at local levels of responsibility. The following aspects will be addressed, noting especially the continuing rapid growth of all types of local areas throughout the world, and the numerous conditions of vulnerability and opportunities which they represent.

- *importance of disaster risk reduction at local levels;*
- *growing relevance of disaster risk reduction for local areas;*
- *opportunities for protecting local areas and environments;*
- *varieties of experience; and*
- *supporting initiatives for local authorities in disaster risk reduction.*

Importance of disaster risk reduction at local levels

As residents of the local communities in which they serve, local authorities are themselves well placed to be conversant with both the disaster risks experienced, as well as the resources and opportunities available to identify and manage those risks. Many times a local environment can provide a more concise or focused environment that enables a concentration on primary concerns which can be more challenging than the much wider variations or multiple hazards evident on a national scale.

Local governments tend to enable a concerted effort of a dynamic mayor or an involved local council to motivate associated interests among the local business, educational and professional interests. There is also an opportunity for the more direct allocation of available resources, for obvious local benefit. Public awareness programmes can be more precisely targeted to the concerns and needs of the inhabitants, emphasizing the more locally familiar conditions or past events that relate to individual experience within the community.

As these factors can increase effective motivation for assessing local disaster risks or the engagement of professional and material resources to manage them, disaster risk reduction needs to be encouraged and supported at local levels. Such an emphasis should become increasingly important as more people move into cities, urban vulnerabilities intensify, and public attention is driven by economics of an ever more urbanized world.

Local authorities of all sizes regularly have offices and budgets dedicated to responding to crisis situations and assisting to meet the urgent needs of residents following a disaster. By contrast, very few local authorities in the world presently have a designated office to monitor potential risks and to motivate public and private efforts to manage risks before they result in major disasters.

As the decision-making authority and many resources are often concentrated in or otherwise determined by national policies, it can be difficult to systematically forecast, monitor or assess disaster risks in specific areas. With the competing priorities of multiple national agendas, often challenged by strong competition for limited

external or federal resources, local officials can defer decisions and responsibility about disaster risks to the central authorities if there is not strong local support to address more immediate concerns. As a result, local government action regarding disaster risk management can often be ineffective, or content in the limited assurances of emergency services that can be deployed only in response to an emergency crisis.

While there is no standard set of practices or a uniform methodology to address disaster risk management in all cities and local areas, there are measures being employed in a variety of settings that can demonstrate the benefits from a sustained commitment to disaster risk reduction. These include activities related to vulnerability and risk analysis, building local institutional knowledge and capabilities, increasing public awareness and participation, and protecting critical public infrastructure. These commitments can be summarized by integrating disaster risk management into daily local government actions, supported by dedicated financial and human resources.

Growing relevance of disaster risk reduction for local areas

Urban vulnerability is one of the most underestimated issues in urban development. By 2050, the world population is expected to grow by three billion people. Almost all of this growth will take place in developing countries, and particularly within their cities and towns.

By more than doubling the urban population, large numbers of people will be concentrated in mega-cities and their increasingly fragile landscape, with huge impacts on the natural resources surrounding them. There are currently almost 450 cities worldwide with a population of more than one million inhabitants. Of these, 50 cities have a population greater than 3.5 million, and 25 urban areas have more than eight million inhabitants.

The stresses and strains of rapid urbanization are nowhere more apparent than in the local areas in developing countries. Collectively, they will have to accommodate 150,000 new arrivals daily. This figure is expected to rise to 180,000 people by 2010. Expressed in more dramatic terms, more than one million new inhabitants will be added to local areas every week.

This human inflow into local areas needs to be set against the continuing deterioration of conditions of shelter and the difficulties of providing basic social services in expanding human settlements in urban areas. Resulting population densities also place many more people at risk to any hazards that may routinely impact the area. In addition, developmental analyses regularly document the fact that poverty in urban areas is rising and that the number of poor people in urban areas in some countries is now increasing at a faster rate than in rural areas.

Urban infrastructure is itself vulnerable to natural hazards. People in urban areas are more dependent on increasingly sophisticated but also often poorly maintained infrastructure. These conditions can threaten the supply of water and adequate sanitation, or place electricity grids at risk. Physical conditions within cities tend to further intensify the effects of hazards emanating from natural phenomena. The amount of concrete and built-up structures in cities radiate large amounts of heat making them localized heat islands, or otherwise contribute to intense water run-off, with disastrous effects. Urban generated pollutants in the atmosphere contribute to high levels of harmful ozone, smog, and conditions that can contribute to increased thunderstorms.

Risk-accumulation processes in urban centres, such as ever-increasing numbers of people at risk from floods or accidental fires, are not so much inherent to urban development as produced by complex and dynamic interactions between human and naturally induced hazards and extreme conditions of vulnerability. The vulnerability of urban populations is not natural, but is constructed and amplified by economic, social and political systems. It is only compounded as more people are packed ever more densely into areas already exposed to natural hazards because of their geographic location.

Some sobering statistics further underscore the physical exposure and potential financial costs of disaster risks faced by urban and local areas in the developing world. Almost half of the world's largest cities are situated along major earthquake

faults or are exposed to tropical cyclone tracks. On average, the number of disaster victims in developing countries is 150 times higher than among industrialized or richer countries. The corresponding economic losses are 20 times greater, when expressed as a percentage of their gross national products.

Throughout the world, cities represent the centres of authority, power and wealth for states. They also include the greater concentrations of resources, assets, and are often the basis of national economies. For these reasons, one may consider that the protection of critical assets and essential infrastructure should have a particularly high priority. In the case of the United Kingdom, the Thames Barrier protects the city of London with its pre-eminent economic and political importance to the nation from a 500-year flood, whereas all other towns and cities exposed to coastal floods in the country are only protected from a 100-year flood.

Recurring disasters can erode the social and economic accomplishments in all countries, and even more severely set back national development in those countries striving to overcome conditions of poverty. With the growth and importance of cities and local areas as the basis of national and local economies in developing and industrialized countries alike, the reduction of vulnerability to disasters in metropolitan areas is one of the critical challenges facing development. Integrating disaster reduction in development is an essential part of making cities and communities sustainable.

Opportunities for protecting local areas and environments

While shifts in policy regarding disaster risk management are most frequently expressed in terms of national attention and development agendas, useful practices are universally acknowledged as being measured in terms of local effectiveness. The specific conditions that exist within local authorities' realm of responsibilities invite more opportunities for local involvement if there is an explicit programme to address risk issues.

Experience and modern risk management practice recognize the importance of a strong and well-structured local disaster risk management capacity. Failing such prior developments, it is often only at the time of a crisis that local governments are confronted with the responsibility of acting. It is precisely at the time of greatest need that many local authorities find that they have neither the means nor adequate legislative authority to mobilize necessary resources.

However, in a growing number of countries, the introduction of a specific disaster risk reduction programme has been able to provide an umbrella for local authorities to work in a coordinated fashion, often at first informally and then with a more structured approach that relate to risk management. This can provide an institutional and information basis to coordinate various interests, including those represented by local departments of transportation, education, health, public utilities and electricity.

Additionally, more local authorities are recognizing that greater focus can be maintained and a more manageable scale of coordinated efforts is possible in addressing risk factors at a local level. One may also consider that there can be more opportunities to apply local knowledge and resources that may be more easily tapped through already existing professional, public and official contacts within a community where professionals and officials both live and work themselves.

Municipal authorities are well placed to reduce the human and financial costs of disasters by establishing a competent disaster management plan. Today, technology and know-how can empower urban decision makers to develop and implement actions to reduce the human and economic losses from hazardous

"One cannot underestimate the value of being a part of something bigger, which is good in and of itself. Most people are pretty good at what they do – or want to be. Many times those people who do not act, often do not know how to do so, but they respond willingly when shown how they can."

Jim Mullen, Office of Emergency Management, Seattle

events and also speed up recovery and install less vulnerable conditions particularly following disasters. Such an approach can preserve the local area's resources for improved public services and much needed economic development.

However, implementation of such plans also relies on central governments establishing a national strategy that enables decentralized decision-making, providing resources for local planning, assessment and intervention. There is a need to promote the development of strong expressions of political will at local levels of interest to institutionalize knowledge and mobilize resources. To ensure success, all of these efforts should be based on cooperative arrangements, extended partnerships and broad local community input.

Varieties of experience

Conducting a systematic risk assessment strategy is an effective vehicle to advocate greater awareness of disaster risk reduction across different segments of the population. It is, of course, crucial to have capable emergency services in place, but this cannot be allowed to substitute for more sustained and multidisciplinary abilities required to pursue other commitments to risk assessment, monitoring and risk management on a continuous basis.

Case: South America

Often it takes an individual champion of the subject drawn from either influential political or professional motivations to provide the spark to interest and then motivate a community. More often, the severe consequences of a disaster that has shaken a community awakens the public to support efforts to embark on a strategy of risk management guided by local leadership.

In Colombia, the National Council for Social and Economic Policy has designed a strategy for the short- and medium-term implementation of the national disaster prevention and management plan. One of the strategy's accomplishments can be seen in the city of Manizales. There, a local environmental action plan has been established through public dialogue and widespread consultation among the community, local officials and the technical agencies concerned. The plan is integrated into the local area's development plan and budget, and includes specific measures to reduce the risk of landslides. While it seeks to relocate the population living on steep slopes, the programme is also linked to the development of ecological parks. Some of the parks are located on slopes too dangerous for settlements, but others have been integrated into the city's watershed thereby protecting important economic functions.

In Bolivia too, a comprehensive national policy for prevention and risk management was established in 2002. Among other applications, the identification and management of risk has been introduced through guidelines for adapting local development plans. Intended to be implemented in 30 pilot local areas, these guidelines will contribute to ensuring that local plans for risk reduction will become consistent with national policy. Manuals are being prepared to guide the design of local plans for risk reduction in relation to town and country planning, human settlements and environmental management.

Case: New Zealand

Following the devastation caused by the 1994 earthquake in Northridge, California in the United States, the Wellington City Council in New Zealand began a series of local and international consultations on updating both the extent and methods for an improved approach to managing the city's own exposure to seismic risks. Led by the mayor and supported by the city's business community, the extended consultation worked closely with the fire service and reached out to many different professional and commercial interests not previously involved in the traditional measures of emergency management.

The city authorities first shifted the focus of shared community interests to reducing Wellington's exposure to a variety of possible urban risks, considering the growth and economic foundations of the city. A consensus emerged quickly that the prevailing disaster management regime focused almost exclusively on emergency response and short-term preparedness measures.

A functional analysis of existing practices showed that emergency managers were ill placed to contribute to important and more far-reaching policy decisions regarding comprehensive disaster risk management programmes. There was a noticeable lack of connection between operational abilities for one type of activity – the provision of emergency services – and the understanding necessary for planning and implementing another – ensuring advance protection for critical economic and social assets of a growing capital city. The approach proved so successful, that it was later expanded, with some revisions for national federal authorities, to wider national application.

Following these recommendations, the city of Wellington and later the government of New Zealand embarked on the revision and implementation of legislative reforms in disaster risk management. With the motivation to encompass an all-hazards approach to risk and to appeal to all segments of society, the following accomplishments have been achieved over recent years:

- broadened responsibilities for local authority emergency managers, with increased roles in training and developing community capacities for risk identification, vulnerability reduction and disaster resilience;
- decentralized emergency management groups, with membership including neighbouring local authorities, emergency services and utility companies in order to ensure that while the national emergency management strategy is focused at the local level, there is improved coordination of human and technical resources across the country; and
- a comprehensive risk management strategy was adopted that integrates disaster management into environmental and community management practices at national and local levels.

Elsewhere in New Zealand, the Auckland Local Authority Hazard Liaison Group was established subsequently by the Auckland Regional Council to enhance communications among local authorities on hazard management issues and to facilitate intra-council communication. It was composed mainly of planners and policy analysts drawn from the city, district and regional councils "to recognize the link between hazard mitigation and land-use planning and the related need to develop tools to manage risk and improve communications among those people working in sustainable development and environmental management".

Case: Cologne, Germany

With its 969,000 inhabitants, Cologne, Germany, is Europe's most flood-prone city. Increasingly frequent floods put major parts of the historic city as well as its large industrial area at risk. A flood in December 1993 caused about US$ 75 million in damages, in striking the largely unprepared community. Improvements in flood protection and related risk management measures led to significantly reduced damages of about US$ 32 million in a flood of similar magnitude two years later.

While emergency protection measures had to be deployed at a cost of about US$ 3 million, it nevertheless became clear that the city averted a disaster. A crest of only a few centimetres more in 1995 would have inundated the historic city centre necessitating the evacuation of 100,000 inhabitants. Large factories, several chemical industry refineries, and the Cologne exposition facilities barely escaped major damage that would have involved large losses. The sewer network as well as the underground railway system would have led water to distant areas with ground elevation below the Rhine River.

The proximity of the two events, and the recognition that better protection was possible led to a significant change in the public's outlook. The Cologne municipality developed a comprehensive flood protection scheme, and then adopted it unanimously for introduction in 1996.

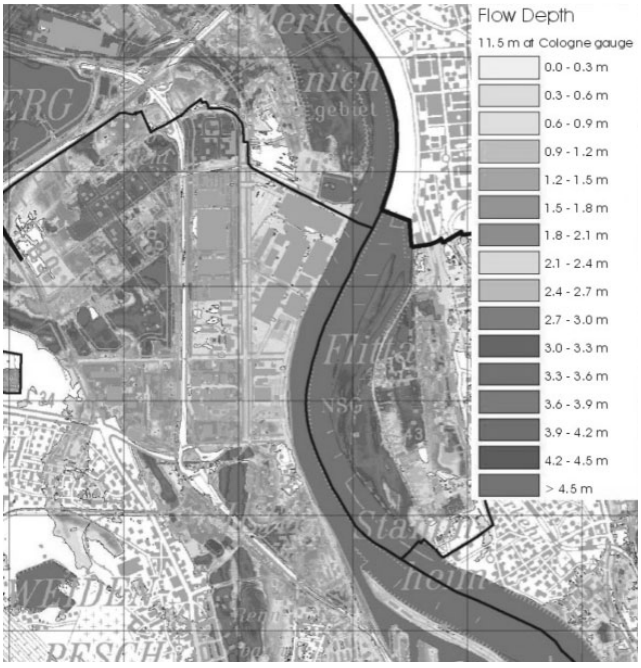
The strategy emphasized the equal importance of water retention, reduction of potential material damages and better preparedness of the residents. Water retention was improved by using ecologically-based technical measures like reconstructing embankments in the hinterland, reshaping smaller waterways in a natural way, and unsealing land areas to allow for increased percolation of groundwater.

The best use for the flood plain was considered, as well as reconstructing river embankments. In the

city vicinity, 28 kilometres of embankments were newly constructed with 27 kilometres more rebuilt. The sewer network was protected by numerous construction measures positioned at various outlets and at locations to control the runoff from wastewater treatment plants.

The uses of information played a crucial role too. Documentation about the earlier responses to the floods was recognized as an information management system that could transfer knowledge and practical experience between different generations of disaster managers and the general public, alike.

Flood map for a catastrophe scenario



An inexpensive and effective measure for raising awareness throughout the population turned out to be the distribution of leaflets at the beginning of the annual period of possible flooding. Posters that informed about precautionary measures, the location of information centres and various media outlets were added in the areas of greater risk.

The use of radio and television was particular successful in 1995 in aiding the emergency management activities. Individual citizen's flood-protection initiatives further supported precautionary efforts and worked in association with emergency management and flood control authorities.

Notably, by relating flood forecasting and response measures to an electronically distributed emergency plan, further improvements were made in preparedness and response measures. This improved the timely reaction capabilities and remedied previous deficiencies in communication.

Terminals were placed in all organizations concerned with emergency management, and they were all linked online to a central database. Both real time and cumulative information were available to provide information about successful efforts as well as failed or problematic approaches to specific problems. Information related to data for forecasting water levels, as well as citing specific actions to be taken by previously indicated authorities when certain thresholds were reached. These actions were then codified into a series of emergency procedures.

The integration of GIS into the current flood-risk management system is expected to provide a new generation of disaster mitigation tools for urban areas. The Cologne municipality already completed flood maps (see map).

There is further possibility for the use of dynamic maps that could show the location of various protection measures and their effects, such as identifying individual gate valves to be closed and the resulting effects if the action were to fail. Such maps can be very useful to anticipate elapsed times before maximum water levels are reached. However, like other technical options, further evaluation remains necessary to determine if the intended benefits from dynamic maps would warrant the cost of producing and maintaining them at the required levels of accuracy.

While the Cologne municipal flood management system continues to evolve, the following beneficial effects have been widely accepted:

- acceleration of executing protection measures;
- increased information about the interdependence of protective measures;
- enhanced emergency management supervision;
- improved visualization of risk consequences;
- introduction of effective reporting;
- methodical description and maintenance of responsibilities;
- provision of evaluation opportunities for officials concerned;

- centralized and cumulative data storage;
- standardized forecast procedures; and
- effective transfer of knowledge and experience between generations of disaster managers, and the general public.

Many times local areas have difficulties in accessing funds for risk management activities as central budgetary allocations are rigidly designated for either establishment costs or development funds. Emergency funds are often restricted to immediate rescue and relief works following a crisis event. When developmental funds are designated for risk mitigation activities, donors typically negotiate programmes with, or related to, national government authorities.

These conventions that shape international technical assistance programmes can leave local areas at a disadvantage, regardless of either their expressed interests or demonstrated commitment to risk management. It is an important step to establishing a sustained commitment to disaster risk management in practice if means can be found to reach out to local governments. Measures that enable local authorities to building local capabilities, to acquire more knowledge and resources, or to provide legislated authority to implement disaster risk management policies locally are policy investments.

Case: South Africa

Experience has shown that activities relating to disaster management cannot function separately from broader governmental responsibilities. Isolated or disjointed planning of functions associated with different aspects of disaster and risk management by numerous government institutions leads to duplication and the waste of valuable public resources. In an effort to ensure the best allocation of resources, the South African government embarked on an integrated planning strategy. By working through an integrated development planning framework, all activities relating to disaster and risk management now must be incorporated into the established responsibilities of the various line functions and sectors of state activity.

Integrated development planning is a process by which municipalities prepare a five-year strategic development plan that is reviewed annually in consultation with communities and stakeholders. The resulting "integrated development plan" (IDP) is a principal strategic planning mechanism which guides and informs all planning, budgeting, management and decision-making within a municipality, whether rural or urban. The plan promotes the integration of disaster and risk management considerations by balancing social, economic and ecological pillars of sustainability without compromising the capacity of the institution to implement its basic responsibilities. The IDP also aims to coordinate actions across the various subject sectors and operational spheres of government.

The Municipal Systems Act 32 of 2000 requires all municipalities (metropolitan, district and local governing authorities) to undertake an integrated development planning process to produce currently relevant IDPs. As a legislated requirement, IDPs have a legal status and they supersede all other plans that guide development at local government levels of responsibility. Accordingly, every newly elected local municipal council has to prepare its own IDP which will guide it for the five years they are in office. The new council has the option either to adopt the IDP currently in force if deemed appropriate, or alternatively to develop a new one taking account of already existing documentation.

Integrated development planning strives to be an interactive and participatory process which requires the involvement of many stakeholders. Because of its widespread participation, a municipality typically requires from six to nine months to complete an IDP. Crucially the timing to adopt an IDP is related closely to the municipal budgeting cycle so that both resources commitments and planned activities are compatible. The IDP also is reviewed annually with the possibility of amendment should it prove necessary.

The IDP has several core components that function as different phases in its development:

- The analysis phase involves an assessment of the existing levels of development, including the identification of communities without access to basic services.

Table 3.6
Disaster and risk management considerations and the development planning process (South Africa)

Integrated Development Plan		Disaster and Risk Management Integration
Phase 1: Analysis Compilation and reconciliation of the following information: Existing information related to development (what is available?) Community and stakeholder analysis (who should be involved?) Municipality level analysis Spatial Gender Environment Economic Institutional The analysis should identify and involve in-depth study of priority issues.	↔	**Phase 1: Analysis** Compile disaster management information: Hazard assessment (which hazards are prevalent?) Vulnerability assessment - the extent to which the municipality and inhabitants are vulnerable in terms of: Social / cultural environment Economic environment Political environment Natural / ecological environment Physical environment Capacity assessment (what exists to cope with the effects of hazards?) Livelihoods analysis Capacity analysis Resilience analysis Critical facility analysis Historical disaster occurrences (which disasters have occurred in the past?) Historical loss parameters (magnitude of disasters and their effects) Communities-at-risk (who is at risk of hazards?) The analysis is specific to the line functions of government e.g. the department of health links this analysis to its own disaster risk reduction priorities.
Phase 2: Strategy Vision of the municipality Objectives of each priority issue (as per Phase 1) Localised strategic guidelines: Spatial Poverty Gender Environmental Economic Institutional Develop strategies for each priority issue Identify projects in order to implement the above strategies	↔	**Phase 2: Strategy** Formulate disaster and risk management strategies: Prevention and mitigation strategies Vulnerability reduction strategies Capacity-building Contingency plans Emergency preparedness Implement disaster and risk management in the municipality – identify projects: Setting up structures Community awareness Volunteer structures It is essential that strategies be integrated into identified projects in the parallel IDP process, e.g. the department of works may identify an infrastructure project to supply water to a community that can then reduce vulnerability to epidemics and drought. Projects identified by other line functions in the municipality also need to be assessed for any disaster risk they may impose.
Phase 3: Projects Design development projects: According to the projects identified and minimum specifications set by government.	↔	**Phase 3: Projects** Design disaster management projects: According to the disaster management projects identified, e.g. establish district disaster management centre or conducting a livelihoods analysis. Includes all disaster management related activities for ALL other projects undertaken. All project plans MUST be assessed according to the disaster risks they may pose

Integrated Development Plan		Disaster and Risk Management Integration
Phase 4: Integration Compilation of integrated plans and programmes: Sector programmes (e.g. water, housing, health etc.) Five year financial plan Five year capital investment programmes Five year action programme Integrated spatial development framework Integrated local economic development programme Integrated environment programme Integrated poverty alleviation programme Institutional plan Integrated HIV/AIDS programme Development and performance management indicators Disaster Management Plan	↔	**Phase 4: Integration** Compile Disaster Management Plan, includes: Risk profile of municipality (primary hazards and prevalent vulnerability) Risk reduction strategy Disaster response strategy Field operation guides Standard operating procedures Emergency preparedness Disaster management information system GIS (linked with spatial development framework) Electronic databases (link with other sectors) Communications Provide input to other relevant plans: Financial implications of the Disaster Management Plan Roles, responsibilities and actions that need to be taken as part of disaster management Spatial indication of areas / communities at-risk Institutional implications e.g. to address capacities to prevent disasters, or establishment of disaster management centres Management performance indicators
Phase 5: Approval Adoption of IDP including Disaster Management Plan, and submission to various bodies designated in the Municipal Systems Act 32 of 2000.	↔	**Phase 5: Approval** Adoption of the Disaster Management Plan, and submission to various bodies designated in the Disaster Management Act 57 of South Africa (2002)

- The strategic development phase provides a municipality the opportunities to formulate critical elements of its emerging development strategies, such as:
  - The municipality's vision, including internal transformation needs.
  - The council's developmental priorities and objectives.
  - The council's development strategies.
- The project identification phase enables a coherent set of project activities to be planned and scheduled according to the various dimensions of the development strategies and the respective risk factors which might be involved. The projects can take a variety of forms depending on the relative priorities of such areas as infrastructure development, local economic enhancement, establishment or revision of key governmental institutional capacities, improvements in service delivery, expanded public information and awareness, training capabilities, etc.
- The integration phase aims to ensure that all the projects identified are synthesized into a coherent set of concepts and realistic implementation processes, while taking account too of the wisest use of limited resources available to the municipality. The following supplementary plans and tools assist in this integration:
  - a spatial development framework;
  - disaster management plan;
  - integrated financial plan for both capital and operational budgets;
  - key performance indicators and targets; and
  - linkages with other integrated programmes.

- The approval phase follows all planning and integration, and occurs as the municipal council adopts all the plans and projects associated with the IDP. This constitutes a final political authorization and the council assumes ownership and responsibility for all development initiatives that will proceed in the municipality for the next five years.

Disaster and related risk management responsibilities now must be incorporated into each phase of the IDP in all 51 municipality jurisdictions in the country. At the local government levels they must function as being integrated, multisectoral and multidisciplinary

approaches involved in developmental planning, disaster risk reduction, emergency preparedness and disaster recovery.

Table 3.6 illustrates how disaster and related risk management considerations are to be integrated into all aspects of the development planning process. Each sector of government is responsible under the legislation for implementing disaster risk reduction activities. Such an approach ensures that a municipality shall take all hazards, vulnerability and relevant capacities into account throughout all project development and execution stages. High-risk developments can then be identified before the project is implemented and remedial action can be taken.
Although it is still in its developmental phase, more municipalities in South Africa are now realizing the importance of integrating disaster and related risk management activities into their planning processes. A tangible accomplishment of compliance with the Disaster Management Act is that district, metropolitan and provincial disaster management centres are being established currently to fulfil the functions of comprehensive disaster and risk management strategies.

Case: Asia

The Asian Urban Disaster Mitigation Program (AUDMP) was started in 1995 and has been implemented by the Asian Disaster Preparedness Center (ADPC) with core funding provided by OFDA/USAID. It is based on the belief that loss of life and property from disasters hinders sustainable development, and that such losses can be reduced if appropriate methodologies are introduced through different aspects of city and local administration.

The programme's goal is to reduce disaster vulnerability of urban populations, infrastructure, lifeline facilities and shelter in Asia by establishing sustainable public and private sector mechanisms for disaster mitigation.

As good governance and decentralization of governing responsibilities are high on most countries' political agendas, AUDMP promotes country initiatives that demonstrate the value of strategic approaches to urban risk reduction as part of urban development planning processes.

Working to common standards in association with partner organizations in ten Asian countries, AUDMP works to build the capacities of local authorities, national governments, NGOs, businesses and other institutions that can contribute to reducing risk in urban areas.

Primary tools are employed to facilitate organizational networks, share knowledge and successful experiences and to promote dialogue among key stakeholders. By these means, it is anticipated that successful mitigation approaches can be replicated in other cities and countries worldwide.

Risk reduction practices employed include physical measures, such as flood protection embankments or the wider use of safe building designs. Other practical measures that are vital to reducing risk also receive attention. These range from matters of policy advocacy and legislation to public awareness and training. AUDMP encourages and supports community participation in activities such as hazard mapping and creating more public dialogue in determining policy environments in disaster-prone communities.

While AUDMP activities have contributed to many successful accomplishments in local disaster risk management, they have also been able to disclose some persistent limitations to wider acceptance of disaster risk management practices in Asian urban environments. These include:

- lack of local government will and other organizational interests to assume responsibility;
- other political preoccupations or institutional impediments;
- scarcity of funds, or non-allocation of human or material resources;
- lack of awareness of roles of other relevant agencies;
- lack of recognized mechanisms for sharing information and promoting coordination at local scale, and between local and national authorities;
- lack of consistent donor policies or limited donor collaboration;
- cooperation not sufficiently institutionalized within countries, so that if a key individual leaves, cooperation and collaboration may lapse; and
- different or overlapping concepts of shared interests within geographical sub-regions.

Box 3.7
Asian Urban Disaster Mitigation Program and their partners

Demonstration projects undertaken by Asian Urban Disaster Mitigation Program (AUDMP) partner organizations in ten Asian countries vary widely in accordance with local priorities.

In Bangladesh, Cambodia, and Thailand the focus is on floods, while India, Indonesia and Nepal concentrate on earthquakes. The Philippines and Sri Lanka address multiple hazards. Laos is concerned with urban fire, and Viet Nam pursues housing requirements in flood-prone areas.

Some of the specific project activities and lessons include the following:

- Hazard mapping and risk assessment: Projects in Sri Lanka and Philippines have demonstrated methodology for development of urban land use through integration of risk reduction measures. Projects in Bangladesh and Cambodia demonstrate community-based approaches.
- Mitigation planning and implementation: Lessons learned from AUDMP initiatives demonstrate that the planning and implementation of disaster risk reduction practices should involve government officials, community organizations, and NGOs working in partnership.
- Public awareness and education: Different approaches, tools and products have been used in public awareness campaigns for different audiences in Bangladesh, Indonesia, Nepal and Sri Lanka.
- Capacity-building: AUDMP's approach to training, resource materials and continuing education is to develop generic curricula on urban disaster mitigation, which are then adapted and institutionalized at the national and local levels through national partner training institutes.
- Safer building construction: Country projects have carried out detailed analysis of existing building construction practices and the condition of existing building codes, acts, bylaws and construction guidelines to find ways to increase effectiveness. Different initiatives have promoted safer construction in India, Indonesia, Nepal and Sri Lanka.
- Community-based approaches to disaster mitigation: The country projects in Bangladesh and Cambodia specifically focus on the importance of people's perception of flood risks, the purpose and tools of community flood risk assessment, and the strategies for community organizing, resource mobilization and capacity-building.
- Policy, legal and institutional arrangements: Sound policies and legislation for disaster mitigation, as well as institutional arrangements that have clear lines of responsibilities need to be in place. AUDMP's project partners in Indonesia and Sri Lanka have taken the initiative to review country policies related to disaster management.

Case: Naga City, Philippines

In recent years, disaster management has evolved from concentrating on the response of crisis events to a wider consideration of risk management. In pursuing the objectives of IDNDR during the 1990s and further motivated by the encouragement of AUDMP, Naga City in the Philippines has adopted the following disaster risk management principles:

- an all-hazards approach to risk management;
- a comprehensive strategy that incorporates prevention, preparedness, mitigation, response and recovery capabilities;
- an all-agencies approach to participation; and
- building prepared and resilient communities.

Both natural and human-induced hazards that have the potential to cause significant environmental, social and economic losses were considered for the particular risks they posed to the loss of life and damage to communities and critical infrastructure. The local authorities recognized that land use that failed to take account of these hazards was not sustainable and could cause considerable losses to the community and harm to the environment.

In seeking to ensure that their community could grow and prosper in a sustainable manner, Naga City officials sought to ensure a close linkage between hazard mitigation and land-use planning. Following a study to determine the priority areas of attention, they crafted a strategy to manage hazards and to prevent environmental degradation in order to uplift the quality of urban life. A coordinated set of activities was formulated in the Naga City Disaster Mitigation Project (NCDMP).

NCDMP became the focus of the city's evolving disaster risk management initiatives. Its major concern was to identify risk reduction measures that could help the residents, while also promoting the importance of awareness and city planning for potential hazards that could threaten the city. As the first model city in the Philippines, Naga City used its project to help strengthen the capacity of its citizens to develop and implement disaster mitigation standards and practices.

First, the Naga City authorities determined that many of the losses to life and damage to property could be avoided through proper planning, especially with more attention given to locate settlements and centres of economic activity in safer areas. Community-based surveys were further developed with technical data provided by the weather service flood forecasting division, leading to hazard mapping.

The local authorities maximized the use of GIS capabilities as a foundation for planning their disaster risk reduction measures. It also proved to be an effective tool for anticipating which areas of the city would most likely become flooded. This became a useful tool for city officials to target specific households for evacuation. On a longer-term basis, GIS provided the information for systematic land use and urban planning, including the identification of primary areas for watershed development on nearby Mount Isarog.

Having identified the most vulnerable areas of their community, local authorities then proceeded to shift the focus of economic activity from the lower, more flood-prone central business district to elevated and less risky areas of the city. Using their five-year development plan, land-use regulations and economic incentives, new areas have been developed into growth centres. Additional market development areas have been designated in residential districts of the city to encourage residents to become less dependent on the main public market.

Even though the central business district will never be abandoned, as public dependence on this area has now been lessened, even if there were to be a serious future flood crisis, the city would be able to continue operating with minimal disruption and less loss to economic activity. This thrust towards decentralization is likewise reflected in the opening and upgrading of new roads for rural communities, and the establishment of additional social service facilities outside the urban area.

The city officials also looked at the need to enforce the critical provisions of the national building code locally. Even though the national building code had more than enough provisions to ensure that buildings could withstand typhoons as well as other hazards, means were sought to gain greater compliance to its provisions. Existing enforcement of national regulations depended on many different levels of authority and various national offices.

To expedite enforcement and the application of punitive action for violations, the Naga City government authorities drew up their own building ordinances. While they picked up key components of the national code, they also supplemented them with regulations unique to the situation in Naga City. As a result, the city government could prosecute violators on its own with dispatch and without need for the intervention of any additional national bureaucracy. This has dramatically improved compliance with building regulations and the safety of the local structures, bringing them in line with UN-HABITAT guidelines on settlement planning for flood-prone communities.

Through the Naga Kaantabay sa Kauswagan (Partners in Progress Programme), a socialized housing policy was employed to relocate informal settlements from high-risk areas and also to provide them with basic amenities and facilities. So far, more than 12,500 households have been transferred to the city's resettlement sites keeping them safe, far from likely hazards, providing them access to previously lacking basic services.

The Metro Naga Development Council was also enlisted in linking disaster risk management efforts with local development objectives. As the Bicol River snakes through two provinces and dozens of local areas prior to reaching Naga City, successful mitigation of flood hazards within the local area depended on solutions beyond its own boundaries. A wealth of data and recommendations were generated by ten previous studies on flood control within the river basin area over the years, but many remained to be acted upon. By developing a partnership with 14 neighbouring local areas, the resulting Metro Naga Development Council was able to provide resources and to guide more systematic approaches to collective benefits realized on a basin-wide scale. With even greater potential impact, the creation and joint action initiated by the Metro Naga has been able to promote more balanced and sustainable growth within the area.

Environmental dimensions of both risk management and development were also taken into account. By the use of engineered revetments supported by USAID, erosion was reduced along the Naga River and informal settlements were able to be discouraged. Another dimension of the risk reduction measures has worked to restore the watershed of the river by integrating the protection of the river's ecosystem with the development of the livelihoods among its riverine communities.

With the assistance of the Metro Naga Water District and USAID as co-partners, other efforts aim to rehabilitate the upper Naga River by dredging creeks and small tributaries or removing debris from previous flooding and soil erosion. These activities include the use of natural resources and terrain to impound water, minimizing excessive water runoff from the slopes of nearby Mount Isarog.

Institutional management capabilities have been enhanced to reflect a broader commitment to disaster risk management. The Naga City Integrated Emergency Management System (NCIEMS) has been adopted as the basis for comprehensive emergency management. It has been developed in conjunction with the Naga City Disaster Mitigation Office (NCDMO). It is broadly based in that it covers activities that can occur before, during and after crisis situations or hazardous events. To implement the NCIEMS concept, the NCDMO will conduct periodic hazard inventories, followed by capability assessments.

Together these lead to the preparation of a medium-term development plan known as the Capability and Hazard Identification Program. The capability assessment is intended to measure all resources, both internal and external to the city government that can be allocated to counter threats and to optimize the use of the aggregated and intergovernmental resources, as required.

The system further includes means to access additional options to offset shortfalls in capacity on an interim basis. These disaster mitigation measures are actually part and parcel of the growth with equity development programme of the city government, and the departments concerned implement them as part of their regular responsibilities.

The Naga City experience highlights the fact that it is quite possible to associate disaster risk management activities with development strategies. While disaster may set back development efforts, risk management measures and even disaster rehabilitation activities should always be viewed as part and parcel of a locality's overall development programme. To isolate risk reduction from development is to aggravate the impact of hazards and set back development.

Case: Seattle, United States

With its hilly topography, steep slopes, local geology, and above-normal rainfall, the city of Seattle, Washington, has always been exposed to the possibility of serious landslides. While there were periodic landslides, little prior effort had been made to address hazard mitigation on a systematic basis and the subject was on few official or agency agendas.

The city's awareness to potential hazards was considerably increased in the mid 1960s following the discovery of a new seismic fault line that was nearby, shallow and potentially dangerous. As Seattle's population grew rapidly from the 1980s onwards, many new residents who had arrived from elsewhere possessed little knowledge of local risks, nor any historical or institutional memory of earthquake risks in the Seattle vicinity. New earthquake resistant codes were introduced in the 1980s, and only around 10 per cent of homeowners had earthquake insurance.

Following some serious losses to landslides in 1988 and recognition of even greater potential losses from an eventual earthquake, city authorities began a series of activities to improve disaster preparedness and response capabilities. Importantly, through the efforts of the city's emergency management office a commitment was made to several disaster risk management projects designed to reduce the city's vulnerability to damage from future natural hazards.

In 1998, Seattle was designated as one of the first seven Project Impact pilot communities in the country and the department of emergency management received a grant of US$ 1 million. (see box 3.8). Through the use of various public events, public information materials and a

Box 3.8

Lessons from Project Impact: public-private partnerships for disaster reduction

The United States Federal Emergency Management Agency (FEMA) approach of encouraging long-term strategies based on public-private partnerships enlarged the scope of disaster risk reduction activities in every state in the United States during the final years of the 1990s before the programme was closed down following a change of political administration.

FEMA launched Project Impact to encourage local authorities to consider public-private partnerships as a basis for developing disaster resilient communities. The programme used modest amounts of seed money and pilot activities to garner common support from individual city, state and federal governments and to leverage wider support and commitments that could stimulate even more participation and involvement.

From the outset different sectors of society were involved in Project Impact. These included business interests, government and local authorities, and representatives of local or civic organizations. This approach helped to foster interest among a wider body of professional interests and at the local community levels of involvement.

As experienced in the city of Seattle, Washington State, the Office of Emergency Management sought to inform, interest and engage other players. In many cases participants initially did not see their personal connection with disasters, but later came to realize their valuable role in risk management. Eventually these partners in the public interest included the Port of Seattle, GIS experts and scientists from the University of Washington, the city's department of education, individual homeowners and the city's leadership. The project also met with acceptance from the small and local business community because these small investors understood the importance of establishing contingency plans to protect their businesses. As time passed and the public appreciation of the new concepts increased, their interest and participation also grew.

The core components of Project Impact as implemented in Seattle over four years responded to the needs expressed from within the local community. First schools and then individual homeowners responded favourably to technical advice and explicit plans that enabled each of them to increase the structural integrity of their buildings through simple retrofitting procedures. Later the technical, scientific and research communities became involved with the opportunity to update and even expand the existing documentation of seismic and landslide risks necessary for advanced hazard mapping. This in turn was seen to provide useful information to the business community and commercial interests.

Previously, people had laboured under the misapprehension that only the government should be involved in disaster risk reduction. Later, the community took pride that some Seattle secondary school students had won a prestigious national film award for the public awareness film about public earthquake safety they had made as a school project.

The programme demonstrated in many places that people wanted to participate once the concepts of risk reduction were sufficiently understood as being beneficial to them, where they lived and worked. They also protected essential services that the people depended upon, so the relevance of the initial activities extended beyond the original grant periods. Later costs for these risk management services were met through local resources.

Key success factors in Seattle were to identify commonly perceived needs, pursue them methodically as local familiarity and capabilities increased, and seek to maintain a sense of local control and widely shared involvement.

The overarching goal was to make people's own community safer for all, and show that everyone had something to contribute. By working together, they could identify priority concerns that they were then able to manage progressively.

community web site, the general public were provided opportunities and tools to learn more about the natural hazard risks of the region and resources that were available to lessen their impact.

By pooling the knowledge and talents of the many local partners, including those from government agencies, large and small businesses, educators, scientists, neighbourhood organizations, and dedicated volunteers, Seattle's experience has led to several successful programmes, which have continued even after the cessation of the original Project Impact grant funds.

As the community became more involved in disaster risk management activities, new programmes were designed to engage other segments of the population. By working closely with the technical and scientific community, the local university and commercial interests, earlier hazard maps were improved and expanded to include other forms of risk.

Landslide maps now integrate existing records with new data about historical rainfall and the soil properties of Seattle's landslide-prone areas. For earthquakes, a new three-dimensional map of the coastal area is being produced that incorporates the complex geological relationships beneath the

surface with earthquake ground motion data. While engaging the technical community in the process, the mapping helps area residents understand more about the risks they face and aid in the development of sound land-use policies.

The most recent efforts of Seattle's local authorities have been to devise a programme that involves and benefits the small business community, an often overlooked and vulnerable segment of the community. As they are a crucial economic mainstay of any community, the small business disaster reduction programme introduces technical risk specialists to business people to provide advice on measures and available resources to protect businesses from disaster losses.

Supporting initiatives for local authorities in disaster risk reduction

In the 1990s the sustainable cities movement emerged as a powerful driver of policy-making, institutional reform and investment by thousands of local and sub-national authorities, as well as by the development assistance community. A recent survey by the International Council for Local Environmental Initiatives (ICLEI) and the UN Department for Policy Coordination and Sustainable Development (UN-DPCSD) shows there are now more than 6,400 local authorities in 113 countries engaged in local Agenda 21 development programme activities.

A resilient community or local area is a city, town or neighbourhood that reduces vulnerability to extreme events and responds creatively to economic, social and environmental change in order to increase its long-term sustainability. The more a society is confronted by risks and change, the more resilient a community needs to become to ensure its social well-being and economic viability.

"Resilient Communities" was lauded as a partnership at the World Summit on Sustainable Development by ICLEI in August 2002. The concept of a resilient community encompasses the acceptance of developing capacities to identify vulnerabilities and activities to reduce them. It employs tools and strategies for hazard reduction and risk management that include planning measures, urban design features, regulations that are enforced and the investment of resources to protect important assets. It also needs to support institutional and community-based systems for crisis management, response and recovery when necessary.
<http://www.iclei.org/johannesburg2002/ips/ip_5_resilient_communities.pdf>

Another quality of a resilient community is its ability to identify and pursue creative opportunities arising from change. While change may require emergency response at the time of a crisis, a resilient community would also consider not only how to return to its earlier state, but how to address changed circumstances. It can also seek to capitalize on the increased public awareness that often follows a disaster to improve local conditions and to pursue more strategic aspirations proactively.

The resilient communities agenda pursues two lines of action among the worldwide community of local government authorities. First, it asserts the central emphasis of locality-focused and locally specific disaster reduction planning measures. Even though hazards and extreme events generally are not specific to a locality, vulnerabilities and resilience to these events often arise from unique local conditions. Programme activities, therefore, need to support assessment, planning, policy and implementation practices that are sensitive and responsive to local conditions. There is a growing acknowledgement globally that widespread public participation is necessary at local levels, as well as strong and responsive public institutions.

The second line of action promotes a comprehensive approach to vulnerability reduction and building resilience within communities. It is a series of continuous activities that gives priority to the immediacy and levels of risk, but extending into other related fields such as those of urban governance, public administration, planning, finance, social and economic development, and environmental and resource management.

The initiative focuses on introducing policies, tools and methods that can be shared by both the disaster risk management community and the body of interests more readily identified with the principles of sustainable development. This includes focused commitments in such areas as mobilizing already existing efforts for the improvement of infrastructure, upgrading services,

extending environmental management and further engaging governance practice that embodies risk factors into developmental planning.

Resilient communities and cities seek to define a comprehensive concept of urban resilience with the ultimate aim to build communities that are fully engaged and commit resources to reduce vulnerability and risk. Only then can they be well positioned to respond creatively to a century of social, economic and environmental change.

As part of the expanding resilient communities movement, the Earthquakes and Megacities Initiative (EMI) developed an essential tool for managing disasters known as a disaster management master plan (DMMP). DMMP consists of five elements: assessment, preparedness, response and relief, mitigation, and the acquisition of know-how and expertise. It is intended to serve as a guide for the coordination of a city's action and policies for disaster and risk management, and includes citywide action plans and related protocols for each of these five key areas of responsibility. Additionally, it provides information and data for sound decision-making in routine local administration along with specific risk management functions.

The implementation of a citywide DMMP is a rational and efficient approach to building local capacity because its structure fits the conventional local government operating framework which is grounded in similar areas such as urban development, land-use planning, capital planning and public safety that are directly related to disaster risk management activities. The DMMP creates a useful context in which to institutionalize disaster risk management within a city's central administration and operational policies. <http://www-megacities.physik.uni-karlsruhe.de/>

UNESCO and ISDR have joined forces to pursue shared objectives in coordinating a multidisciplinary initiative to reduce natural disasters in Asia, Latin America and the Caribbean. The goal of the project is to preserve sustainable development and reduce poverty by reducing the impact of natural disasters.

Emphasis is given to promoting measures that can incorporate risk management as an integral part of public policy, city development plans and processes. The project builds on previous accomplishments in risk identification in the participating cities. In particular, it uses the results of the Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters (RADIUS) project conducted from 1997 to 2000 under the aegis of IDNDR. The UN has since distributed these tools to local authorities of earthquake-prone cities worldwide (also see box 2.26).

One of the end products envisaged in the later activities is a set of recommendations for local governments that convey normative actions that can be used in urban planning and to empower citizens to enhance disaster reduction. The long-term vision is for cities worldwide to adopt effective measures that local authorities can employ in wider application of existing knowledge to manage risks. By reducing levels of exposure to natural hazards and related risks, opportunities for sustainable development can also be increased.

In each of the cities already belonging to the RADIUS network and selected initially to participate in the expanded programme, they will have the following aims:

- Train local leaders and experts in the use and application of the RADIUS earthquake damage assessment tool.
- Prepare simplified earthquake scenarios for different conditions.
- Prepare simplified earthquake scenarios for future conditions considering current local growth tendencies.
- Test current urban growth plans and policies to understand their implications in changing levels of urban risk.
- Identify and test possible risk reduction measures.
- Perform simplified cost-benefit analyses.
- Compare the relative risk among participating cities.
- Promote the exchange of experiences, information and best practices among the participating cities.
- Raise awareness of the existing risk and the availability of affordable solutions at local and international levels of activity.

Initial activities are focused in Tijuana, Mexico; Antofagasta, Chile; Kathmandu, Nepal; and Dehradun, India. Working groups in each of these

cities have already evaluated current and future earthquake risks by using the risk assessment tools and methodology provided by the project. The estimated growth trends of each city were also considered so that projections could be prepared about future changes in exposure to earthquake risk factors.

The resulting risk analysis and estimation of results has provided documentation to local and state authorities that can assist them in considering the most appropriate measures to reduce their exposure to risks. In the case of Kathmandu, the recommendations included the immediate implementation of building codes and land-use regulations. In Antofagasta, the application of improved construction standards were determined to be crucial for reducing the number of structural failures and collapsed buildings.

Box 3.9
Resilient communities

Resilient communities and cities develop from:

- managing and coordinating programmes through partnership;
- documenting and promoting good policy and best practices;
- reviewing governance structures, policies, tools and practices and documenting their impacts on sustainable communities;
- identifying reference and pilot cities and communities;
- modeling methodological frameworks;
- promoting pilot projects in local areas;
- disseminating the benefits of project learning and experience; and
- maintaining project documentation and circulating outputs.

Future challenges and priorities

Local authorities

The preceding discussion and examples demonstrate that important opportunities exist within municipal areas for authorities to focus attention on disaster risks to which the immediate community is exposed. Similarly, municipal authorities can exert means by which to engage broad measures of public support. Municipal administrations often command authority over a more manageable area that holds more immediate relevance to the resident population than is likely in comparison to national scales.

Disaster risk management can be presented as a matter of tangible and proximate value to inhabitants, which can encourage their more willing involvement as they appreciate the prospective benefits in their own surroundings. While there are various social and economic perceptions that shape exposure to risk as in any population, government structures in municipalities often tend to be more centralized in focus, but still rooted in local, neighbourhood, or localized community interest groups.

The primary challenge for authorities is to understand and then adopt the importance of disaster risk reduction as an important criteria for the municipality's own economic and social well-being. This will become even more pressing as municipalities become subjected to more rapid population growth, and reflect greater concentrations of productive resources and wealth at the same time that they make greater demands on existing natural resources and threaten the local environment. While growth is accompanied by risk, protection and well-being of a community results from how accurately those risks are assessed and then managed - in the public interest and by sustained civic support.

It is widely recognized that effective disaster risk management must be realized at local community levels, but the overall impetus needs to be provided by broader and consistent forms of leadership. Municipal authorities and local governments play leading roles in relating their current and localized threats or needs to opportunities that may exist in larger jurisdictions such as those at provincial or state levels. They also need to demonstrate the likelihood of practical accomplishments at local levels that can be supported by the more broadly described and heavily resourced national policies or development incentives.

Matters of public awareness, urban and regional planning, risk assessment and later decisions regarding priority allocation of resources for managing risks all depend on holistic, sustained, and balanced strategies. However as municipal authorities need to motivate a wider public interest and involvement through government practice, sustained commitment to protecting communities is dependent on the extent to which the emphasis can successfully be transferred to the importance for individual neighbourhoods, "our" children's schools, or the public infrastructure on which "we" depend in daily life and livelihoods. Such an approach can often suggest that rather than necessarily requiring new or additional resources, awakened sensibilities can make use of the reallocation of already existing resources, whether they are expressed in material or human terms.

Success factors can be outlined easily, but they need to be given both means and structure if they are to be achieved. First there is the requirement to identify commonly perceived needs, and then to convey them for a clear and broad understanding about how they relate to the community's own interests. Once established as a set of core values, they then should be pursued consistently and methodically, however expanding or progressing only as the developed civic familiarity and capabilities increase. Throughout the process, it is important that local control be maintained and widespread participation consistently encouraged for vitality to be assured. Both the values as well as the work need to be widely shared, with the interests of multiple generations leading to sustained attention to the subject, and with a sense of obvious benefit for the locality.

In a functional capacity guided by municipal authorities, these principles can be realized through a systematic approach that most frequently begins with a commitment to localized risk assessment. This often results in a surprising recognition of both the widened extent and the growing interest of more people becoming involved within a community, to protect their vulnerable physical and social assets from disaster risks. Through the continuing process of analysing disaster risks institutional knowledge grows and their capabilities increase. The process expands and succeeds to the extent that the subject of disaster risk management in practice becomes integrated into daily governmental actions and public responsibilities. A useful illustration of this value may be the public recognition and official commitment of resources to ensure that seismic safety of schools is an inherent part of routine school maintenance responsibilities. Similarly, a municipal public works authority routinely should review the exposure of crucial physical infrastructure in a rapidly expanding municipality to the likelihood of annually expected natural hazards such as storms, floods or icing.

The role, and the challenge, for municipal authorities in reducing disaster risks can be summarized most easily as adopting a broadly-based strategy that provides civic direction that can inform and engage the interest and abilities of a community working together to assess and manage the risks that may threaten their own home and way of life. In this there are mutually shared self-interests, between municipal authorities and all inhabitants of the community.

3.3 Regional cooperation, interaction and experience

Hazards often reflect regional characteristics grounded in the predominant geographical conditions. Historic events and common political features also contribute to shared experiences within different regions around the world.

While the impetus may vary in different regions, natural hazards and the risks they pose to people present opportunities for neighbours to strengthen their efforts in risk reduction.

They do this by sharing skills and experiences and by combining resources to develop resilience to disasters. As disaster risk management encompasses a wide range of interests and abilities, there is a growing requirement for more political and professional interaction through regional cooperation.

Regional dialogue gives added depth and force to combined national interests, as much as regional institutions can tap and channel broader international expressions of intent into coordinated and better-suited practical activities.

A review of some examples of regional cooperation will show the scope of organizational frameworks employed to galvanize cooperation in disaster risk reduction. The fact that only a few of these examples display organizational developments created expressly for the purpose of disaster risk management highlights the extent to which risk issues pervade multiple dimensions of society and rely upon the work of many people.

The Americas

A major shift is taking place in many countries in the Americas with greater attention given to risk reduction. Triggered by several major disasters during the last decades and further motivated by promotional efforts and technical cooperation during the 1990s, the region has been fortunate to develop relatively advanced concepts of risk management. This has brought together the combined efforts of social research, practical experience and frequent opportunities to engage an expanding range of professional interests.

There have been additional mutually reinforcing efforts and long-standing involvement of such regional and international organizations as the Pan-American Health Organization (PAHO), the International Federation of Red Cross and Red Crescent Societies (IFRC), and the Office for Foreign Disaster Assistance/USAID (OFDA/USAID).

Since 1973 the UN Economic Commission for Latin America and the Caribbean (ECLAC) has promoted the ideas that risk management and vulnerability reduction are fundamental to development policies in any systemic view of competition, equity, sustainability and governance issues. These views were initially publicized in ECLAC's first manual on the subject in 1991, and they were more recently expressed in an updated version in 2002.

More recently, UNDP and UNICEF have joined in providing technical cooperation, training and public awareness for vulnerability and risk reduction. Other organizations have encouraged the development of new capabilities over many years, often built around strategic programmes in social sectors such as health and education. These include efforts by the Organization of American States (OAS) and the Network for Social Study of Disaster Prevention in Latin America (LA RED).

Although it is not always explicit in government and society discourse, more people now recognize

Box 3.10
High level commitment

At the Third Summit of the Americas, held in Canada in 2001, the assembled Heads of State declared:

"We commit to strengthening hemispheric cooperation and national capacities to develop a more integrated approach to the management of natural disasters. We will continue to implement policies that enhance our ability to prevent, mitigate and respond to the consequences of natural disasters. We agree to study measures to facilitate timely access to financial resources to address emergency needs."

the relationship between inadequate development practices and the development of social vulnerability that contributes to increased disaster risk.

Moreover, the relationship between environmental degradation and hazard incidence increasingly has been brought to the forefront by institutions such as the Central American Commission for Environment and Development (CCAD), the World Conservation Union (IUCN), the Inter-American Development Bank (IADB), Corporación Andina de Fomento (CAF), the Caribbean Development Bank (CDB) and the World Bank.

Climatic variability, as perhaps manifested most readily to the general public by the El Niño/La Niña phenomenon, has prompted the World Meteorological Organization (WMO) and regional organizations to proceed beyond areas of scientific concern and technical research. More programmes are focusing on means by which available information can more readily be applied for early warning and institutional strengthening for risk reduction.

Central America

The impact of consecutive catastrophes from 1997-2001 has been important in changing the way disasters are conceptualized in Central America. As mentioned in chapter 3.1, Hurricanes Georges and Mitch devastated the economies throughout the region and caused much damage to personal property from floods across the countryside.

An economic assessment undertaken by ECLAC with the involvement of UNDP and other agencies established the fact that Hurricane Mitch damaged the interests of both the poor population as well as the private commercial sector. This served to create a collective view of the need for change. The El Salvador earthquakes of 2001 later raised serious questions about the risk consequences of land use and inadequate environmental management practices.

In addressing these conditions, the governments of the region, working together through the Coordinating Centre for the Prevention of Natural Disasters in Central America (CEPREDENAC), have confirmed a political commitment to risk reduction and reconstruction processes through social transformation. CEPREDENAC also involves many women at all levels and has promoted gender-sensitive social audits of disasters as well as gender-inclusive mitigation strategies. Their experience is a valuable example for the world.

This advance in political will has been achieved through expanding regional integration. Governments and heads of state have shown a readiness to proceed jointly, working to achieve common purpose through shared resources. This is reflected by their endorsement of a Strategic Framework for the Reduction of Vulnerability and Disasters in Central America, and the adoption of a Five Year Plan for the Reduction of Vulnerability and Disaster Impacts (1999-2004).

The strategic framework identified six major areas:

- strengthening national disaster organizations;
- developing early warning systems and strategic plans;
- increasing research on hazards and vulnerability, including the promotion of information exchange;
- formulating distinctive risk reduction strategies for specific sectors;
- providing mutual assistance in case of disaster; and
- enhancing risk management at local levels.

There has been more collaboration with community and municipal organizations such as the Community Network for Risk Management, the Federation of Community Organizations and the Central American Municipal Federation.

There is a promising expansion of programmes dedicated to reducing vulnerability to natural hazards at local levels, and building national capacities and exchanging experience and information regionally.

Beginning in July 2001, UNDP launched a two-year Regional Programme for Risk Management and Disaster Reduction. This concentrates on improving local risk management practices, within the framework of CEPREDENAC's Local Level Risk Management Programme, and strengthening the capacities of national risk reduction systems.

A new phase of the UNDP-coordinated inter-agency Disaster Management Training Programme (DMTP) is being designed to focus on national risk scenarios and the identification of priority research and training requirements of the region.

However, challenges still remain in moving successfully from the expression of political intentions to fundamentally changed policies and practices. Advances will require enormous efforts including greater social consciousness, legislative and institutional changes, modified social practices, the reduction of corruption, and the mobilization of the private commercial sector. The objective is to instil a society-wide acceptance of sacrificing short-term gains in exchange for long-term sustained protection for social and environmental resources.

Another programme of regional collaboration and capacity-building was launched by the Swiss Agency for Development and Cooperation following Hurricane Mitch. The Disaster Prevention Programme was conceived to run from 1999-2003 with a budget of US$ 5 million. Support was offered to El Salvador, Honduras and Nicaragua. The programme concentrates on raising awareness of natural hazards, capacity-building and institutional strengthening. It works with an array of institutional actors including national government agencies, municipalities, scientific and technical institutions and universities.

Box 3.11

Coordinating Centre for the Prevention of Natural Disasters in Central America

The Coordinating Centre for the Prevention of Natural Disasters in Central America (CEPREDENAC) has been key in realizing change. Starting as an informal group of scientific and official response organizations in 1987, it has become the official Central American Integration System's (SICA) specialized organization for risk and disaster reduction strategies.

Following the coordination and operational demands imposed by the devastating disasters in the final years of the 1990s, it has proven crucial in tying together many professional abilities and regional political interests. Importantly, the regional strategy called for the updating and completion of CEPREDENAC's Regional Plan for Disaster Reduction. Since 1999, this has been the vehicle by which CEPREDENAC has promoted action identified by the governments and many other projects throughout the region.

CEPREDENAC has gained status through its work plans with other specialized agencies. It has undertaken risk reduction activities with PAHO in the health sector; the Housing and Human Settlements Coordinating Committee in the housing and human settlements area; the Central American and Panamanian Institute for Nutrition and WFP in food security matters; and the Central American Transport Committee in communications and transport. It has pursued additional endeavours to further risk reduction in other regional agencies in the fields of agriculture, water management, telecommunications, and electricity generation and distribution.

CEPREDENAC has moved toward broader regional programme development, encouraging projects to be implemented by national authorities or local groups. Recently, CEPREDENAC and the Regional Unit for Technical Assistance (RUTA) published guidelines for the introduction of risk management practices in rural development projects throughout the region. In a similar vein, CEPREDENAC is now addressing risk issues associated with the important Puebla to Panama Logistical Corridor, undertaking more work with the private sector, the regional and international banking community, and promoting risk reduction issues in Central American development agencies.

With IADB, World Bank and Japanese funds, CEPREDENAC is financing a Regional Prevention and Mitigation Programme to finance projects favouring risk reduction proposed by national CEPREDENAC commissions. At the beginning of 2001 it created a Local Level Risk Management Programme with the support of IADB and UNDP.

Initial activities have involved the establishment of a conceptual framework for risk management that will encourage programme activities, and the start of a systematic process of recording experiences in local level management in the region. A third initiative is the institution's Regional Action Plan for Central America, financed by UNESCO with Dutch, German and French support. This regional programme provides training for specialists in the use of technologies for analysing hazards, particularly the use of GIS applications.

Box 3.12
Community-based regional initiative

Initial consideration given to community-based disaster reduction outlooks was boosted by a German Agency for Technical Cooperation (GTZ) inspired project called Strengthening of Local Structures for Disaster Mitigation (FEMID). To undertake a regional approach for introducing risk reduction considerations within local development frameworks, it used pilot activities in all six Central American countries. Experience gained in the use of early warning in local communities was applied to floods in the project pilot zones.

The Masica area of northern Honduras became a regional and international example of good practice. After early warning schemes had been consolidated in different areas, local communities – formed to promote this single activity – began to develop a broader interest in other primary risk reduction issues. This then led to some of the groups establishing new relationships with development agencies, as occurred in the Chepo area of Panama.

The Caribbean

Since its establishment in 1991 by the Caribbean Community (CARICOM), the Caribbean Disaster Emergency Response Agency (CDERA) has worked to create a methodical approach for developing disaster management programmes among its member states, including inter-island projects.

Originally initiated to help countries cope after a disaster, increasingly, more emphasis has been given to disaster risk reduction as part of development and environmental concerns. Disaster reduction has been introduced in most regional initiatives at policy level, including through the Programme of Action for Small Island Developing States, as a priority area of action in CARICOM, and through the programmes of the Association of Caribbean States.

These interests are reinforced through the biennial Caribbean Natural Hazards Conferences organized by the primary regional disaster management stakeholders. These have included the University of the West Indies, CDERA, USAID and UNDP.

Furthermore, the assessment of vulnerability has become a key policy area for CARICOM. It has been raised in several forums including those of the World Bank, IADB, OAS and the Commonwealth Secretariat.

At the Conference of Heads of Government of the Caribbean Community, the highest collective decision-making body in the region, the relationship between disaster management and the environment has been declared a matter of cabinet level responsibility.

Other agencies have also contributed to the development of capacities by supporting disaster management programmes implemented by government agencies and NGOs. In 1991, CARICOM committed itself to establishing a permanent agency with a focus on preparedness and response planning, supported by its member states. Since then, CDERA has worked to broaden the disaster management agenda in the region, giving particular attention to training and creating a core of professionals as a source of regional expertise.

Andean countries of South America

Five countries which share Andean topography and are exposed to a high level of risk often must cope with disasters. Bolivia, Colombia, Ecuador, Peru and Venezuela all experience earthquakes, volcanic eruptions, floods and droughts. From a socio-economic point of view, the greatest impact is felt from hydrometeorological disasters.

Information systems to support disaster risk management are relatively scarce. There is a lack of consolidated information or channels for easy access to information about different hazards. The information which is available is often highly technical and is not easily understood by a general audience. Recently, the countries are improving this limitation.

In these Andean countries, the use of disaster risk management as a public policy tool within development organizations is still in the early stages of consolidation. A lack of official institutional frameworks explains the relatively limited public awareness about risk in each of these countries.

However, there has been a growing recognition of the need to incorporate disaster risk reduction into

Box 3.13
Andean Regional Programme for Risk Prevention and Reduction

The overall objective of the Andean Regional Programme for Risk Prevention and Reduction (PREANDINO) is to encourage and support the formulation of national and sectoral policies for risk reduction and disaster prevention, and the development of models and forms of institutional organization that introduce a preventive approach for development planning.

Its objectives at the regional level are to:

- promote, support and offer guidance on the organization of schemes and programmes for horizontal cooperation between equivalent institutions in the Andean countries, so as to strengthen their technical capacity for studying and adopting preventive policies and programmes;
- promote region-wide risk prevention programmes, primarily those related to awareness of the threats to which there is the greatest vulnerability;
- ensure the feasibility of, and to support and coordinate technical cooperation initiatives among the Andean countries;
- encourage supra-regional bodies and international organizations to propose and implement cooperation projects at the national and regional levels; and
- promote the institutionalization of prevention in the Andean region.

Strategic areas

To reach its objectives, PREANDINO has defined a strategy to:

- incorporate risk prevention in state policy and in the institutional and civic culture in the Andean region;
- emphasize three areas for action; the dissemination of information on risk, improved institutional management of risk reduction, and the inclusion of prevention in national, sectoral and territorial planning in the public and private sectors;
- attempt to ensure, from the very beginning, the strongest possible commitment to the objectives of the programme at the highest levels of decision-making in the public and private sectors;
- create the best possible conditions for the exchange of information between the Andean countries on institutional developments, planning experience, and methodological and technical progress in identifying and evaluating threats, vulnerability and risk;
- make ongoing efforts in the region and in each country to ensure that more is done to reduce the risks that affect people's quality of life; and
- create a favourable climate for international technical and financial cooperation in the countries of the Andean region, so that optimal, effective and coordinated use is made of the resources for risk reduction.

At the operational level, the key players in this initiative are the respective countries' national committees for risk reduction. These include representatives from the ministries of planning, science and technology, and the environment, as well as from national civil defence or disaster management agencies.

All of these institutions are linked through a network that allows participants to share information about their activities and by so doing, to shape indicators that can gauge the effectiveness of disaster and risk management. This cooperation is augmented by conferences and workshops, which facilitate the exchange of information and provide a common basis by which to conduct negotiations with financial bodies.

the broader context of development initiatives. The common historical and cultural roots of these countries further encouraged their institutional cooperation, which has been enhanced through the Andean Integration System.

In 1997-1998, the presidents of these five Andean countries requested the Andean Development Corporation (ADC) to conduct a study of the economic and social impact of El Niño on their countries, and to analyse the existing institutions dealing with disaster prevention. This resulted in an institutional and technical review of each country, highlighting institutional weaknesses and a particular need for greater regional coherence in risk reduction matters.

Subsequently, in 1999, the presidents provided ADC with a mandate to coordinate activities necessary to strengthen risk prevention standards and institutions of each country and to develop principal regional projects that share those aims. To pursue these objectives, ADC established the Andean Regional Programme for Risk Prevention and Reduction (PREANDINO) in late 2000 to support the creation of a network that will foster the exchange of experience and contacts. Resource capabilities are being established in each country to promote permanent channels to exchange information among research centres, producers of hazard-related information, and potential users within various professional disciplines.

In parallel developments, representatives of the national civil defence organizations of the Andean countries have met several times since 2000 to consolidate a regional basis to improve coordination of their response and preparedness activities. The Southern Command of the United States Army has supported these efforts, among others.

All of these activities led to the establishment of an Andean Committee for Disaster Prevention and Response within the Andean Integration Community in July 2002. It was developed in accordance with the objectives of ISDR and supported by several regional institutions and bilateral development agencies in order to promote improved and better integrated risk management activities in the area.

Africa

The African continent is very vulnerable to disasters from natural causes, particularly from hydrometeorological hazards. The vulnerability of people and their livelihoods remains high and is rising, influenced by endemic poverty, with dire consequences for the vulnerability of the entire continent. Tragically, there is a vicious cycle of disasters devastating the economic base, thus worsening poverty, while high poverty levels diminish the ability to avoid, reduce or mitigate risks or to recover socio-economic productive capacity.

Other negative factors contribute to the high and increasing vulnerability in much of Africa. A rapid growth in population often exceeds resources available to provide adequate essential social services, or to ensure economic well-being. The devastating social and economic consequences of prevalent infectious diseases, the high rate of urbanization, and too often troubled or problematic elements of governance all frustrate sustained commitments to managing risk in many African countries.

Both the prevalence and the persistence of these conditions command the attention of many African leaders, and warrant increased regional collaboration. There have been several expressions of concern at the many and accumulating consequences of natural disasters comprising some of the major constraints to sustainable development. African leaders have identified disaster reduction as a priority area of action crucial for both economic and sustainable national development for upcoming years.

This was the case in two annual meetings of the African Ministerial Conference on the Environment held in conjunction with preparation for the World Summit for Sustainable Development (WSSD) held in Johannesburg, South Africa in 2002. The recommendations of the WSSD further amplified these concerns and the unavoidable relationships between the consequences of disasters and national development.
<http://www.unisdr.org/eng/risk-reduction/wssd/>

While hydrometeorological hazards represent recurrent risks to African countries, they also

provide an important context to marshal professional resources and to motivate institutional commitments to risk management on a regional or subregional basis. Extended droughts in the Sudan-Sahel region in 1970-1974 led directly to the formation of the Permanent Interstate Committee for Drought Control in the Sahel (CILSS) in West Africa, in 1974. The 1984-1985 drought that caused acute food insecurity and famine that devastated the livelihoods of more than eight million people in the Greater Horn of Africa directly influenced the creation of the Intergovernmental Authority on Drought and Development (IGADD) in 1986. This institution led to the development of the present Intergovernmental Authority on Development (IGAD) to address broader environmental and developmental issues.

Other specialized technical institutions have been created to address the consequences of hydrometeorological hazards in Africa through various forms of regional and subregional cooperation. Often with the support of UN agencies such as WMO, UNDP, FAO and UNEP, technical institutions have been created to share information and limited professional resources to best effect. These include the activities of the Africa Centre for Meteorological Applications to Development (ACMAD) located in Niamey, Niger; the Regional Centre for Training and Application in Agrometeorology and Operational Hydrology (AGRHYMET) that is linked to CILSS also in Niger; and the Drought Monitoring Centres, located in Harare and Nairobi where they are linked to IGAD and SADC, respectively.

In Eastern, Central and Southern Africa, major shifts are taking place to revise and expand the roles of IGAD and SADC institutions to identify and manage risks on a regional basis. Initiatives have been taken in both regions to strengthen the exchange of information, to recognize the need for more operational cooperation among countries, and to adopt broader political and technical commitments to risk management policies. Challenges remain though to move national policies beyond under-resourced and often uncoordinated emergency relief assistance functions.

To support this emerging process of regional and subregional cooperation, the ISDR Secretariat and the Disaster Reduction Programme of UNDP's Bureau of Crisis Prevention and Recovery have both opened African regional offices based in Nairobi, Kenya. A review of the current institutional status and related governmental views pertaining to disaster risk reduction has been conducted, and a regional conference on early warning was held in June 2003. By recognizing achievements, identifying constraints and gaining commitments for further development, this latter meeting prepared a joint African input for the global conference on early warning held in Bonn, Germany in 2003.

East Africa

Intergovernmental Authority on Development

The Intergovernmental Authority on Development (IGAD) is a subregional authority composed of seven member states in East Africa. Together, the countries of Djibouti, Eritrea, Ethiopia, Kenya, Somalia, Sudan, and Uganda occupy over 5 million square kilometres, and have a combined population of more than 154 million people.

More than 70 per cent of the inhabitants live in rural settings where poverty is acute. Many of them migrate and pursue their livelihoods over considerable distances. Social services are often few, and the environment is both fragile and subject to serious degradation. Throughout the region, the economy depends largely on agriculture, including livestock production, and is heavily influenced by climatic and geographical conditions. When drought occurs in the region, the impact often lingers and is widespread and severe. Floods also have proven to be destructive.

The basis for IGAD was created in 1986 by the expression of a common objective among the member states to work together to mitigate the effects of drought in the region and to address more generally the problems associated with desertification and food insecurity. The authority originally contained two technical departments: agriculture and food security; and the environment and natural resources.

From 1986-1995, the agriculture department initiated programmes including a food security

strategy and an early warning system for drought. The environment department outlined several programmes to combat land degradation and desertification, planned an integrated information system, conceived a disaster management strategy, and promoted environmental education and awareness programmes. However, progress was very limited as most of the strategies were not fully implemented; the disaster management strategy conceived in 1990 remained dormant for six years.

In taking account of these difficulties, in 1996 the mandate of IGAD was expanded, adopting a broader approach to developmental objectives. A department of political and humanitarian affairs and a department of economic affairs and infrastructure were added. Disaster management was highlighted and placed under a revised humanitarian and conflict resolution department, responding to important subregional conditions at the time.

More importantly, the understanding of what constitutes possible hazards and the conceptual framework of disaster management systems has continued to evolve. As part of this revised IGAD strategy, national officials ranked hazards in the region in three categories based on a combination of past consequences, but also by taking account of other criteria that previewed a subregional disaster risk assessment. These include such parameters as considerations about the pace of hazard onset, potential magnitudes or severities that could be expected, frequency of occurrence, and most importantly the anticipated possible impacts of a hazard on the society and the environment. Potential risks have grown to include pandemic and epidemic diseases, environmental hazards and industrial accidents.

IGAD also revisited its disaster management strategy and redefined it to elaborate new programme approaches. The revised objectives establish capabilities needed to ensure the availability of minimum needs for food, water, shelter, health and security through assistance which is appropriate in terms of type, timing, location, method of provision and duration for this purpose.

This has been crucial for implementation especially at the national and sub-national levels where action eventually would need to take place so that lives, assets and the environment are safeguarded.

Importantly, the specific objectives that were outlined sought to promote the development and implementation of suitable national disaster preparedness strategies. These called for several related needs:

- a framework of principles, policies, legislation and agreements at regional and national levels which could enable disaster preparedness and response measures to be implemented by a variety of agencies;
- national, regional and international agencies that could collaborate effectively in disaster preparedness and response;
- capabilities to ensure that disaster management intervention could be based on adequate and timely information including early warning and vulnerability assessments;
- awareness of communities exposed to hazards so that they and their related institutions could act promptly and effectively when emergency conditions occurred;
- mechanisms and infrastructure for timely identification and mobilization of resources in times of threat; and
- appropriate mechanisms to target and implement timely assistance for those people most in need.

Overall, the IGAD strategy for disaster prevention and preparedness can be summarized as being shaped to tackle the root causes of disasters through long-term programmes for sustainable development. This needs to be based on an orientation that can identify vulnerable people within communities, and then to work to strengthen their own social coping mechanisms with particular attention given to community participation and decision-making. The revised programme was adopted by Heads of State of all seven IGAD countries in October 2003.

Accomplishment will depend on the extent that the following principles can be realized:

- strengthening essential policies, legal and institutional frameworks at national levels;
- improving early warning and information systems;
- building capacity and undertaking training in disaster management;
- increasing public education and raising awareness;

- establishing linkages between national systems and subregional capabilities;
- demonstrating functions that add value to subregional mechanisms; and
- integrating gender issues into subregional disaster management strategies.

From its inception, IGAD has recognized the importance of developing a viable early warning system. As efforts proceed, information is being consolidated to provide more dimensions to the social and economic consequences of risks. As the early warning information system is being strengthened, it currently includes a combination of market and food prices on the Internet, reports about food production prospects and requirements, as well as the use of remote sensing technology to monitor the behaviour and pattern of rainfall and biomass production in the region.

In order to strengthen sustainable institutional frameworks, the Drought Monitoring Centre in Nairobi (DMCN) has become an integral part of IGAD's subregional early warning system. Its work is supplemented by efforts of USAID's Famine Early Warning System Network (FEWSNET); FAO's Global International Early Warning System (GIEWS); WFP's Vulnerability Assessment and Monitoring programme (VAM); and the field work of the UN Office for the Coordination of Humanitarian Affairs (OCHA) in continuously assessing the food prospects and needs in the subregion.

In terms of regional cooperation in the meteorological data exchange and sharing, DMCN receives inputs from most of the global and subregional programmes. These are concerned primarily with seasonal rainfall forecasting, and the analysis is integrated into its own seasonal rainfall forecasts.

Such consensus seasonal rainfall forecasts are issued publicly in workshops, the Greater Horn of Africa Climate Outlook Forums, held on a rotating basis among the countries of the subregion. Participants include a variety of both technical and policy stakeholders and users of the information.

Climate specialists are drawn from the region as well as from other regional and international institutions, and participating hydrologists, water managers and water users represent both governmental and private sector interests. Farmers, public health officials, disaster managers, and commercial representatives are included as primary users of the information, with members of the media participating as key communicators. External and technical agencies such as WMO, the US Geological Survey (USGS), US National Oceanic and Atmospheric Administration (NOAA), USAID, FAO, UNEP provide additional support to subregional programmes.

The dissemination of the forecasts is accompanied by a basic interpretation of the potential impacts of the seasonal outlook. While particular attention is given to the possibilities of drought and floods, the implications for public health, hydropower generation, communications and other sectors are also conveyed.

The workshops are generally preceded by a one or two day media and users workshop to increase the familiarity with meteorological terminology. National workshops with similar participation are conducted immediately after the subregional forums.

After the initial presentation of the seasonal forecasts at the forums, subsequent DMCN monthly bulletins update the seasonal outlooks. Together with regular WMO communications, the process associated with these climate outlook forums has proven to be very useful in raising the understanding and the anticipation of potentially hazardous flood and drought conditions in the region.

Additional work is anticipated to link warning capabilities to disaster management activities in the subregion, based on a network that can facilitate the collection, synthesis and dissemination of data and information between local, national and subregional levels of interest. Efforts will concentrate on the wider application of advanced technologies, using more Internet-based information sources including those drawing from remote sensing. It will be important to establish technical teams to integrate data for planning and decision-making, as well as building a more permanent basis for continuous learning and a viable operational network.

Parallel activities are envisaged within IGAD's agricultural production systems. The authority has

produced a scheme to manage crop production system zones. This valuable activity will conduct detailed evaluations of seasonal crop production estimates using satellite technology, used in conjunction with GIS technology.

Southern Africa

Until the early 1990s, perceptions of risk in the region were shaped predominantly by armed conflicts and their destabilizing consequences. Unlike institutional developments in some other regions of the world, the first political engagements with natural disaster reduction in Southern African countries were driven by the protracted ravages of drought or the disruption of livelihoods caused by these other emergencies.

There are now a number of regional disaster reduction initiatives in place, with their antecedents dating back to the 1980s. Then, the Southern African Development Coordination Conference (SADCC) had as one of its priorities the diversification of transportation and communications throughout the region.

To reduce the dependence of landlocked countries on South African infrastructure, major investments were made to improve regional road and rail links. These were considered vital to the growth of struggling economies and crucial for the movement of food and relief supplies across the region in times of drought, conflict or other emergencies.

By recognizing the strategic importance of food security, SADCC also made the subject a priority sector for regional coordination. To this end, it established the Regional Early Warning Unit which consolidated crop information provided by national early warning units of the countries and monitored trends in regional food security. SADCC mechanisms played key roles in assessing and managing risks by establishing systems for early detection and response to possible food shortages.

Other political, social, economic and environmental changes have continued to shape the risk landscape in Southern Africa. Many segments of the rapidly growing population remain without acceptable levels of social services or sufficient economic opportunities. These conditions are compounded by the rapid and often insufficiently planned growth of African cities and their increasingly concentrated populations.

The countries of the region already know they can expect more hazards in the future. Since the floods that affected much of the region in 2000-2001, there is a growing recognition in official quarters of a much wider range of sudden threats. There also continues to be the possibility of more intense examples of slow emerging conditions of drought and disease, exacerbated by variations in climate, increasingly fragile natural environments, and persistent impediments to national development that affect human livelihoods.

Southern African Development Community

Concerns have provoked recognition at the highest political levels of the pressing need to focus on regional cooperation and to allocate more resources to risk reduction. As SADCC's successor, the Southern African Development Community (SADC) comprises 14 member states extending south from the Democratic Republic of the Congo and Tanzania. With a collective population of approximately 200 million, SADC members are: Angola, Botswana, the Democratic Republic of the Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, United Republic of Tanzania, Zambia and Zimbabwe.

While the overall purpose of the regional political community is to foster the economic integration and the promotion of peace and security among member countries, SADC is devoting progressively more attention to issues of public vulnerability, regardless of whether potential disaster threats result from climatic hazards, conditions of poverty or disease.

As its technical engagement in disaster reduction has continued to evolve SADC has been working to develop disaster management as a regional priority, with the establishment of an Ad Hoc Working Group on Disaster Management in 1999. An Extraordinary Summit for SADC Heads of State and Government was convened in Maputo, Mozambique in March 2000 to review the impacts caused by the floods across the region. At this summit, representatives of the SADC

countries expressed the need for improved institutional arrangements for disaster preparedness and management of similar risks in the future.

In May 2000, the SADC Sub-Sectoral Committee on Meteorology meeting was convened. There, the directors of the national meteorological and hydrological services (NMHS) in the SADC countries recommended that a regional project be formulated to address and strengthen the local capacities of national meteorological and hydrological services for early warning and disaster preparedness.

A month later, the SADC Committee of Ministers for Water recommended that a strategic and coordinated approach be developed to manage floods and droughts within the region. By the end of 2001, SADC had developed and approved a multisector disaster management strategy for the region, and the SADC Water Coordination Sector drafted a Strategy for Floods and Drought Management in the SADC Region.

Meanwhile, SADC leaders were spurred on by the severity of the floods earlier in the year which revealed inadequate disaster management linkages among the nine countries affected. By August 2002, the SADC Council of Ministers approved an overarching SADC Disaster Management Framework. This called for an integrated regional approach to disaster management, and it established a full Technical Steering Committee on Disaster Management.

While the political process has since proven to be sporadic, there are some instances in which efforts are proceeding to reduce risk and to focus more attention on anticipating, mitigating and responding to sudden-onset hazards. Moreover, some of the governments in the region are proceeding to revise their own disaster legislation to place greater emphasis on natural disaster risk.

Several of SADC's key technical units play critical roles in disaster reduction. The SADC Food, Agriculture and Natural Resources directorate (FANR) oversees regional food security issues and several other programmes related to the management of natural resources. The Food Security Programme and related Regional Early Warning Programme provide member states and the international community with advance information on food security prospects in the region. This includes providing information about food crop performance, alerts of possible crop failure and other factors affecting food supplies.

The unit also conducts assessments covering food supply and demand, and makes projections on related matters such as food imports and exports, the identification of areas or affected populations threatened by food insecurity, as well as threatening climate conditions that could trigger food insecurity. The FAO has long supported FANR with data from GIEWS, among other information.

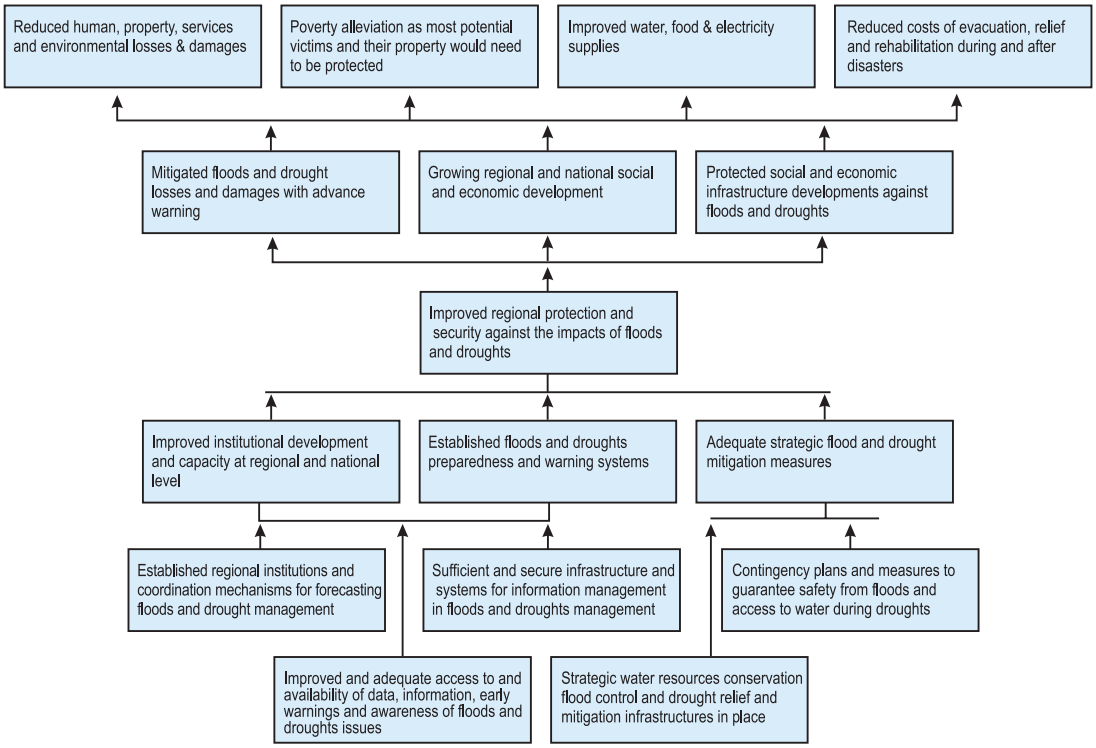
The SADC Regional Remote Sensing Programme collaborates closely with the Regional Early Warning Programme by working to strengthen national and regional capabilities in the area of remote sensing and GIS applications. It offers a range of specialized services for use in early warning for food security and natural resources management, including training agro-meteorologists in the use of satellite imagery products. It is also used to monitor and map land-use patterns, land degradation and desertification conditions.

Despite the specific nature of its name, the SADC Drought Monitoring Centre (DMC) located at the Zimbabwe Meteorological Service has a primary responsibility to monitor climate extremes, especially as they relate to droughts and floods. By working closely with the national meteorological and hydrological services in the region, and with technical support from WMO, the centre generates highly regarded seasonal rainfall forecasts.

It also produces climate analysis and information including regional climate data, synoptic reviews and weather outlooks, semi-processed global ocean-atmospheric data, monthly and seasonal forecast updates, and a ten-day drought watch for the SADC region.

DMC coordinates the Southern Africa Region Climate Outlook Forum (SARCOF) every year. Beyond playing a crucial role in forecasting seasonal rainfall, SARCOF has proven to be a useful process that extends climate analysis and training practices to an expanding range of multisectoral users in Southern Africa.

Figure 3.1
Southern African Development Community strategy for floods and drought management in the region



Source: SADC Water Sector Coordination Unit, 2001.

The centre provides opportunities to develop the technical and analytical abilities of staff, drawn from meteorological and hydrological services in the region through a secondment programme. It also manages meteorological and climate databanks for the region.

SADC programmes in water resources, environment and land management all have crucial roles to play in developing policies that take account of risk in their respective areas of expertise in all SADC countries. These include a number of projects related to land-use practices and conservation of environmental conditions, which can reduce both flood and drought-prone conditions.

Various SADC programmes also relate to the risks posed by climate change, and this places it in the forefront of inter-agency cooperation and collaboration to reduce the risk of future hydrometeorological hazards.

The water sector has long given attention to the development of cooperative agreements on shared river basins, but the floods of 2000 and 2001 underlined the need for greater attention to regional flood risk, in addition to recurrent drought. The need for inter-state cooperation associated with water-related hazards is particularly acute as there are more than ten shared watercourses in the region, with the largest, the Zambezi River flowing through nine countries.

The successful implementation of the SADC disaster reduction strategy rests on interaction between different technical and administrative networks across Southern Africa. In May 2001, an integrated Strategy for Flood and Drought Management in SADC countries was approved for implementation over a four-year period. The strategy focuses on preparedness and contingency planning, early warning and vulnerability information systems, mitigation measures, response activities and recovery strategies.

The process involves regular consultations through which the national directors of disaster management, early warning, meteorological and water authorities meet with SADC counterparts to monitor progress and address impediments to reduce drought and

flood-related disasters. This process has been assisted by USGS support for the development of flood and drought maps for the region.

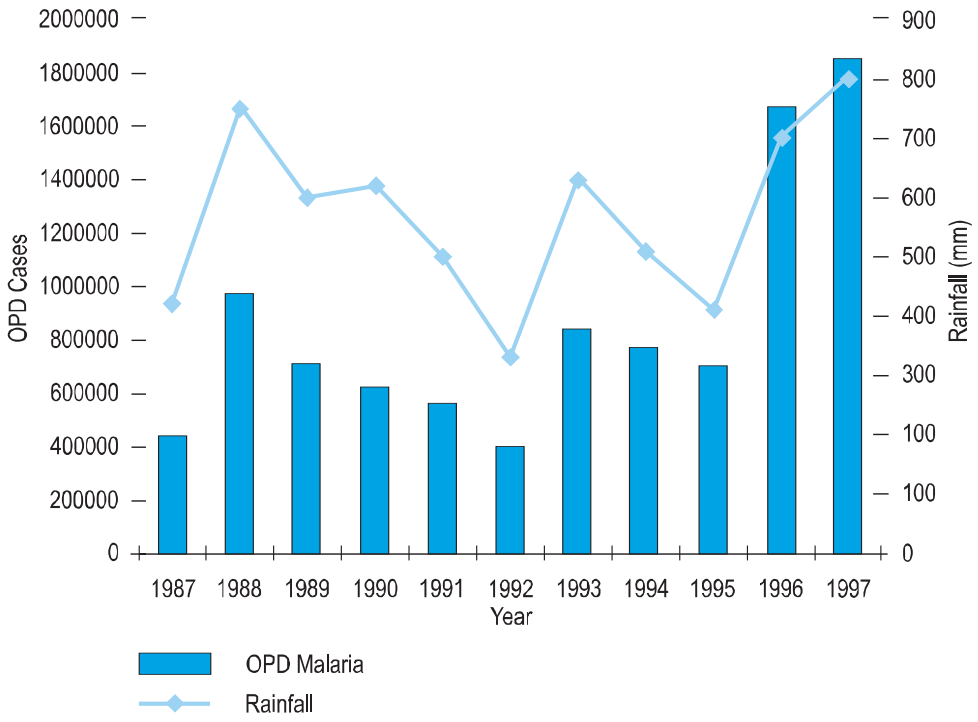
Another example of regional technical cooperation is demonstrated by the coordinated use of 50 real-time data collection stations installed in 11 countries under the SADC Hydrological Cycle Observing System. These stations and the information they gather are expected to make major improvements in the availability of data for trans-boundary hydrological information for flood forecasting. This European Union funded project is implemented by SADC in association with the national hydrological services of the participating countries.

In addition, the Zambezi River Authority (ZRA) was established by Zambia and Zimbabwe in 1998 to coordinate their decisions on water use, power generation, as well as upstream and downstream risk consequences of their water management policies.

Following the 2000 floods, the ZRA formed a Joint Operations Technical Committee with Hidroeléctrica de Cabora Bassa in Mozambique to share data and technical information about the operations of the Kariba and Cabora Bassa reservoirs. Cooperation is furthered by a weekly exchange of data and monthly meetings during the critical rainy season.

SADC's health sector works closely with the WHO Inter-Country Office for Southern Africa; WHO has long recognized the public health consequences of disasters. The WHO Southern Africa Malarial Control Programme addresses the causative factors of hazards in creating epidemics. The very close correlation that exists between temperature, precipitation and the incidence of malaria in specific locations underlines the essential cooperation between all sectors relating to water, climate, land, environment, health and disaster risk management.

Figure 3.2
A comparison of rainfall and malaria by year in Zimbabwe



Source: WHO Southern Africa Malarial Control Programme, WHO Inter-Country Office for Southern Africa, Harare, Zimbabwe.

West Africa

The Economic Community of West African States

The Economic Community of West African States (ECOWAS) is composed of 16 countries with the objective of promoting cooperation and integration leading to an economic union in West Africa. The community of interests has progressed in phases to implement its agenda, leading from the foundation of its organizational structures and related protocols, through efforts in conflict management to a current focus on regionalization activities.

Against this background, environment and natural resource management issues pertaining to risk factors cover four areas in ECOWAS. There are regional meteorological and water resource management programmes, subregional programmes for desertification control, and a programme to control floating weeds.

The meteorological initiative is supported by the Global Environment Facility (GEF) and the African Development Bank (AfDB) with recent activities focusing on revising regional applications of meteorological programme applications in environmental management and agricultural sectors. Attention has also been given to monitoring the implementation of the METEOSAT information and data communications project in member states.

There is presently no subregional activity on natural disaster reduction nor a consolidated regional strategy of risk management activities designated as such within the programme portfolio of the ECOWAS Secretariat. The subregional programme for desertification control of the Subregional Action Programme for West Africa essentially functions as a disaster reduction and risk management initiative, but it is not regarded as such by the ECOWAS Secretariat. However discussions were initiated among some ECOWAS members late in 2003 about the possibly desirability of formulating a regional strategy for disaster risk reduction.

Both the desertification control and the meteorological information programmes offer possibilities for the inclusion of any future subregional disaster reduction initiatives that may be devised. There are also elements in the ECOWAS organizational framework that would allow for the development of a comprehensive disaster reduction and risk management initiative, such as a protocol relating to the mechanism for conflict prevention, management, resolution, peacekeeping and security.

There are other activities which can provide some associated benefits and collaboration to the management of risk issues throughout the area, despite their largely singular concerns. Some of these are outlined below.

The Sub-Regional Action Programme to Combat Desertification in West Africa and Chad provides a strategic and programmatic framework for integrating any disaster reduction and risk management initiatives into poverty reduction, environmental protection and sustainable development planning in the subregion. It also provides a basis for cooperation among various inter-governmental organizations, such as the West Africa Economic and Monetary Union, CILSS and the Niger Basin Authority.

Other subregional technical institutions that could be involved in this process are ACMAD in Niamey, Niger and AGRHYMET, also located in Niger. These institutions provide a basis for the engagement of scientific and technical hydrometerological inputs to disaster reduction and risk management strategies in the subregion. Their activities contribute to fulfilling roles similar to those provided by the Drought Reduction Centres in East and Southern Africa.

The Sahel Institute in Bamako, Mali and both the Regional Remote Sensing Centre and the African Centre for Studies on Rural Radio located in Ouagadougou, Burkina Faso, are other examples of subregional institutions pertinent to disaster risk management in West Africa. Unrealized opportunities remain, that could be augmented by international organizations and UN agencies, to link these various institutional and technical capabilities for a more structured regional approach to monitor hazards to reduce disaster risks in West Africa.

Despite its seeming distanced subject, the ECOWAS Ceasefire Monitoring Group could provide a system of potential strategic and

contingency planning, communications, information and operational capabilities that could serve as a backbone for any eventual subregional disaster reduction and risk management initiatives.

It could provide the principles for collaboration in areas including early warning, disaster management focused at both subregional and national levels. It could be employed to encourage a consistent approach to coordinating national disaster management strategies or allocating resources. In terms of potential, such a force capability in West Africa is an advantage not equally evident in other African regions.

In this respect, ECOWAS is currently developing communication and information management capability for early warning and other shared information needs in collaboration with external partners. It is also anticipated that ECOWAS will play a leading future role in the implementation of the New Partnership for Africa's Development (NEPAD), where growing involvement with environmental management can provide a relevant link to risk management in practice.

Asia

In contrast to Latin America and the Caribbean and responding to different conditions than those in Africa, regional collaboration in Asia stems less from the consequences of a single devastating disaster. Rather, it results more from shared outlooks emerging from various professional interests.

It is difficult to identify a single approach to disaster risk reduction among the many cultural, social, and political distinctions in Asian societies. Yet, there is a clear movement to identify and address disaster risks. People involved in wider issues of development are emerging as potential collaborators in reducing disaster risk. These include policy makers involved in environmental management, climate variation, natural resource utilization, regional planning, the construction or protection of infrastructure, education, communications and public administration.

In many of the examples reviewed here, a growing involvement with risk issues is a feature of regional forums that previously adopted more narrow concepts of crisis or in some cases may not have discussed risk in explicit terms.

A multi-donor funded partnership to mitigate natural hazards in central Viet Nam brings government agencies together with international and regional NGOs to address the issues of disaster risks at both national and district levels. The partnership tackles such concerns as disaster preparedness, water resource management, community relocation and rehabilitation, environmental management and livelihood issues of vulnerable communities through specific projects.

Over the past several years, a Regional Consultative Committee on Regional Cooperation in Disaster Management (RCC) has been convened by the Asian Disaster Preparedness Center (ADPC) with support from the Australian Agency for International Development (AusAID). The committee comprises heads of national disaster management authorities from 24 countries in Asia.

Members have endorsed the importance of the RCC as a forum to exchange information and experience regarding national disaster risk management systems. Annual meetings held in 2000, 2001 and 2002 addressed capacity-building and reviewed experiences of new legislation, policy and institutional reform, and related planning processes.

These meetings recommended more information exchange to enable countries developing new or modified legislation or institutional arrangements to learn from the experiences of others in the region. Countries were also encouraged by other's examples to develop disaster risk management plans at national, provincial and local levels. Through these actions, the RCC has served to consolidate and strengthen regional initiatives, even though the various priorities and interests of the individual countries may vary.

The second RCC meeting urged countries to adopt a total disaster risk management strategy that would represent "a comprehensive approach to multi-hazard disaster risk management and reduction, which includes prevention, mitigation and preparedness in addition to response and

recovery". The following areas of action were identified:

- developing community programmes for preparedness and mitigation;
- building capacity within national disaster management systems;
- promoting cooperation and enhancing the mutual effectiveness of programmes of subregional organizations, such as those of the Association of South East Asian Nations (ASEAN), the South Asian Association for Regional Cooperation (SAARC), the South Pacific Applied Geoscience Commission (SOPAC), the Mekong River Commission (MRC), and the International Centre for Integrated Mountain Development (ICIMOD); and
- creating awareness and promoting political commitment through regional initiatives.

The 2002 meeting was attended by the heads of national disaster management offices of 23 Asian countries and included a special session about drought management and mitigation in Asia. The meeting endorsed the adoption of comprehensive disaster management approaches by all member countries and called for capacity-building programmes catering to different audiences.

Information on these and other initiatives as well as the experiences of several countries in the region were shared in regional workshops on institutional frameworks and planning for disaster risk management. One, organized in Bangkok in April 2002 by ADPC with the support of the European Community Humanitarian Aid Office (ECHO), OFDA/USAID and the Asian Development Bank (ADB) provided additional opportunities to establish links and develop relationships among individuals and institutions involved in disaster risk management planning in the region. Another conducted under the auspices of the Asian Urban Disaster Mitigation Program in Bali, Indonesia in October 2002 reviewed the accomplishments and the new organizational and operational relationships that have been developed over the past seven years of disaster risk reduction activities in ten countries.

The Asian Disaster Reduction Centre (ADRC) is a multilateral organization for disaster reduction based in Kobe, Japan. Composed of 23 member countries plus four additional advisory countries, ADRC engages focal points in participating governments to facilitate the exchange of information. It strives to identify acute needs and to develop human resources dedicated to disaster reduction.

ADRC also works with other disaster management organizations engaged in Asia, such as OCHA, UN Centre for Regional Development (UNCRD), ADPC, and OFDA/USAID. It conducts studies and encourages research that will contribute to putting disaster management technologies to practical use. This includes the use of geographic and satellite information systems. It also maintains a web site of products and techniques that are useful for disaster reduction practices such as methods for structural reinforcement against earthquakes and preventing landslides.

ADRC provides financial and technical support for activities and disseminates beneficial experience around the world. By using these tools and based on specific requests, it has launched cooperative projects to develop disaster risk management capacities of its member countries. These projects include the promotion of educational programmes to develop disaster reduction capacities, (community-based flood disaster mitigation project in Indonesia, school educational programme for disaster reduction in the Philippines); and activities that increase professional skills (urban search and rescue training in Singapore).

The centre also encourages operational analysis and the circulation of technical knowledge by inviting visiting researchers from member countries to ADRC, and by conducting short-term visitor training programmes.

Regional cooperation is promoted further by ADRC's management of an information database on natural disaster reduction in Asia. With a particular focus on matters of legislation, disaster management, training and country reports, the web site shares lessons for disaster reduction among Asian countries.

ADRC organizes international conferences and workshops to discuss the status of disaster reduction activities in Asia. In 2002, it held the

Fourth ADRC International Meeting in New Delhi, followed immediately by a second meeting of the same regional participants to discuss ISDR involvement in Asia. Later in the year, ADRC and OCHA jointly conducted the Regional Workshop on Networking and Collaboration among NGOs of Asian Countries in Disaster Reduction and Response, in Kobe, Japan.

The Fifth ADRC International Meeting was convened in Kobe, Japan in 2003 where particular emphasis was given to reviewing the achievements and challenges in disaster reduction in Asia as a basis to develop the paradigm of related regional and international cooperation further. This series of annual meetings continues a process to build disaster reduction capacities and the evolution of guidelines that can improve its effectiveness in Asia, in the process serving as a contribution to the review of the *Yokohama Strategy and Plan of Action for a Safer World*.

With common objectives but different emphasis, both ADPC and ADRC have cooperated with OCHA to organize consultative meetings involving regional institutions, UN agencies and multilateral development assistance organizations. Such meetings were held in Kathmandu in 2001 and Bangkok in June 2002.

This second meeting discussed emerging international partnerships for reduction of risk and vulnerability to natural hazards with additional partners in the region focused on total disaster risk management. These included the longstanding interaction with UNDP and IFRC, and also marked the productive relationships maintained with the USAID Regional Office in Manila and the European Commission's regional Disaster Preparedness ECHO (DIPECHO) programmes based in Bangkok, among others.

ADRC maintained other interests in regional cooperation for total disaster risk management with the Asian Development Bank, the International Institute of Disaster Risk Management (IDRM), Emergency Management Australia (EMA), ICIMOD and ASEAN.

The ASEAN Secretariat is another regional institution that has linked disaster risk issues with other programme interests. The ASEAN Secretariat and member countries have reached an advanced stage of planning for disaster management. With technical support from ADPC and additional assistance from the European Union they have developed a new ASEAN Regional Programme on Disaster Management to guide cooperative action among the member countries in the following areas:

- planning and conducting joint projects;
- collaborating on research and encouraging networks among member countries;
- building capacities and developing human resources in areas of priority concern;
- sharing information, best practices, and disaster management resources;
- promoting partnerships among various stakeholders including government authorities, NGOs, community and international organizations; and
- promoting advocacy, public awareness and education programmes related to disaster management.

The ASEAN Regional Forum (ARF) is another platform composed of the ASEAN countries and 13 additional dialogue partners: Australia, Canada, China, European Union, India, Japan, Republic of Korea, Mongolia, New Zealand, Papua New Guinea, Russian Federation and the United States.

Under its umbrella, several groups have been established to promote cooperation in specific areas including disaster relief and marine search and rescue. Achievements of ARF include a series of training activities, developing a matrix of past cooperation in disaster relief among member countries, conducting an inventory of early warning systems and drafting guidelines for post-disaster responsibilities. Annual meetings have been held since 1997 and by drawing participation from senior levels of ministries of foreign affairs, defence, disaster management and others they have provided a unique platform to consider multiple aspects of disaster management.

Elsewhere in Asia, the South Asia Association for Regional Cooperation (SAARC) consists of seven member countries: Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. At a meeting of the SAARC Technical Committee on

Environment, Meteorology and Forestry in January 2002, reference was made to "the need for mechanisms to promote capacity-building and technology transfer to support natural disaster management".

It was further stressed that together with concerns about the negative impacts which climate change exerts in the region, a common South Asian position should be developed on these issues in international forums.

At the 11th Summit Meeting of SAARC held in Kathmandu in 2002, the consensus view was that "the Heads of State or Government felt a strong need to devise a mechanism for cooperation in the field of early warning, as well as preparedness and management of natural disasters, along with programmes to promote the conservation of land and water resources".

As all SAARC member countries are exposed to similar hazards, they have much operational experience in disaster risk management that could be exchanged. Possibilities include the sharing of more information in training, operational and technical professional information. Other initiatives could further the exchange of government officials, and more coordination in policy formulation and implementation, especially in efforts to reduce risks associated with trans-boundary hazards and to increase operational cooperation in disasters that affect neighbouring countries.

There are other technical frameworks in Asia that focus increasing attention on the consequences of natural hazards. As climate has become accepted as a major determinant in contributing to recurrent risks, the meteorological services of the region have worked in close partnership with an increasingly wide range of sectoral agencies. The unprecedented breadth of impacts associated with the El Niño/La Niña events during 1997-1998 across South East Asian countries underlined the need for effective and continuing risk assessments.

The application of seasonal climate forecasting is now considered increasingly as an integral part of comprehensive risk management. Regional institutions such as ADPC have also become more involved in working with national agencies and technical institutions to study the impacts of past extreme climate events in order to anticipate and mitigate the impacts of future occurrences.

In May 2002, a two-week training course on the applications of climate information was organized jointly by ADPC and the Thai Meteorological Department. It brought together, for the first time, meteorological forecasters, water resource managers, agriculture sector managers and food logisticians. The participants assessed the risks posed by climate variability in the region and worked to develop strategies to minimize those risks.

Such activities illustrate a movement towards the introduction of risk management concepts in other resource management sectors beyond traditional or singular disaster management organizations.

International relationships at the regional level are a key requirement in the development of effective flood early warning systems as rivers pass from one country to another. The development of expanded institutional capacities of the Mekong River Commission (MRC) over recent years is another fine example of good regional cooperation. The MRC has developed a long-term flood management programme that was given impetus by the devastating floods of 2000 in the Mekong Delta.

The programme reflects the priorities identified by MRC member countries and is being implemented by them over the six-year period, 2002-2008, in association with their respective national disaster management agencies and NGOs active in the region. Activities include flood emergency management and mitigation projects, land-use management, transboundary flood issues and the dissemination of early warnings.

Although there is a system for tracking river levels, there is still no proper early warning system that will provide information to disaster-prone populations, and there is no centralized information centre. To address this and other issues, the UN Disaster Management Team in Cambodia is currently supporting the development of a regional network for disaster management and mitigation in the Mekong countries. This is to reduce the vulnerability of the poorest residents to the negative impacts of disasters and to protect broad based development gains.

Cambodia response to ISDR questionnaire, 2001.

Box 3.14
Challenges for regional interaction in Asia

- Tunnel vision that considers risk awareness marginal and places greater importance on political visibility in responding to disasters that have occurred.
- Different constituencies and mandates pertaining to various sectors of disaster risk management.
- Scarcity of resource allocations for risk reduction in contrast to emergency response.
- Weak or inconsistent use of dynamic risk assessments in national development strategies.
- No single umbrella organization representative of regional interests and priorities related to disaster risks.
- Lack of awareness, policy or economic motivation to include disaster risk impact analysis in project designs.
- Different, overlapping or overlooked geographical coverage of countries where donor interests are concerned.
- Lack of programmatic mechanisms for matching regional providers with local needs – decisions often influenced more by political affinities than potential disaster risks.
- Nationalist motivation or competing initiatives and duplication among donor interests.
- Bilateral versus multilateral initiatives, donor or supply-side influenced projects.
- National policy objectives contrasting with broader regional collaboration.
- Insufficient working-level cooperation and knowledge transfer, duplication of information collection and dissemination.
- Limited opportunities for dialogue on a regional level. Lack of structured communication and knowledge of other agency programmes.

The extent of cultural variation and political diversity across Asia can work against regional cooperation. However, at least some of these limitations can be overcome, or measures taken to resolve them if the international donor community and regional organizations alike work towards a more consistent understanding that accords disaster risk reduction an explicit and visible role in development strategies (see box 3.8).

The extent of cultural variation and political diversity across Asia can impede regional cooperation. However, by focusing on common interests through a more coherent approach pursued by the international donor community and regional organizations, disaster risk reduction can assume a more distinctive and visible role in development strategies.

Pacific small island developing states

The management of disasters is widely recognized in the Pacific as a national concern, although in a reflection of deeply held cultural attributes, it is equally understood that strengthening regional linkages and fostering a sense of common purpose improves overall disaster and risk management capabilities for all.

The similarity of hazards that Pacific small island developing states (SIDS) face, the shared problems they experience, and a generally common approach adopted in their institutional arrangements have provided a fruitful basis for regional cooperation.

Regional organizations have buttressed these attributes further by working through the principles of partnership in development efforts in the individual Pacific SIDS. Regional cooperation also has been demonstrated by the multilateral and bilateral technical assistance organizations that have long been active in disaster relief and rehabilitation work in the region.

During the past 25 years though, people in the Pacific have displayed a consistent regional approach of transforming policy objectives, public understanding and practical implementation related to disaster management. This has proceeded from the prior concentration on the needs for urgent disaster assistance during a crisis, to the ongoing identification and management of risks experienced by local communities, integrated into overall national development strategies.

The emphasis has changed now to a more proactive approach of increasing awareness about natural hazards and preparing for them. The major challenge in this respect for the Pacific region has been to formulate and implement strategies to reduce community vulnerability. Throughout the region, governments have been encouraged to develop risk reduction strategies and local communities are becoming motivated through ongoing and consistent public education campaigns.

There has been an admirable progression of well-structured programmes for disaster risk

management in the Pacific. Throughout, it has been guided by the political practice of regional consensus, with each stage championed by respected regional organizations. The consistency of approach and continuity that has been provided by national, regional and international partners alike has been a hallmark of successful regional collaboration.

During the 1980s, the Office of the UN Disaster Relief Coordinator (UNDRO) supported disaster preparedness and response activities in the Pacific by providing technical and financial assistance for disaster management seminars, workshops and planning exercises. In October 1990, a South Pacific Programme Office (SPPO) was established in Suva, Fiji to act as the coordination centre for these activities.

During the next ten years SPPO evolved in response to altered UN organizational responsibilities, successively pursued by the UN Department of Humanitarian Affairs (UNDHA), and then by UNDP South Pacific Office (UNDP-SPO). Their joint and proactive approach created the evolution of a regional strategy known as the South Pacific Disaster Reduction Programme (SPDRP) which had two phases: from 1994-1997 and 1998-2000. This sustained common effort greatly aided the development of individual national plans for disaster risk management.

During much of the 1990s SPDRP pursued objectives to:

- strengthen human resources and institutional capacity to manage the effects of natural disasters effectively and rapidly;
- provide appropriate technical support materials for disaster management at all levels of responsibility;
- establish a disaster management information system;
- achieve an acceptable and sustainable level of regional cooperation and collaboration;
- empower communities to reduce their vulnerability to natural disasters;
- establish training capacities at regional and national levels;
- increase national capabilities through mitigation measures and development activities; and
- strengthen sustainability through improved regional and national coordination and mutual support.

Activities were clustered under six related programme components that provided a uniform and consistent focus throughout the region:

- in-country training and technical assistance;
- regional training;
- disaster mitigation activities;
- development and use of regional support materials;
- information management; and
- regional cooperation and coordination.

Although SPDRP was planned and coordinated on a regional basis, much of the activity was demonstrated by individual Pacific island states. The collective programme provided a mechanism for international donors to target assistance for the region that avoided duplication of effort and inter-agency competition. Support was channelled through SPDRP by Australia, China, Germany, Japan, Netherlands, New Zealand, United Kingdom and United States.

An integral part of the SPDRP was the Pacific regional IDNDR programme, greatly facilitated by the Australian National Coordination Committee for IDNDR, which funded 31 country projects. It also supported several other regional projects, conducted both regional and international meetings and maintained an active programme to disseminate information.

By a decision taken by all the Heads of State through the Pacific Forum, a Disaster Management Unit was established within the South Pacific Applied Geoscience Commission (SOPAC-DMU) in July 2000. SOPAC-DMU was created to provide an institutionalized regional approach to disaster risk management while drawing upon the accomplishments of SPDRP from the 1990s.

The annual Pacific Regional Disaster Management Meetings and other activities initiated by SPDRP continue in the SOPAC-DMU programme. Information is disseminated regularly through the publication of quarterly SOPAC-DMU reports and a newsletter. Other major efforts continue to engage the commitment of international agencies and to develop expanded partner relationships through formal memorandums of understanding with foreign

In the South Pacific, a risk assessment project, known as the Pacific City Project, is being implemented by the South Pacific Applied Geoscience Commission (SOPAC) in the capitals of Pacific small island developing states. The project was originally based on earthquake related hazards, but it will now be extended to include other hazards. A micro-zoning map is now in place for the seismic hazard maps.

Tonga response to ISDR questionnaire, 2001.

government agencies and international institutions.

The goal of SOPAC-DMU is to strengthen national disaster management programming capacities and to integrate risk management practices within the economic strategies of countries in order to achieve long-term community resilience.

The current strategy for improving Pacific regional collaboration rests on two primary objectives: to establish a highly functional coordinating body (SOPAC-DMU), and to strengthen the capacity of national risk officials to accomplish effective disaster management programmes domestically.

This will be implemented through the Comprehensive Hazard and Risk Management (CHARM) programme, a comprehensive strategy based on sustainable hazard and risk management. The approach is based on the Australia/New Zealand Risk Management Standard and will allow Pacific island states to clearly identify, prioritize and then manage community risks. It also seeks to achieve greater effectiveness in disaster response and recovery practices.

It is expected that CHARM strategies will lead to a redefinition of national disaster management office (NDMO) responsibilities in a number of countries, as disaster risk management is integrated in government planning. Therefore, advocacy at senior levels of government and the involvement of professional development strategies are also priorities.

There are many government ministries and regional organizations undertaking risk management projects. Many of these are conducted in isolation, with little shared information which can lead easily to duplication. Officials need to have a comprehensive understanding of all the hazards and the risks that exist, together with an overview of projects being undertaken elsewhere in the region, if they are to have a clear picture of remaining needs.

The CHARM approach is based on coordinated efforts and familiarity with all risk-related projects that are underway and their respective linkages. By integrating a variety of professional disciplines from many different sectors CHARM works to assimilate risk awareness into the national planning processes. This process equally

Box 3.15
Progress in the Pacific

There has been admirable progress of well-structured programmes for disaster risk management among Pacific small island developing states (SIDS). Programmes are guided by regional consensus and championed by respected regional organizations:

- From 1990-1999, IDNDR provided a common purpose and an international structure to address a shared need for disaster reduction across Pacific SIDS.
- In 1993-1994, Pacific SIDS developed a common programme on Natural Disaster Reduction in Pacific Islands Countries, presented at the World Conference on Disaster Reduction in Yokohama, Japan, 1994.
- From 1994-2000, UNDP South Pacific Office supported the South Pacific Disaster Reduction Programme (SPDRP), which proceeded in two phases from 1994-1997 and 1998-2000.
- A tripartite review conducted by the UN Department of Humanitarian Affairs-South Pacific Office (UNDHA-SPO) and SPDRP, led to a Regional Disaster Management Framework being formulated in September, 1997.
- The Alafua Declaration was adopted by the Pacific Islands Forum in September 1999 to institutionalize a collective regional strategy for disaster reduction.
- In July 2000, the South Pacific Applied Geoscience Commission-Disaster Management Unit (SOPAC-DMU) replaced SPDRP.
- With the design and official endorsement of a Regional Programme Plan, SOPAC-DMU embarked on a three year implementation process from 2001-2004.
- Future directions will be guided by the innovative Comprehensive Hazard and Risk Management (CHARM) project, an integrated risk management framework and practice to manage unacceptable risks in Pacific SIDS, in the context of national development planning, encompassing both regional and individual country initiatives.

needs to be supported by developing skills, training continuously and advocating for risk reduction measures to be implemented.

In order to institutionalize these principles by translating concepts into activities, CHARM has identified the following strategic elements:

- *Creation of a regional CHARM development strategy*
  As a new concept, CHARM requires investment in the professional development of senior officers from stakeholders' agencies. It also requires close collaboration with the region's traditional donors and other regional organizations.
- *Foster national development strategies*
  With linked programmes that can optimize technical assistance and future planning, CHARM provides an inter-agency basis for sustained commitments by government and non-government players.
- *Training*
  As CHARM will require time and the collaborative effort of all major stakeholders for it to be fully implemented, in-country training capacities need to be developed and strengthened to drive this process.
- *Strengthen information technology capabilities*
  A critical factor is to ensure that NDMOs throughout the region are equipped with human and technical capacities to manage multidisciplinary information resources. This will require appropriate technological tools and computer-based information and communication systems.

Another example of regional collaboration elsewhere in the Pacific has been driven by a specific intention to assess the potential effects of climate change and variability on the US-affiliated Pacific islands. The Pacific assessment was a regional contribution to the first US National Assessment of the Consequences of Climate Change and Variability, coordinated by the East-West Center in Honolulu, Hawaii.

It was accomplished between 1998-2000 through the collaboration of partners from the region and representatives from all US-affiliated islands; namely Federated States of Micronesia, Northern Mariana Islands, Hawaii, Marshall Islands, American Samoa, Palau and Guam.

The initiative sought to nurture the critical partnerships necessary to develop and use climate related information to understand and respond to the challenges and opportunities presented by climate variability and change. Based on extensive involvement of experts and stakeholders from diverse knowledge groups, the assessment combined research and analyses with dialogue and education.

In the end, the assessment was an exciting and highly interactive process involving more than 200 participants who were engaged through small discussion groups and two key workshops organized to encourage and accommodate widespread regional participation in research and dialogue.

Box 3.16
Comprehensive Hazard and Risk Management

The key elements of the Comprehensive Hazard and Risk Management (CHARM) process carried out in the Pacific are:

- identifying known hazards;
- analyzing each hazard against national development priorities;
- identifying vulnerable sectors in relation to hazards;
- identifying risks and determining the most appropriate ways to manage those risks within realistic time and resource frameworks;
- identifying what activities or projects are already being implemented or proposed, both at the country level and by regional organizations;
- identifying programming gaps;
- identifying possible options for altered development priorities in light of impact scenarios; and
- determining lead responsibilities and agencies for managing the implementation of the risk reduction strategy.

"Disaster management is everyone's business. It is a fundamental component of individual, community, business, NGO and government safety and well-being. It is an essential pre-requisite for the achievement of community resilience and sustainable development. [To] ensure an integrated and sustainable approach to comprehensive hazard and risk management is achieved, a major function of the Disaster Management Unit will be to act as a coordinator to bring together major stakeholder groups representing regional, governmental, community, corporate and NGO interests. In this broker and facilitator role, the DMU will play a pivotal part in identifying, encouraging and assisting in disaster reduction and risk management activities throughout the region and within Pacific island countries."

Source: SOPAC, 2000; and SOPAC-DMU, 2001.

Box 3.17
Shared principles for adaptation to a changing climate in the Pacific

- Responding to climate variability is an information-intensive endeavour that requires a continuing dialogue among scientists and decision makers.
- Research results must be transformed into useful and usable information for any productive action to result.
- The effects of climate need to be considered on multiple, interacting sectors and activities of the society.
- Integrate science and decision-making across sectors and among the different levels of government responsibility.
- Address current deficiencies in reliable baseline information and island-specific vulnerability studies (one size does not fit all in either science or decision-making).
- Enhance and strengthen programmes of education, training and public outreach.
- Pursue proactive, forward-looking approaches, emphasize precautionary approaches that enhance flexibility and reduce the adverse effect of unanticipated consequences.
- Improve climate monitoring and prediction by integrating climate information, such as El Niño forecasts.
- Monitor changes in sea level, periodically updating inundation maps and related planning assumptions.
- Identify, evaluate and utilize more sustainable approaches to water resource management, agricultural practices, and other types of natural resource management activities including forests, wetlands and foreshores.
- Enhance consideration and integration of traditional knowledge and practices.
- Embed disaster risk management, preparedness and response activities in sustainable development planning processes.

The assessment supported exploration of climate vulnerability in a number of key sectors. In considering the challenges of ensuring public safety and protecting community infrastructure, a number of climate-related hazards of concern were identified. These included droughts, fires, tropical cyclones and other severe storms, floods, mud and landslide hazards, episodic high surf conditions, sea-level variation (on various time scales), and long-term sea-level rise (with coastal inundation hazards).

The full report documents the potential impacts, sensitivity and resilience in the context of providing access to fresh water, protecting public health, and ensuring public safety and protecting community infrastructure. It also looks at the economic and social considerations of climate change and variability in sustaining agriculture, tourism and promoting the sustainable use of marine and coastal resources.
<www2.eastwestcenter.org/climate/assessment>

Box 3.18
Implementing CHARM

There are several key principles for implementing the Comprehensive Hazard and Risk Management:

- Ensure ownership by the country;
- Ensure links with national strategic plans;
- Ensure harmony with existing systems;
- Ensure appropriate communication and consultation with communities, stakeholders, donors and development partners;
- Establish the principle that risk reduction is vital to national development and that CHARM is a powerful tool in the reduction of risk; and
- Ensure CHARM is promoted as a public safety tool, a risk reduction change driver, as cost-effective and as part of an agreed regional programme with donor support.

Europe

Risk reduction is not a subject that has yet stimulated a comprehensive institutional arrangement throughout Europe, although there are a number of individual initiatives which do contribute to increasing opportunities of collaboration within specific political or subject matter contexts. However, as severe climate events, and notably recent storms, floods and coastal pollution have occurred with considerable social and economic ramifications in a number of European countries, there may be growing political stimulus for more regional cooperation related to disasters. It remains to be seen, however, the extent to which more resources may be allocated for disaster risk reduction, in contrast to recovery and rehabilitation after social assets and critical infrastructure are destroyed.

The most significant example of European cooperation relating to hazards and risk management is the EUR-OPA Major Hazards Agreement of the Council of Europe, which has the objective of enhancing multidisciplinary cooperation between member states to ensure better prevention, protection and relief in the event of major natural or technological disasters.

This intergovernmental European Open Partial Agreement (hence, EUR-OPA) was established by the Council of Europe in 1987 and provides the opportunity for any other non-member state of the European Council to accede to its arrangements and terms for collaboration. As of August 2002, it had 28 members, including 14 Mediterranean countries (Albania, Algeria, France, Greece, Italy, Lebanon, Malta, Morocco, the Former Yugoslav Republic of Macedonia, Portugal, Spain, Turkey, Monaco and San Marino).

The agreement is conducted in collaboration with the European Union, other European institutions, such as the European Space Agency (ESA), and international organizations. Specialized UN agencies including the International Atomic Energy Agency (IAEA), the International Labour Organization (ILO), ISDR, OCHA, UNESCO, and WHO, as well as IFRC and NATO, are also affiliated. There are two aspects to cooperation: political, and scientific and technical.

Politically, decisions are taken by government ministers, following guidelines and priorities for action that are defined at ministerial sessions and transmitted to the Committee of Permanent Correspondents and its various sub-committees. A platform for concerted action and cooperation was formulated through these measures whereby countries were placed on an equal footing to designate representation from Europe for the Inter-Agency Task Force on Disaster Reduction (IATF/DR). This common approach also embarked on a comparative analysis of national legislation relating to risk management in Europe.

In the scientific and technical domain, research and coordination efforts are encouraged through the European Network of Specialized Centres. Twenty-three technical institutions share functions in research, training and expertise on different, but often linked issues of risk important to European and Mediterranean countries. The centres are situated in Western, Eastern and Central European countries, as well as in other countries that share the Mediterranean basin.

Several important recommendations for enhanced cooperation in matters of risk reduction were adopted at the Ninth Ministerial Session of the EUR-OPA Major Hazards Agreement in Bandol, France in October 2002. One called for the development of increased European-Mediterranean collaboration particularly through the exchange of information, and another identified the first phase of implementing risk reduction policies and procedures that could further ISDR objectives.

The major decisions taken are summarized below:

- Establish Euro-Mediterranean Synergy to strengthen disaster reduction and preparedness by establishing a network focusing on procedures and protocols for more online exchange of information and data concerning the occurrence and effects of disasters, as well as the use of uniform terminology and definition of risk management concepts. Risk assessment procedures and techniques likewise could be better harmonized to consider such areas as the stability of buildings and civil engineering works, and the safety of chemical, radiological and other hazardous facilities such as pipelines. Early warning systems for natural and technological hazards were similarly identified as areas for future commitments. Throughout, a common commitment was acknowledged that the agreement's undertakings must address the nature of hazards and their prevention and that all information, knowledge and scientific expertise should facilitate risk management decision-making.

- Association with the objectives and activities of ISDR was encouraged by calling for the establishment or consolidation of national programmes or platforms for disaster reduction in the Euro-Mediterranean region and that they be accorded recognition and support by national governments. The integration of risk management into planning and land-use policy was highlighted as having particular potential impact. While these and related measures could be pursued in cooperation with the Council of Europe and the European Commission, it was noted that it should also be developed with the support of the ISDR Secretariat, in particular for the benefit of developing countries.

- To further these intentions, interest was expressed in sponsoring a joint regional conference by EUR-OPA Major Hazards

Box 3.19
Major Hazards Agreement of the Council of Europe (EUR-OPA) Specialized Centres

European Centre for Disaster Medicine (CEMEC), San Marino promotes the prevention and mitigation of the effects of natural and technological disasters.
<http://www.diesis.com/cemec>

European University Centre for Cultural Heritage (CUEBC) in Ravello, Italy. CUEBC is an experimental laboratory that conducts scientific research and specialist matters. It is part of the European University for Cultural Heritage.
<http://www.cuebc.amalficoast.it/>

European Natural Disasters Training Centre (AFEM) in Ankara, Turkey. Its main goal is to reduce the destructive effects of hazards through research, training and education at all levels, from policy makers to field workers associated with disaster preparedness and response.
<http://www.europarisks.coe.int/afem50.htm>

European Centre for Prevention and Forecasting of Earthquakes (ECPFE), in Athens, Greece, is involved in all aspects of prevention as well as in the development of practical ways of managing earthquakes.
<http://www.europarisks.coe.int/ecpfe50.htm>

European Centre on Geomorphological Hazards (CERG) in Strasbourg, France. CERG is concerned with studying the major hazards associated with earthquakes and landslides.
<http://www.europarisks.coe.int/cerg50.htm>

Euro-Mediterranean Seismological Centre (CSEM) in Bruyères-le-Châtel, France. CSEM members are devoted to the promotion of seismological research.
<http://www.emsc-csem.org/> and <http://www.csem.bruyeres.cea.fr>

European Centre for Geodynamics and Seismology (ECGS), in Walferdange, Luxemburg, acts as a link between scientific research and its application to the prevention and interpretation of hazards.
<http://www.ecgs.lu>

European Centre on Training and Information of Local and Regional Authorities and Population in the Field of Natural and Technological Disasters (ECMHT) in Baku, Azerbaijan. It provides training and information of local and regional authorities in the field of major hazards.
<http://www.europarisks.coe.int/ecmht50.htm>

Euro Mediterranean Centre on Evaluation and Prevention of Seismic Risk (CEPRIS) in Rabat, Morocco. It works to develop a unified strategy and common frameworks for coordinating regional seismo-tectonic zoning and assessment of seismic hazards and risks in the Mediterranean region.
<http://www.europarisks.coe.int/cepris50.htm>

European Centre for School Training in Risk Prevention (CSLT) in Sofia, Bulgaria. It develops and promotes general and partial educational policies, training concepts and teaching methods in the field of risk prevention training in schools.
<http://www.bg400.bg/cslt>

Euro-Mediterranean Centre for Research on Arid Zones (CRSTRA) in Algiers, Algeria, conducts scientific and technical research programmes on arid zones and zones threatened with desertification and drought.
<http://www.europarisks.coe.int/crstra50.htm>

European Centre of Technogenic Safety (TESEC) in Kiev, Ukraine, is a scientific research and educational organization.
<http://www.europarisks.coe.int/tesec50.htm>

European Centre for Vulnerability of Industrial and Lifeline Systems (ECILS) in Skopje, the Former Yugoslav Republic of Macedonia. It promotes programmes for theoretical and applied research of urban vulnerability.
<http://www.iziis.ukim.edu.mk>

European Centre on Urban Risks (CERU) in Lisbon, Portugal. Its principal functions are to provide a framework for coordinating relief and natural and technological hazard management and for devising a common strategy to combat urban hazards.
<http://www.europarisks.coe.int/ceru50.htm>

European Centre on Floods (AECF) in Kishinev, Moldova concentrates on proposals to prevent the risk of flooding.
<http://www.europarisks.coe.int/aecf50.htm>

Euro-Mediterranean Centre on Insular Coastal Dynamics (ICOD) in Valletta, Malta. ICOD's brief is to work in three main areas of education, applied research and information activities related to coastal dynamics.
<http://www.icod.org.mt/IcoD/ICoD main.htm>

Scientific Centre of Monaco, European Oceanological Observatory (OOE) in Monaco, conducts research with the objective of evaluating major ecological risks and restoring degraded habitats.
<http://www.europarisks.coe.int/ooe50.htm>

European Centre of New Technologies for the Management of Major Natural and Technological Hazards (ECNTRM) in Moscow, Russian Federation. One of its primary objectives is the use of space technologies for the forecasting, prevention and relief in major natural and technological disasters.
<http://www.europarisks.coe.int/ecntrm50.htm>

Higher Institute of Emergency Planning (ISPU) in Archennes, Belgium, organizes specific courses concerning problems of emergency planning for officials in public office.
<http://www.europarisks.coe.int/ispu50.htm>

European Centre for Research into Techniques for Informing Populations in Emergency Situations (CEISE) in Madrid, Spain. Its work concerns methods of informing the public in emergency situations.
<http://www.proteccioncivil.org>

European Inter-regional Centre for Training Rescue Workers (ECTR) in Yerevan, Armenia, provides training of rescue workers and related instructors for humanitarian assistance.
<http://www.europarisks.coe.int/ectr50.htm>

European Centre on Geodynamical Hazards of High Dams (GHHD) in Tbilisi, Georgia, was created to develop multinational, multidisciplinary approaches to the problems of geodynamic hazards, generated by high dams.
<http://www.europarisks.coe.int/ghhd50.htm>

European Advisory Evaluation Committee for Earthquake Prediction (EAECEP) is a committee of the Council of Europe. This institution of 13 specialists was established in 1993 by the Committee of Ministers and works closely with the EUR-OPA Specialized Centres. It is responsible for giving advice on earthquake prediction made by scientists.
<http://www.europarisks.coe.int/eaecep.htm>

Agreement, the ISDR Secretariat and the government of Spain within two years to review and consolidate the work accomplished and to make specific proposals for the improvement of risk management in the Euro-Mediterranean region. Specific problems of individual subregions were identified as involving aspects of international cooperation within and outside the Euro-Mediterranean area including the transboundary aspects of risk management, and the contribution of science and technology to disaster management.

- Information and awareness of disaster reduction and preparedness could be improved in European and Mediterranean countries by the implementation of a radio and Internet risk information broadcast (IRIS project), and through the continuation of training and research programmes in universities as well as by creating national observatories to monitor safety in schools and higher education. These latter activities form part of the FORM-OSE Program, which also includes the Sismo School Programme, an awareness initiative for students that will place working seismic stations in schools.

- Strengthened measures for implementation of risk reduction initiatives should be pursued by the Executive Secretary of the EUR-OPA Major Hazards Agreement developing cooperation further with the European Commission. This could be developed particularly with the Directorate General of the Environment, leading to the implementation of existing EUR-OPA initiatives in risk reduction.

Several developments within the European Union have begun to draw the European Commission's attention to the need to elaborate a more integrated approach to vulnerability and risk reduction. While within the commission itself, there is not yet an overall strategy, funding has been committed to support some specific activities related to disaster reduction.

In terms of research related to natural hazards and disaster risk issues, there are two different Directorates General (DG) involved. Direct research explicitly earmarked as a percentage of the overall European Commission (EC) budget for research is undertaken by the DG Joint Research Centre (JRC) to support policy-making within the EC. Considerably more additional research funds are managed by the DG Research. Even though it does not conduct research itself, the DG Research does allocate funds among many professional, commercial and academic bodies to study hazard and risk subjects, and is equally responsible for the management and supervision of specific framework programmes.

These commitments underwrite a variety of programme activities by which the European Union expresses its overall research agenda, and both the DG JRC and DG Research are involved with advancing those objectives through their respective activities. The DG JRC has been carrying out research in the field of natural hazards over many years, while in parallel the DG Research has been funding many initiatives across Europe that enhance collaboration in the field.

In both these related research aspects, as well as with the additional interests particularly of the DG for the Environment, it is evident that throughout Europe individual countries address hazard and risk factors through their respective national, regional, and local projects. Furthermore, there are a variety of consortiums that also collaborate on joint projects in areas such as floods, wildfires, and trans-national collaboration as in river basin initiatives for the Danube, Rhine and Elbe rivers, among others.

The EC position on disaster management and civil protection matters is more explicit and focused than the overall understanding of disaster reduction as a strategy involving the management of risks and vulnerability as components of long-term development planning. Several EU countries participating in the ISDR programme have displayed a broader understanding of these issues and the related complementary associations.

These countries, together with those due to join the EU in 2004, are working with ISDR to further develop the process underway within the European Commission to enable vulnerability and risk considerations to find their appropriate position and profile among the strategic agenda of the EU.

Two legislative measures adopted in recent years illustrate efforts that can lead to a more holistic approach to disaster risk management and vulnerability reduction. However, a strong civil protection connotation remains present in both. A European Council decision of October 2001 supported "establishing a Community mechanism to facilitate reinforced cooperation in civil protection assistance intervention". While the text mentions prevention, it does so with no further elaboration nor does it provide any practical details.

An earlier decision in December 1999, about "establishing a Community action programme in the field of civil protection" makes reference to risk awareness and assessment as well as the general context of sustainable development. In an annex, reference is also made to potential projects of general interest which may draw attention to "prevention, preparedness, detection and study of the causes of disasters (analysis of risks and vulnerability)", and "analysis of the socio-economic implications of disasters".

The first community action programme in the field of civil protection (1998-1999) defined a general framework for community involvement and expressed the commitment to initiate long-term programmes. A subsequent programme running from 2000-2004 identifies five major projects, including a new one relating to the prevention of natural and technological disasters. This anticipates the implementation of common principles and guidelines for disaster prevention at all levels in the European Union. Three fields are considered: risk assessment procedures; the prevention of flash floods and the mitigation of their impact; and the reduction of fire risks.

Concerning specific experiences accumulated in this field, a report on risk assessment procedures used in civil protection and rescue services in different EU countries was prepared from data collected by questionnaire in 1998. The report describes the use of risk assessment methods in these countries and provides examples of best practices. Several other projects have been completed, which relate to floods.

Guidelines for the prevention of flash floods have also been prepared in anticipation of elaborating a pan-European flood forecasting and modelling system to provide the basis for an early warning system. Other important programmes exist in Europe to facilitate the exchange of information and to guide European organizations and EU member states in identifying hazards and managing hazards and disaster risks.

A special unit of targeted research for decision support within the Joint Research Centre's Institute for the Protection and Security of the Citizen, Technological and Economic Risk Management Unit serves as a useful facility for disaster risk reduction. There, the Major Accident Hazards Bureau (MAHB) is dedicated to providing scientific and technical support for the actions of the European Commission in controlling major industrial hazards.

MAHB endeavours to assist other EC, and in particular the DG of Environment to implement EU policies on the prevention, mitigation and control of major hazards or technological accidents. It conducts scientific and technical activities related to the daily implementation of relevant EC legislation, such as the original Seveso Directive which was approved by the Council of Ministers in 1982 after the chemical accident at Seveso, Italy. <http://mahbsrv.jrc.it/>

Another DG supported service is the Natural and Environmental Disaster Information Exchange System (NEDIES). It has a primary objective to support European Commission services, governments and EU organizations in their efforts to prevent and prepare for natural and environmental disasters and to manage their consequences.

The project has been launched to supply updated information about the occurrence of natural and environmental disasters and their management, as well as to supply information on past disasters and main consequences, methods and techniques relevant for the prevention of disasters, preparedness and response for civil protection services.

It also provides an interdisciplinary platform for dialogue among all actors in natural and environmental disaster management, creating the possibility of a common European repository of disaster experience, with a particular focus on mitigation of disaster consequences. <http://nedies.jrc.it>

The European Environment Agency's (EEA) core task is to provide decision makers with the information needed for creating sound policies to protect the environment and to support sustainable development. In the area of disaster risk reduction, it conducts studies on issues such as the impact of extreme hydrological hazards in relation to Europe's water resources. It also supports the EC in diffusing information on the results of environmental research.

European cooperation for international development assistance

Another important dimension of European cooperation is the European Union's commitment to support disaster risk management activities through international development assistance. In this respect the primary instrument is the European Community Humanitarian Aid Office (ECHO). As a service of the European Commission, ECHO's primary mandate is to provide emergency assistance and relief to the victims of natural disasters and conflicts outside the European Union.

However, in following earlier IDNDR and Yokohama strategy recommendations, it also works to ensure disaster prevention and preparedness. This includes funding community-oriented pilot projects. From 1994-1997, ECHO financed prevention and preparedness projects in various locations totalling about US$ 20 million. A specific programme for disaster preparedness was created within ECHO in 1996 for that purpose.

DIPECHO is a regional programme to implement ECHO-financed activities, initially in Central America, the Caribbean and South-East Asia, plus Bangladesh. The operating criteria is to finance projects which promote better integration between disaster prevention and sustainable development, rather than to finance those project activities which are already considered a part of existing development programmes.

Additionally, 17 projects totalling more than US$ 5 million were financed in the First Action Plan

for the Andean Community, targeting vulnerable, disadvantaged urban and rural communities, municipal agencies and local disaster-related organizations. Through these projects, training, planning and prevention works have been implemented.

DIPECHO now allocates about US$ 7 million worldwide each year. The programme's principal objective is focused on reducing the impact of natural disasters by strengthening local physical and human resources in high-risk areas. <http://www.disaster-info.net/dipecho>

ECHO is committed to increasing its support for disaster preparedness in Central Asia. Over the past decade, natural hazards such as landslides, floods and earthquakes have killed about 2,500 people and affected 5.5 million people, or 10 per cent of the total population in Tajikistan, Kyrgyzstan, Uzbekistan, Kazakhstan and Turkmenistan. ECHO has provided nearly US$ 1 million for ad hoc disaster preparedness activities in Central Asia since 1998.

Greater attention is now considered to be warranted by the high frequency and serious impact of natural disasters, and the low response capacity in many of the vulnerable areas. Early in 2003, the European Commission approved a US$ 2.75 million action plan to help vulnerable populations in Central Asia prepare for and respond to natural disasters.

The money will support small-scale infrastructure projects, disaster preparedness initiatives and response mechanisms. Funds will be allocated to international agencies operating in the region, via ECHO. The decision marks an extension of DIPECHO to Central Asia.

The action plan's specific objectives are to strengthen the capacity of local communities to foresee, respond to and cope with disasters, and to protect vulnerable groups from likely natural disasters through small-scale infrastructure works, early warning systems, disaster preparedness training, radio communication systems and public awareness campaigns.

Local response capacities will also be strengthened through local disaster management plans. Structural measures will be employed to protect vulnerable communities from avalanches, mudslides and flooding through the construction of protection barriers, the reinforcement of mountainsides and by strengthening the banks of flood-prone rivers.

Most of the approximately US$ 3 million will be allocated for operations in Tajikistan, the most vulnerable of the five countries. Disaster-prone regions in Kyrgyzstan and Uzbekistan will also be targeted.

European subregional frameworks

Within Europe, there are emerging initiatives striving to adopt a broader professional community of interests to a subregional operational framework that relate to disaster risk reduction. Some examples, with origins provoked by a specific type of hazard or technical consideration and the need to seek broader trans-state policy commitments, are presented below.

Case: Central and Eastern Europe

The Central European Disaster Prevention Forum (CEUDIP) was established in 1999 through the efforts of the national committees for IDNDR from the Czech Republic, Germany, Hungary, Poland and Slovakia. The motivation was to formulate an institutional mechanism that could increase the collaboration in disaster reduction related to all types of hazards, particularly floods, often experienced simultaneously by these neighbouring countries.

Following the shared experience of the Oder River floods early in 1999, the initial interest that stimulated the participating countries was a common desire to improve early warning capabilities. Other issues have since emerged, such as the role of the media in disaster reduction, national legislation about declared emergencies, the participation of civil society in disaster reduction activities, and the preparation of training materials.

Since 1999, the forum has conducted annual meetings in Prague, Warsaw, Bratislava and Bonn. The members of CEUDIP agreed at their meeting in 2000 that closer cooperation would be

required with EU policies related to civil protection and disaster reduction. As four of the CEUDIP countries have been accepted for future membership in the EU, they have assigned particular relevance to assess their present capabilities in relation to EU norms.

The participants of CEUDIP have recognized the growing importance of strong and active participation of the public, working through civic groups and NGOs to supplement the efforts of government institutions and agencies. At CEUDIP's meeting in Bratislava in 2001, it was agreed to improve common regional standards and to develop a project of cooperation with EU institutions involved in emergencies, risk and disaster reduction issues.

In 2002, unusually heavy rainfall provoked record floods in the major rivers of Central Europe with extremely high water levels recorded on the Elbe, Danube and Vltava rivers. Much of the Czech Republic and Slovakia and parts of Germany and Austria were affected, with record water levels recorded in the centres of Prague and Dresden. Elsewhere in Europe, Italy, Spain, the Russian Federation, Romania and Hungary also suffered repercussions from the heavy rainfall.

About 100 people died, hundreds of thousands were evacuated, and tremendous damage was caused, including the loss of much physical infrastructure. Munich Re. estimated the losses as more than US$ 15 billion.

The EU has few means to help member states address such losses in the short term. After the severe consequences of the 2002 floods, this lack of capacity was widely criticized. The European Commission has since been forced through political pressure to consider several propositions, including the re-establishment of a previously maintained contingency solidarity fund.

Originally conceived to assist member states respond to losses from extraordinarily severe natural disasters, defined as causing damages of more than 1 billion Euros or 0.5 per cent of a country's GDP, the fund is expected to be financed from various sources, including structural and regional funds. While initially intended to be re-capitalized in the amount of 500 million Euros, strong political imperatives have boosted the amount to 1 billion Euros following the effects of the Central European floods. It remains to be seen to what extent such resources will be committed to risk identification, assessment and protection, in contrast to replacing or repairing assets only after they become lost or damaged.

Additionally, in responding to the Vltava and Elbe floods, the United States Trade and Development Agency (USTDA) sponsored a symposium in Prague in December 2002 that brought US and Czech experts together. This meeting on Flood Management Strategies: Recovery and Prevention discussed ways that US public and private sectors could assist in reconstruction efforts and develop strategies to prevent future flood damage, including flood risk management. A US$ 395,000 grant was offered by USTDA to the Regional Government of Central Bohemia to set up an emergency management system.

The Swiss government provided about US$ 25 million in a similar initiative to spur regional cooperation in flood-stricken regions in Austria and Slovakia, although it was directed mainly towards immediate recovery needs rather than to motivate prevention activities.

By contrast, the World Wide Fund for Nature (WWF) called for European prevention policies to work with nature by implementing wetlands and floodplains protection as well as soil, forest and water ecological management. This would prevent future extreme events, as was the case in some parts of Bratislava where floodplains were able to absorb the Danube floodwaters.

Aside from specific flood-induced initiatives, there are other subregional associations that have been established through the creation of the Central European Initiative (CEI) Cooperation Agreement on the Forecast, Prevention and Mitigation of Natural and Technological Disasters. An agreement was concluded in 1996 between Austria, Croatia, Hungary, Italy, Poland and Slovenia, with the European Commission maintaining observer status for improved cooperation in matters of civil protection and disaster management.

Areas identified for specific attention include the exchange of scientific and technical information or

data on a regular basis, as well as improving the communications links among national institutions involved with earthquakes. Common research programmes have been identified and joint efforts pursued for the training of specialists that were conducive for setting up joint programmes. A common operational manual comprising data from the five countries has also been compiled to further this objective. <http://www.ceinet.org>

Within a more of a regional security context, driven by common political interests, the South-East European Stability Pact has developed a role in disaster management issues with the creation of a Disaster Preparedness and Prevention Initiative (DPPI). This framework was initiated in March 2000 with 12 Eastern European countries participating with international organizations including OCHA, IFRC and NATO, to foster regional cooperation and coordination in disaster preparedness and prevention for natural and human-induced disasters. Initially a regional risk assessment and capabilities survey was carried out in the 12 countries of Eastern Europe.

In particular, the DPPI encourages the development of environmental regulations and codes that can contribute to the prevention and mitigation of disasters. Additional attention has been given to facilitate operational matters of disaster preparedness like advance negotiation on border crossing procedures and the agreement on subregional disaster management standards. More information is available online. <http://www.stabilitypact.org>

Within the subregion, there have been antecedents for civilian-military programmes within individual countries that serve a variety of interests. Bulgaria's State Agency for Civil Protection participated, since April 1998, in the activities of the Black Sea Economic Cooperation Framework, under an agreement directed at protecting the population from natural and human-induced disasters. It then became associated with the CEI cooperation agreement in 1999.

Since then, the same civil protection agency signed an agreement in April 2001 in Sofia, Bulgaria to establish a Civil-Military Emergency Planning Council (CMEPC) for South-Eastern Europe by cooperating with Croatia, the Former Yugoslav Republic of Macedonia and Slovenia. While Albania, Greece, Turkey and Romania were participating in the CMEPC initiatives, they also had the option to join the agreement as full members if they wished.

Case: Mediterranean countries

Within the technical and scientific community, countries throughout the Mediterranean basin are benefiting from the Programme for Reducing Earthquake Losses in the Eastern Mediterranean (RELEMR).

Initially organized by UNESCO, the USGS, and European and other US earth science organizations, RELEMR is based on an earlier successful joint endeavour, the Programme for Assessment and Mitigation of Earthquake Risk in the Arab Region (PAMERAR). <http://www.unesco.org/science/earthsciences/disaster/disasterPAMERAR.htm>

Both of these programmes have concentrated on activities designed to "establish or reinforce seismic and strong motion networks, promote the formulation of seismic building codes and provide training in seismology, earthquake engineering and civil defence".

The reduction of earthquake losses in RELEMR is pursued through seismic-technical framework studies, earthquake monitoring and assessment, risk assessments and the implementation of related risk reduction measures. These will be accomplished by participating countries in areas including the expansion of urban planning, building codes, strengthening and rehabilitating existing buildings, and improving poor foundation soils. <http://www.unesco.org/science/earthsciences/disaster/disasterRELEMR.htm>

Case: Russian Federation and Commonwealth of Independent States (CIS)

Traditionally, the Russian Federation has been involved in international cooperation in natural disaster reduction. Currently, about 30 intergovernmental agreements on disaster reduction are in effect with other countries, with another dozen or so cooperative agreements under various stages of negotiation.

Regional multilateral cooperation is growing within the CIS Intergovernmental Council for Natural and Technological Emergencies. In 2002, a code for interaction in natural and technological hazard mitigation was adopted by the CIS. This followed the creation of a joint intergovernmental scientific programme on risk reduction in 2001. One of its goals was the design of unified legal and technical norms for disaster management. In 1998, an intergovernmental science and technology programme for seismic monitoring of the CIS territory was adopted. It aimed to develop regional monitoring and warning systems. However, effort to motivate local community action remains an area where much more attention and commitment is necessary.

Since 1998, several measures were adopted to organize the regional intergovernmental programme for development of a joint CIS corps for emergencies, with additional efforts envisaged to improve related information use, communication and warning systems.

Regional interactions also take place in the border areas of the Russian Federation and neighbouring countries. Recently, joint efforts were undertaken with China in flood prevention and preparedness; with Kazakhstan in locust mitigation; and in Mongolia to halt the spread of foot and mouth epidemics.

The Russian Federation is also participating in bilateral cooperation in natural disaster management. Special bilateral cooperation agreements on emergency mitigation have been concluded with France, Spain, Viet Nam and India. Bilateral projects have also been implemented in particular areas of emergency forecasting and mitigation of natural hazards in Greece, and in the management of forest fires elsewhere.

Future challenges and priorities

Regional cooperation, interaction and experience

In reviewing the accomplishments of regional cooperation in different parts of the world, two factors stand out. Institutionally, the sustained commitment of permanent facilities and institutions are integral to promoting multidisciplinary approaches to disaster risk management. More fundamental, it is crucial that there is understanding that leads to the acceptance of countries in the same region sharing both their information and their concerns in various forums, so that they may collaborate more effectively in their activities.

It is clear that both policy interests and material resources must transcend strictly national outlooks. Regional efforts must support both the human growth and organizational development that are essential for strengthening national as well as local capacities. The examples cited demonstrate that in some instances such recognition is thrust upon a region abruptly, such as Hurricane Mitch on Central America, or it may evolve more methodically through shared orientations as has been the case for Pacific island states.

In all cases there needs to be an established and consistently supported apolitical institutional hub that can promote as well as respond to multidisciplinary and multi-state issues related to disaster risk reduction.

The function which these institutions serve as a dissemination vehicle, acting as clearing houses for diverse material that merges political, professional and public interests should not be overlooked in building regional collaboration. There is little doubt that the momentum and resulting success in regional cooperation also is due to the efforts of regional and international organizations.

While organizations such as IFRC, UN agencies and the development banks are working throughout the world to encourage more productive forms of collaboration, the regional emphasis provided by organizations such as PAHO, OAS, UNDP, CEPREDENAC, PREANDINO in the Americas; ADPC and ADRC in Asia; SADC, IGAD, WMO, UNDP and UNEP in Africa; and OCHA, UNDP and SOPAC in the Pacific, has proven to be of unparalleled importance

In 2003, both ISDR and UNDP Bureau for Crisis Prevention and Recovery opened African regional offices in Nairobi, Kenya. Increased policy interest and new initiatives also are emerging in Africa. SADC has been working to provide policy impetus for disaster risk awareness in Southern Africa. IGAD is increasingly seeking to promote a fuller engagement in Eastern Africa. However, in more general terms, the realization of practical forms of institutional commitment in Africa overall, continues to be a challenge.

It is hoped that through more guidance to ECOWAS member states in West Africa, as well as within the countries of Northern and Central Africa, a greater awareness of shared consequences of risk factors with the environment, sustainable development, livelihoods and government policies will result. NEPAD too, offers a promise for more cooperation among African countries to give enhanced visibility to disaster risk issues through its specific commitments to environmental concerns.

Throughout the Arabic-speaking world and among European countries too, there is an absence of consolidated recognition or material support for a sustained regional focus on disaster risk reduction.

An international framework of regionally focused institutions should be created and sustained, dedicated to the various aspects of disaster risk management practice. The wider dissemination of information about hazards and risk management and the purposeful sharing of experience are the lifeblood of more regional cooperation.

3.4 Community action

Risk reduction measures are most successful when they involve the direct participation of the people most likely to be exposed to hazards. Local leaders, including both men and women drawn from political, social and economic sectors need to assume a primary responsibility for the protection of their own communities.

Community processes and actions to accomplish disaster risk reduction are much talked about, in theory, but they are much more difficult to realize in practice. There is adequate experience to show that the involvement of local residents in protecting their own resources can work – if sufficient attention and investment are devoted to the subject. The salient issues and examples which illustrate successful practice are presented under the following headings:

- *the essential role of community action;*
- *community leadership and relationships;*
- *building community capabilities;*
- *NGO and volunteer activities;*
- *building local self-reliance: sharing resources, building partnerships;*
- *dynamics of local collaboration; and*
- *traditional community coping mechanisms at stake.*

"Much has been learnt from the creative disaster prevention efforts of poor communities in developing countries. Prevention policy is too important to be left to governments and international agencies alone. To succeed, it must also engage civil society, the private sector and the media."

Kofi Annan
UN Secretary-General
International Decade for Natural Disaster Reduction (IDNDR)
Programme Forum
Geneva, July 1999.

The essential role of community action

Disaster reduction is most effective at the community level where specific local needs can be met. When used alone, government and institutional interventions often prove to be insufficient and frequently are seen to be sporadic and only responding to crises. They are inclined to ignore local perceptions and needs and the potential value of local resources and capacities in the process. As a result, it is not surprising that emergency relief assistance far exceeds resources invested to develop local disaster risk reduction capabilities.

First, communities must be aware of the importance of disaster reduction for their own well-being. It then becomes necessary to identify and impart essential skills that can translate risk awareness into concrete practices of sustained risk management. Such an approach needs activities that strengthen community capacities to identify and cope with hazards, and more broadly to improve residents' livelihoods.

The Asian Urban Disaster Mitigation Program (AUDMP) has validated these principles through its activities with local institutions working in local Asian environments. In community-based disaster mitigation projects, planning and implementation are participatory in design and address the community's vulnerabilities and capacities.

Projects in Bangladesh and Cambodia have been designed by focusing on people's perception of flood risk, community flood risk assessments, community and resource mobilization and capacity-building. All of these elements contribute to integrating community-based disaster management into the daily concerns of poor and vulnerable communities, making them cost-effective options.

Community

The definition of community in this context refers to a social group which has a number of things in common such as shared experience, locality, culture, heritage and social interests.

Community leadership and relationships

Any system of local planning and protection must be integrated into larger administrative and resource capabilities such as provincial, state and national disaster plans or related risk reduction strategies. Communities cannot implement community-based disaster mitigation plans on their own.

Viable community-based disaster reduction depends on a favourable political environment that understands, promotes and supports this participation process.

A useful Australian study found that the extent of commitment by local governments to take action depends on emergency managers making the right choices about citizen involvement in planning risk management activities. This can build an informed constituency for disaster reduction and drive a real commitment among elected officials to take action. Key decisions include:

- objectives to be achieved by involving citizens;
- the timing and type of activities in the planning process in which citizens participate;
- which citizens to involve;
- techniques that can best motivate citizen input; and
- information that is to be provided to citizens.

Disasters are opportunities for change and community development. Women are participating actively in rehabilitation and reconstruction around the world. Their organizations have a special role to play and are doing so in several places.

By using "networks of networks" community-based organizations and NGOs share experiences among community leaders and groups. One such network linking women's organizations is the Grass Roots Organization Operating in Sisterhood (GROOTS).

Case: India

Another organization, in India, is the Swayam Shikshan Prayog (SSP), meaning self-education for empowerment. It is a voluntary organization based in the state of Maharashtra that seeks to bring women and communities among the poor into the mainstream of the development process.

SSP seeks to achieve its aims by building core social, economic and political competencies among grassroots women's collectives in the context of decentralized planning and development activities. District resource teams partner with community-based women's groups and local governments across the states of Maharashtra and Gujarat.

Box 3.20
Rebuilding communities in India

In January 2001, immediately after the Bhuj earthquake in the Indian state of Gujarat, Indian NGOs and community-based organizations began to help in the recovery effort. One of these NGOs was Swayam Shiksam Prayong (SSP).

Drawing on their experience following the 1993 Latur earthquake in the Indian state of Maharashtra, they proposed a policy which would not only rebuild the devastated Gujarat communities but reform and strengthen their social and political structures.

The central concept was that people – especially women – need to rebuild their own communities. Key elements of the strategy included:

- using reconstruction as an opportunity to build local capacities and skills;
- forming village development committees made up of women's groups and other community institutions to manage rehabilitation;
- engaging village committees to monitor earthquake-resistant construction;
- redressing grievances at the village level;
- striving to locate financial and technical assistance within easy reach of affected communities, and not be dependent on it being mediated by others;
- arriving at a clear definition of the role of local governments in planning and monitoring, information flow, problem-solving, and infrastructure use and development;
- distributing information about earthquake safety and entitlement to all homeowners;
- encouraging the use of local skills and labour, and retraining local artisans in earthquake-resistant technology;
- including women in all aspects of the reconstruction;
- assigning titles of houses in names of men and women;
- encouraging coordination among government officials, district authorities and NGOs; and
- seeking to facilitate public-private partnerships for economic and infrastructure development.

<http://www.sspindia.org>

Through the process of self-education, SSP facilitates the demonstration and scaling up of initiatives and strategic partnerships, and in so doing provides space for the women's collectives to participate in local planning and guidance processes. Self-help groups are encouraged first to address women's own savings and credit needs, before proceeding to broader communal development needs. This credit for empowerment strategy includes more than 20,000 women who spearhead a grassroots movement for self-reliance. The community-based network initiated by SSP now has more than 1,200 women's self-help groups, linked together through a federation that forms the basis of the movement.

Case: Turkey

In April 2001, the *Huairou Commission Newsletter* reported that Turkish women displaced by the major earthquake that struck the Marmara region in August 1999 began organizing themselves immediately after the disaster. Assisted by the Foundation for the Support of Women's Work (FSWW), Netherlands Organization for International Development Cooperation (NOVIB) and the American Jewish World Services, they worked with government agencies, local municipalities, other NGOs and technical professionals.

FSWW built eight women and childcare centres to provide a safe environment for children and a public living room for local women, providing day-care services as well as income earning opportunities for women. Additionally, these facilities have become centres for women to consider housing and resettlement problems and priorities including:

- the future utility and limitation of temporary prefabricated settlements;
- how to resolve problems of isolation, transportation, local governance, minimal infrastructure and wide-spread unemployment;
- housing requirements of renters and others who are not legal owners; and
- earthquake safety standards for future housing.

Groups of women go door to door in their community to gather basic information about their settlements, to publicize meetings and to increase participation. The women discuss problems and possible solutions, and consider their role in motivating changes. They invite experts to their centres, visit construction sites, prioritize lists of officials to contact, and devise strategies to hold authorities accountable for the information they provide and the promises they make. They visit local authorities to get information about reconstruction activities and then post their findings at the centres, the settlement administration office, shops and schools.

In all eight centres women's groups meet regularly with local officials. They also exchange strategies across centres. In Izmit, they signed a protocol with the city council to develop policy proposals on the future of prefabricated settlements and housing safety in the region. Local authorities have started to understand that the women serve an effective communication function within the community.

The most important lesson the women have learned is that resettlement is a long process that requires ongoing monitoring. Following are some of the women's impressions about their work:

- They feel more confident and stronger.
- They have begun to see that they can influence the decision-making process if they act together.
- They believe that only a common and widespread sense of responsibility in the community can promote public safety and mitigate the effects of a new earthquake.
- They are comfortable with the technical language related to construction and can question safety and quality standards.
- They understand infrastructure issues.
- They can undertake repairs and become plumbers, electricians and carpenters for the benefit of the community.

Building community capabilities

Many inhabitants of local communities are potential victims of natural disasters. Their personal assets, physical property and ways of life can be threatened by hazards. They also represent the greatest potential source of local knowledge regarding hazardous conditions, and are the repositories of any traditional coping mechanisms suited to their individual environment.

It is little wonder that it is the local population which responds first at times of crisis. Indeed, they are also those left behind to pick up the pieces and rebuild after a disaster. Given these conditions, it is striking that the participation of local communities often proves to be problematic in many disaster risk management strategies. There are several reasons why this may be so, and each points to a lesson for effective engagement of community participation.

A grass roots approach is needed to promote change and to engage fully all members of the community in reducing risks. Local communities are the most aware of historical risk scenarios. Local community groups should have the chance to influence decisions and manage resources to help reduce their vulnerability and cope with risk.

Neither the widespread dissemination of prior experience nor the abundance of scientific and technical knowledge reaches local populations automatically. An informed and sustained programme of public awareness is essential to convey the benefits of experience to vulnerable communities in terms that relate to local perceptions of need.

To be effective, knowledge must be presented in a way that relates to local conditions and customs. While this has long been accepted as a cardinal principle in sustainable development, it is not well integrated in risk reduction strategies. The realization of virtually all disaster risk reduction is essentially local in nature – and that requires community action.

A sustained programme of sharing information between knowledgeable residents and external specialists is essential. Over-reliance on technical experts and one-way communication is ineffective and marginalizes women and other groups disadvantaged in the professions and technical specialties relating directly to disaster risk management. As sharing information with both women and men at the community level becomes more important, capturing women's knowledge of local ecosystems, vulnerabilities and capacities remains a continuing challenge.

In every community, knowledge, professional abilities and experience fashioned from adversity can be found, but seldom are these resources called upon or fully utilized. A special effort is required to recall locally-valued traditional coping mechanisms and strategies. These can sit comfortably alongside modern technology.

Case: Norway

Snow and slush avalanches are a natural hazard to local communities in many parts of Norway, but especially in the vicinity of deep fjords along the coast. They cause human fatalities and significant damage to houses and infrastructure every winter.

Geiranger is an area in the municipality of Stranda on the West Coast of Norway with a high exposure to snow avalanches. As relocating the 1,000 residents was not realistic, energies were instead devoted to finding acceptable means by which they could live with minimized risks. The community took an initiative in 1996 to have an expert evaluation of the hazards. The assessment concluded that any structural mitigation measures could not be justified because of the very high cost set against the low frequency of possible events. Instead, a more attractive approach was proposed to apply an early warning arrangement together with a preparedness plan based on community actions.

The following are the major elements of the plan undertaken by the community:

- engage in technical assistance to conduct detailed hazard zoning in the avalanche-prone areas;
- organize a local avalanche group consisting of representatives from the political and technical leadership in the community, the police, civil defence agency and the people living in the hazard zones;
- prepare criteria for hazard evaluation including installation of meteorological equipment;
- prepare an action programme for different hazard levels, including procedures for warning and evacuation; and
- hire external assistance for training the local avalanche group about the nature of the hazards.

The system was put to a real test on 4 March 2001, when the weather conditions were extreme. As the hazard level was judged to be high, 32

people were evacuated to a hotel in a safe area. An additional 180 people were trapped between two avalanches because of an impassable road along the fjord but were successfully evacuated with the use of a ferry to a safe place on the opposite side of the fjord. Because of the well-developed preparedness plan, all operations were successfully carried out without the loss of life.

The learning experience from the Geiranger case is very positive. Several other communities along the western coast of Norway, exposed to similar risks, are now adopting the Geiranger approach.

Case: Uganda

Preventive landslide management is one of the most appropriate approaches to minimize landslide disasters in hilly and mountainous areas. This was demonstrated by a one-year landslide mitigation project involving the local community in Sironko district of Uganda. It was initiated by the disaster preparedness department in the office of the prime minister.

Until recently landslide management in Sironko was reactive. Government and humanitarian agencies responded to the effects of landslides when they occurred by providing victims with basic relief supplies, temporarily alleviating their suffering during the rainy season. As such efforts do not address the actual cause of the problem they do not save lives or protect property from loss or damage.

While landslides have long been perceived as natural events with no remedy, authorities only considered responding to them as they occurred. The local communities in the areas of unstable terrain were aware that they were prone to landslides but their fatalism contributed to a sense of helplessness.

With support provided by the German Agency for Technical Cooperation (GTZ), the department of disaster preparedness commissioned a study to establish the causes and to consider the impacts and possible mitigation measures that could provide a long-term solution to the problem. The report was presented to a stakeholders' workshop in Sironko district. An action plan was developed which led to the establishment of the Sironko Landslide Mitigation Project.

The research established that while it was clear that landslides resulted from a number of natural factors such as geology, soil type, slope of the terrain, drainage, rainfall and land-cover conditions, it was primarily the human activities that actually triggered the landslides in the area. This implied that the landslides and the losses associated with them could be reduced or averted altogether by altering the land-use practices.

The inception of the project was a turning point in the management of landslides in Sironko. The district and community adopted a preventive approach to landslide management based on reducing the risk by identifying and zoning risk-prone areas and then planning the most appropriate use of land; encouraging people settled in hazardous areas to relocate to safer areas; preventing new settlements in risk-prone areas; integrating landslide prevention measures into road construction contracts, establishing early warning systems; and implementing slope stabilization practices such as afforestation, reforestation and agro-forestry projects.

At a policy level, the authorities of Sironko district have adopted landslide prevention planning and management strategies by integrating landslide issues in district and sub-county development plans supported by a budgetary framework. By being aware of the root causes of landslides and seeking to address them, the local communities are also encouraged to avoid landslide-prone areas and to minimize destabilizing activities.

Following community sensitizing activities in local workshops, community meetings and electronic and print media, public perceptions about the causes and possible mitigation of landslides are slowly changing. Achievements can be seen in the following ways:

- The level of public awareness about the causes, impacts and management possibilities of landslide risks is now very high.
- The local population now appreciates that landslides are mainly triggered by human activities, and they can be reduced through better-suited activities.
- People living in landslide-prone areas were temporarily relocated to safer areas during the time of heightened El Niño threats during 2002, with no fatalities being recorded as a result.

- Risk prevention planning is done at district and sub-county levels as landslide management issues are included in district and sub-county development plans.
- An integrated approach to planning has been adopted in which all departments having interests in the landslide-prone areas plan their programmes together, taking account of the landslide risks.
- Afforestation and reforestation have been adopted as major slope stabilizing measures, with the use of fast growing trees, those helpful for other crops or which have additional value as timber.

Additional challenges also remain, often with primary implications for sustainable development policies. Although communities are being encouraged to relocate to safer areas on a permanent basis, as Sironko is one of most populated districts in Uganda there is likely to be only a limited amount of land for resettlement. Prevalent conditions of poverty are also likely to limit the opportunities for relocation of people to safer areas, with little funding for resettlement. High population densities in Sironko can threaten the sustainability of afforestation or reforestation activities. Although Sironko district and sub-counties are integrating landslide issues into their development plans, there is a general lack of funds to implement the intended plans within local government activities.

The positive start that has been made suggests important follow-on policies. There is need for the government to institutionalize preventive landslide planning and management in all districts experiencing landslides. This could productively be accomplished by encouraging landslide planning and management to be taken into account by all institutions having interests in landslide-prone areas so that individual activities do not increase the risk of landslides. For example, the construction and maintenance of roads should strive to reduce the risk of landslides, rather than contributing to their later occurrence. Where it is feasible or the potential loss is great, there are instrumentation mechanisms that can monitor landslide risks or otherwise provide early warning of impending destabilization.

NGO and volunteer activities

Experience demonstrates that NGOs involved in disaster risk reduction are focused primarily on public awareness activities and advocacy programmes, although it should be noted that there are also other examples of their commitment found throughout this global review. In particular, many NGOs seek to encourage a shift in emphasis from emergency disaster response to local community participation in planning, assessing vulnerability and implementing risk management practices.

Some countries, including Bangladesh, India and the Philippines have elaborate policies and operational mechanisms to accommodate the participation of NGOs and community-based organizations in all aspects of national development. However, the extent to which they have embraced risk reduction activities is still modest.

In the Americas, there has been a recent spurt of interest in the subject but concrete policies are yet to be fully realized. In Africa, a handful of initiatives seem more a consequence of current or continuing threats than motivated by a fundamental shift in policy awareness or local community commitments.

Case: Philippines

In the Philippines, the Citizen's Disaster Response Network (CDRN) is a national network of 14 NGOs that promotes community-based disaster preparedness work. Since its inception in the early 1980s it has conducted advocacy work to help reduce the impacts of hazards.

By working together with communities, CDRN has developed strategies to enhance people's capacities, forming disaster response committees in villages, developing local early warning systems, organizing rescue teams and diversifying livelihoods. Receiving little external support from donor agencies, it has reached hundreds of villages and initiated community-based disaster mitigation initiatives.

Case: Bangladesh

CARE Bangladesh has adopted a community-based approach to reduce the vulnerability of flood-prone communities in the Tongi and Gaibandha municipalities of Bangladesh. This has been

accomplished by working in collaboration with partner NGOs in the municipalities and with the Disaster Management Bureau of the government of Bangladesh.

As part of the Bangladesh Urban Disaster Mitigation Project, the activities were funded by OFDA/USAID and managed by AUDMP. The project began by motivating community volunteers to conduct baseline surveys and vulnerability assessments. Different community groups recognized the importance of their joint community efforts mobilized by these initial activities, and how each could contribute to practical risk reduction activities.

This project emphasized the importance of promoting hazard and risk awareness among community groups. It sought to involve collaborators in other subject areas by placing community-based disaster risk management issues on the political agenda.

Since 1998, the government of Bangladesh has designated the last working day of March as National Disaster Preparedness Day in order to promote community awareness about the value of disaster risk reduction. In 2001, this national day was organized jointly by the Tongi and Gaibandha Municipality Disaster Management Committees, CARE Bangladesh and other partner NGOs.

Case: Zimbabwe

The Community Drought Mitigation Partners' Network is chaired by the local NGO Southern Alliance for Indigenous Resources (SAFIRE). It aims to promote and strengthen drought mitigation in Zimbabwe. The current members are Environmental Development Action in the third world, the Organization of Rural Associations for Progress, Zimbabwe Freedom from Hunger Campaign, World Vision and Zimbabwe Projects. They all strive to implement joint community-based risk reduction projects, conduct public debates on drought mitigation, and produce and distribute the *Living with Drought* newsletter.

Their efforts seek to share the benefits of their experience and to circulate the results of recent scientific research related to disaster reduction. Meetings are also convened between scientists and innovative farmers.

An anticipated Southern African Drought Technology Network represents the idea for a similar regional network that can address the needs of the rural poor. It intends to facilitate information-sharing among small-scale farmers, NGOs and community-based organizations in the areas of rural food security, agricultural research and extension, as well as relating the role of agribusiness in fostering drought-coping strategies.

Community-based disaster risk reduction initiatives are well developed in Zimbabwe, but documentation of successful practices can be improved. It will be important to complement this with further research to feed into the further elaboration of national disaster management plans and strategies.

Case: Germany

The Community Action Group for Floodwater in the Old Community of Rodenkirchen is a non-profit association in a district of Cologne, founded after the severe flooding of the Rhine River in 1993 and 1995.

This community group promotes the interests of more than 4,000 residents in matters of local flood protection. It strives to achieve a balance between the legitimate protection of the population and the aims of a sustainable floodwater policy which also must include the rights of downstream inhabitants and the river ecology as a whole.

"We are convinced that protection against flooding can only be successful in the long term if all inhabitants along the river perceive themselves as a community working in solidarity with each other. As we ourselves have experienced with our own considerable efforts and the many setbacks we have suffered, acting together does not come naturally but, rather, it is a product of knowledge, experience and conviction, mediated through communication – and this is best achieved through personal contacts."

Source: Community Action Group for Floodwater in the Old Community of Rodenkirchen, Cologne, Germany.

This means, for instance, that while the group supports the construction of polders on the upper reaches of the Rhine and its tributaries, it also expects the city of Cologne to undertake its own efforts to ensure that any natural retention areas which are sacrificed as a result of structural protection measures are compensated by other environmental considerations or practices for flood management in the municipal area.

Building local self-reliance: sharing resources, building partnerships

Disaster reduction depends on the conscious commitment of individuals and communities. This requires understanding and accepting the values of changed behaviour, having access to the necessary technical and material resources, and accepting personal responsibilities to carry through the efforts involved.

Communities are frequently inattentive to the hazards they face, underestimate those they identify, and overestimate their ability to cope with a crisis. They also tend not to put much trust in disaster reduction strategies and rely heavily on emergency assistance when the need arises.

These viewpoints underline the need for tools to create a culture of prevention against all forms of hazards within communities. This requires the knowledge of practical and low-cost methods to address likely hazards that can be conveyed to a wide variety of participants including community groups, merchants, wider commercial interests and local government employees.

Case: Indonesia

In recent years, Bandung, Indonesia has suffered repeated floods. The communities most affected have been low-income populations. They seldom had ready access to warning information or emergency equipment that would enable them to evacuate to safer areas or protect their possessions. Efforts to reduce the risk of annual floods through strategic planning have become necessary.

In 2000-2001, the government of Indonesia asked the Bandung Institute of Technology (BIT) to implement a community empowerment project in cooperation with the Asian Disaster Reduction Center (ADRC). Following the Great Hanshin-Awaji Earthquake in Japan in 1995, ADRC learned that community participation is indispensable to enhance disaster management capabilities.

Thus the Bandung project aimed to help local residents cope with flood risk. Two flood-prone districts were selected as test cases for town-watching. Local residents walked around their communities with BIT experts to discuss specific factors that could improve their capacity to live with risk. As a result, local residents proposed measures such as road improvements, the construction of protective embankments and better definition of natural watercourses in order to reduce future risk factors.

Case: UN Centre for Regional Development in India, Indonesia, Nepal, and Uzbekistan

The UN Centre for Regional Development (UNCRD) Hyogo Office was established in Kobe, Japan in April 1999 to promote disaster mitigation activities in developing countries. It provides advisory services to vulnerable communities, especially in ways that can improve the safety of primary community facilities such as schools and hospitals.

These programmes help to develop disaster-resistant communities by linking socio-economic considerations with physical hazards in urban development work at local levels. The ultimate goal is to attain safer and more sustainable livelihoods. To achieve this, the initiatives focus on community development and empowerment activities.

Specific programmes such as the School Earthquake Safety Initiative formulate new approaches to integrate disaster mitigation components into urban development work through school activities. The programme is being conducted in India, Indonesia, Nepal, and Uzbekistan with the overall goal to empower communities with know-how and technology for safer earthquake construction, and to build disaster-resilient and self-reliant communities.

To achieve this, specific focus has been given to schools. The vulnerability of the school buildings is evaluated and affordable retrofitting techniques are then recommended. There are five project objectives:

- evaluate the vulnerability of school buildings in each of the selected cities;
- recommend designs and affordable means of strengthening vulnerable schools;
- retrofit one or two demonstration schools using appropriate or improved traditional technology;
- provide training to local construction workers who build schools and residential dwellings; and
- prepare disaster education materials for school children, teachers and communities and use them for training and education purposes.

Case: India

More than one year after the earthquake in Gujarat, most of the affected families were still struggling to put their lives together. While in some places aid agencies had built and handed over houses to villagers, the experience of a local community in Patanka shows how community-led rehabilitation can yield results.

Patanka, a village of about 250 families, suffered extensive damage during the earthquake. About 170 houses collapsed and the remainder were badly damaged. Since it lies in an area beyond the reach of most relief teams, it received less attention from aid agencies. Even distribution of government compensation, as everywhere, was taking time.

Kheemabhai, a village leader from Patanka, learned about a Delhi-based disaster management NGO called the Sustainable Environmental and Ecological Development Society (SEEDS). He contacted SEEDS and explained that the inhabitants would like to reconstruct their village, themselves. Although SEEDS had been working in the area, this was the first time it was approached by a community keen to reconstruct itself. The village only requested logistical support from the NGO.

A meeting was organized with the district government to ensure speedy distribution of compensation so that the villagers could start rebuilding their homes. After a visit to the village by the district official, the enthusiasm he found convinced him of the opportunity the people represented. Patanka became a hive of activity.

People began rebuilding their homes; getting building materials from a special depot and collaborating with engineers on technical details about seismic-resistant construction. Entire families became involved, with women and children seen curing the masonry work with water or ferrying material to their sites.

Everyone contributed to the partnership approach. The initiative was truly led by the community. The SEEDS team helped the villagers obtain building materials, including limited amounts of cement and steel. The villages supplied their own stone, bricks, wood, roof tiles and labour. Architects and engineers from SEEDS trained the masons, labourers and the villagers on earthquake-resistant technology through on-the-job training and workshops.

Patanka is an international example of good practice in community-led rehabilitation. Two master masons from Nepal's National Society of Earthquake Technology came to teach their Gujarati partners how to build safe houses. They developed a very good rapport with all the villagers and expressed considerable respect for the abilities of the local masons.

While there were many external supporters, the decision-making was done by the people of the community itself. Each family determined its own home design, the material they would use and then initiated the construction. Now, there is a pool of trained masons in the village able to help neighbouring villages to rebuild.

Recognizing the strength of this community-led rehabilitation model, organizations including UNCRD, Gap Inc. and the Earthquake Disaster Mitigation Research Centre in Japan all supported and promoted the Patanka project.

In Patanka, there was not only excitement about building a new village, but a great sense of ownership and pride among the villagers. They did it themselves, paid for it themselves, and accomplished it in a technically safer way that will protect their homes in the future.

SEEDS and UNCRD recently published *The Sustainable Community Rehabilitation Handbook*, based on their experience in reconstruction following the Gujarat Earthquake.

Case: South Asia – Bangladesh, India, Nepal, Pakistan, Sri Lanka

Duryog Nivaran, the Network for Disaster Mitigation in South Asia, sponsors a project called Livelihood Options for Disaster Risk Reduction. The project recognizes that for millions of people in South Asia, living with disaster risk is a fact of everyday life. Therefore, the project is community-based and identifies the links between livelihoods and disaster risk reduction.

Only by strengthening livelihoods and building more effective coping capacities within communities can a viable foundation for disaster risk reduction be created. Supported by the Conflict and Humanitarian Affairs Department of the UK's Department for International Development (DFID), the project has the following goals:

- conduct research to identify the implications of disaster risk on livelihoods;
- formulate strategies that strengthen livelihoods and reduce risks;
- develop the capacities of stakeholders through community-based approaches to disaster management;
- undertake pilot demonstrations of risk reduction strategies;
- advocate policies to influence a paradigm shift that recognizes disasters as a part of the development process; and
- empower communities to take an active role in building resilience to hazards and to minimize future exposure to disasters.

<http://www.duryognivaran.org>

Case: Maldives

Community awareness of vulnerability is common in the Maldives. The country's landmass of low-lying coral atolls is particularly threatened by rising sea levels. From 1998-2000 there were five damaging storms that affected 43 islands and five atolls.

In June 2000, severe waves lashed the resort island of Bolifushi causing US$ 1.3 million in damage. To prevent such hazards from becoming future disasters, local communities and NGOs have worked together planting trees on the beaches and constructing sea walls to prevent beach erosion. This has minimized the impact of waves on the islands.

Case: Central American communities

The Central American Community Risk Management Network was inspired by the impact of Hurricane Mitch. Feeling as though they had been excluded from the reconstruction process, community-based organizations worked to develop grassroots approaches to risk management and disaster reduction. The network was formed in Nicaragua in May 1999 with the support of CEPREDENAC, GTZ, UN-HABITAT and the IDNDR.

The network works through existing community organizations by providing training and technical advice. It has focused its attention particularly on the popular understanding of the relationships that exist between disasters and development. It stresses the need to strengthen existing community-based development organizations rather than creating new local disaster organizations. Member communities of the network have participated in early warning projects and training activities.

Dynamics of local collaboration

With the proper motivation, local communities are receptive to new ideas. However, the full participation of local inhabitants is only possible to the extent that efforts are based on mutual trust, a clear definition of the decision-making process and transparency in the management and financing of the activities. Politics and financial disparities exist in most villages and neighbourhoods, so it becomes important to identify shared values and concerns.

Scientists and engineers need to translate their research findings into concepts and language understandable by communities. Administrators must devise risk management practices that protect residents' interests and assets.

More often than not, successful community action hinges on low technology approaches that are easily and economically adopted by local people. Community action must be associated with a larger national strategy in which local efforts play a crucial part. Importantly, it must be recognized that localities are not unitary or one-dimensional but reflect communities of interest based on economics, location, gender, ethnicity and other factors.

If local capacity is to flourish, community collaborations must be inclusive and working relationships developed or strengthened among worker associations and unions, environmental groups, women's groups and other community associations. Successful outcomes depend on community involvement in planning and implementing activities so that local residents feel that the work of reducing risks has relevance to their lives.

They are crucial in both risk mapping and resource assessment, as too often the needs and resources that already exist within a community are overlooked or discounted. If these assets are harnessed and developed from the beginning, they form a valuable part of the process.

The IFRC Disaster Preparedness Appeals Analysis Mapping for 2002-2003 has indicated that a significant percentage of the sample group of 32 National Red Cross and Red Crescent Societies included community-based disaster management activities in their programmes. The IFRC learned that successful participatory planning needs to define a distinctive methodology with clear aims and objectives. It needs to involve

Box 3.21
The benefits of experience in community participation

The following is a list of the benefits and limitations of community participation in risk management observed by the International Federation of Red Cross and Red Crescent Societies.

Benefits:

- Participatory rapid appraisals provide relevance, increase ownership, and motivate self-initiated projects (Nepal).
- Bridges the gap between relief and rehabilitation (Mozambique).
- Increases the number of volunteers – the formation of Red Cross and Red Crescent community groups increase capacity at the local level.
- As mitigation components increase, so does resilience at community level, encouraging partnership processes.
- Action planning and identification of vulnerability become more problem-oriented (India).
- The development of community disaster plans creates a more organized response; they become a unifying force (Peru).
- Integrating community-based disaster preparedness with health programmes promotes development and income generation, increasing resilience to disasters.
- Establishing networks with local government leaders (Papua New Guinea).
- Community originated empowerment supported by Red Cross and Red Crescent through moral support rather than hardware, for example by encouraging the identification of risks by communities.
- Integrating disaster preparedness into health workshops merges similar programme interests and aids cooperation within volunteer training of civil protection agencies, the Ministry of Health, and the National Red Cross and Red Crescent Society (Syria).
- Creating regional awareness for community action and promoting HIV/AIDS as global disaster and health issues (North Africa).

Limitations:

- Sometimes there was misunderstanding with local authorities, who saw the programme as a threat to maintaining a sense of dependency by the local population.
- Inadequate capacities of the local Red Cross and Red Crescent to support activities at the community level. However, community-based disaster preparedness approaches progressively are resulting in increasing Red Cross and Red Crescent capacities at national, branch and community levels of activity.
- Poor planning processes in some areas.
- Insufficient efforts to ensure sustainability after initial funding period.
- Roles can sometimes clash with those of local authorities, especially in the absence of an inclusive planning process.
- Lack of community-based disaster preparedness and management was a serious detriment in gaining public response at local level (Turkey).

Source: International Federation of Red Cross and Red Crescent Societies, 2002.

the government, technical agencies, NGOs, community leaders, UN and other international agencies. In addition careful thinking is required for a reliable funding strategy that can ensure sustainable commitments.

There is a need to identify performance indicators and criteria for success if a sense of public value is to be sustained. In this regard, it can be important to define local roles within the larger context of other national programmes. The experiences of the national societies in Bangladesh and Philippines demonstrate positive relationships between integrated participatory planning and enhanced levels of local self-reliance.

Traditional community coping mechanisms at stake

In many places, land use in local communities is based on traditional practices which help to cope with phenomena such as drought and floods. Both land tenure and seasonal uses and resources are often based on communal interests, frequently reflecting long considered environmental conditions. In many communities in Africa, island states and particularly fragile ecosystems such as arid lands, these practices may be respected more by local inhabitants than national juridical law.

Increasingly, traditional ways are being replaced by dominating modern economic interests, often increasing vulnerability and exposure to hazards and weakening coping capacities. Examples can be found in the Brazilian rainforest, where the interests of indigenous groups are being superseded by external economic interests. In some places forest is being replaced with pastoral land, causing land degradation, increasing potential drought and flood conditions and creating circumstances of social exclusion among the traditional or settled inhabitants.

In just one example that is not unique, urban migration in Pacific island states results in radical lifestyle changes for many islanders. Urban immigrants frequently lack knowledge about local hazards and urban risks, and are seldom familiar with appropriate behaviour to minimize potential losses in their adopted habitats.

More importantly, in terms of a social cohesion that is essential for self-reliance, they are often marginalized politically and frequently lack the social network of kin. Such a network supplies vital support and can be relied upon for information and communal responsibilities in most villages.

The process of urban adaptation involves a shift away from community self-reliance and shared knowledge towards an expectation that official government organizations will provide protection, warnings, support and relief. These are considerations yet to be seriously accommodated in national strategies of disaster reduction and risk management.

Future challenges and priorities
Community action

It is crucial for people to understand that they have a responsibility towards their own survival and not simply wait for governments to find and provide solutions. A meaningful link needs to be fostered between the development of national policy direction and the use of mechanisms that can translate disaster reduction principles into sustained and flexible locally-based activities.

Community participation is something that is understood differently in each cultural or political context. Following are some challenges and priorities for consideration:

Increasing social cohesion and community empowerment at all levels

- Local communities, civic groups, traditional structures and public services should be encouraged and financed as they can reduce vulnerability and strengthen local capacities.
- Existing community-based organizations, including women's organizations, should be reinforced.
- Mechanisms for community participation in information, decision-making and resource management to reduce risk should be strengthened in ways that include all community groups, and both women and men equally.
- The involvement and participation of people in all technical, developmental and policy-related projects need to be encouraged by creating inclusive discussion forums. In this way, people can evaluate, explain and discuss their own needs, as well as maintain a dialogue with scientists, politicians and other skilled people about what can be done to reduce risks.
- Externally determined policies should be re-evaluated by local people to ensure they are compatible with their community needs.

Enhancing local technical skills

- Transfer of expertise at local level should be enhanced, such as early warning procedures particularly suited to small-scale requirements.
- Transfer of local experiences and their application within various communities must be developed.
- Traditional knowledge or means of anticipating and managing risk factors should be recorded and as needed, taken into local consideration.
- Better communication is required among authorities and community leaders.

Ultimately, the success of risk reduction pertains emphatically to sustainable development, and both endeavours require the widespread participation of an informed and committed public. As the sustainable development context encourages participatory processes through community efforts, these should also be applied to disaster risk reduction practices.

As effective risk reduction must draw on traditional strengths, collective experience and local skills, they must all be pursued conscientiously over a period of time and supported with necessary resources, long before an immediate threat of crisis.


Riskland

Chapter 4

Building understanding: development of knowledge and information sharing

4.1 Information management and communication of experience

Effective disaster risk management depends on the informed participation of all stakeholders. The exchange of information and easily accessible communication practices play key roles. Data is crucial for ongoing research, national planning, monitoring hazards and assessing risks. The widespread and consistent availability of current and accurate data is fundamental to all aspects of disaster risk reduction.

Information describes working conditions, provides reference material and allows access to resources. It also shapes many productive relationships. Rapid developments in modern communications help to record and disseminate experience, convey professional knowledge and contribute to decision-making processes.

Integrating new developments in information management with established and more traditional methods can help to create a much better understanding about hazards and risk at all levels of responsibility. This information can be disseminated through public awareness programmes. Information is also instrumental in achieving more comprehensive early warning systems and effective mitigation efforts.

This section will discuss:

- *current issues in information management;*
- *international dimensions of disaster risk management information;*
- *electronic exchange of global experience;*
- *regional initiatives;*
- *national information programmes; and*
- *technical information about hazards.*

This section deals with information management. Web site addresses have been included in the text, where relevant. More web sites for additional information are listed in the directory of organizations (see annex 2).

Current issues in information management

Advantages

Disaster risk reduction issues concern popular interest and official policy. The information available on the subject is expanding rapidly. The sources, previously associated mainly with catastrophic events or considered the domain of specialists, now reach a wider range of users. The number of interested people, educational institutions, organizations and local community users is growing, as are relevant web sites, networks, professional and often multidisciplinary exchanges.

In addition to these many sources for exchanging technical or specialized data, other means of communication have emerged to disseminate research about disaster risks and to convey information about new activities and programmes. Within the ISDR framework, Internet-based electronic conferences and discussion forums have been successful on several occasions.

Geographic Information Systems (GIS) technology is an increasingly accepted tool for the presentation and analysis of hazards, vulnerabilities and risks. Other forms of information dissemination provide new insights about knowledge engineering, management techniques and cognitive sciences. Many of these tools are becoming increasingly widespread and useful even at localized levels of activity in such matters as facilitating decision-making, planning options, working online with remote collaborators, and conducting a variety of distance conferencing or educational opportunities.

Some promising developments in the evolution of information systems relate to innovative machine/user interfaces that rely on natural language processing for searching and analysing data. Other systems rely on the expanded use of "fuzzy logic" and expert learning systems such as those based on neutral networks.

Many of these advanced techniques hold promise in communicating information in quicker or automated early warning systems, distinctive public awareness programmes, and for a wide variety of educational or community-based applications. They can assist in the development of learning materials, guided by the specific needs and interests of communities or individually targeted users or interest groups.

Limitations

The tremendous growth in the number of sources and volume of data pose challenges in the processing and dissemination of meaningful information. Users find it ever harder to assess the accuracy and validity of information. Systematic processes of gathering data and the timely provision of desired products are keys to ensuring the effective use of information. Sorting, analysing and targeting information for primary interest groups are also critical in the dissemination of knowledge.

There is a growing tendency for many information providers to rely on increasingly sophisticated means of electronic communication, thereby excluding many potential users. Women generally tend to have less access to computers than men and, across the globe, regions vary widely in the access that low-income residents have to computers.

Many institutions now rely on electronic communications to satisfy their own needs. By doing so they may unintentionally place their information beyond the reach of many people most vulnerable to hazards.

Several factors have hindered the development of efficient information systems for general use, while other constraints might be more institutional in nature.

Several commentators in Africa have conveyed to the ISDR Secretariat their view that the provision of timely, definitive information remains problematic in all aspects of disaster and risk management.

Responses from Bangladesh and others to an ISDR survey said that a plethora of government agencies, international and technical organizations, academic institutions and NGOs all produce relevant information, resulting in information overload. The need of individual organizations to have adequate information for their own programme interests has motivated most development agencies to work from their own information systems that cannot be applied easily to other settings.

As a result, information related to hazards or past disasters either can be scattered or duplicated, often appearing to be inconsistent or incompatible. Too often, the systematic coverage of data, its reliability, timeliness or general quality relating to the dynamic nature of risks is problematic or poor.

Such basic inadequacies can be further compounded by the perceived sensitivity of data about infrastructure or potential threats to a society by security services or various other governmental responsibilities. It is such features, rather than inherent limitations of modern

Box 4.1
Lack of information or lack of access?

According to ISDR reports, there are many countries in which a wealth of disaster risk information exists in archived form. Such information might be inaccessible for restricted institutional or technical reasons:

- Data is restricted for presumed security purposes or as an institutional power base.
- Inadequate cross-sector communication about the existence of data.
- Dissemination of information is not considered a priority by the organization.
- Information is maintained in specialist, non-standard or outdated formats.
- Existing information is costly to convert into more readily accessible formats.
- Data compilers have not consulted users about their data requirements.
- Information for women's advocacy organizations and other community-based groups is not readily available and gender-specific data is not consistently gathered or disseminated.

communication technologies, that are often seen to impede easier or more effective access to crucial information.

While many organizations are involved in risk reduction activities, no universally-acknowledged focal point exists to provide easy or consistent access to the great variety of pertinent information. As a consequence, important data is scattered around the globe, or valuable experiences are confined within individual institutions, with no common point of access.

One of the major constraints in the more effective use of information is the unavailability of data. Many areas are without basic data or have not maintained consistent databases over time. Even on an individual basis, precise information often is difficult to obtain as much of the existing data is either generalized or does not reflect a comprehensive picture of the situation at hand.

There is a growing need for disaster events to be geo-referenced in order to look at risk not only from a singular hazard point of view, but also from an orientation to the relative levels of exposure. This requires more attention to be given to improving the geographical and temporal coverage of publicly available hazard and risk databases. While increasing attention may be given to linking database information, there are few examples that are truly integrated, or which encourage multi-variant analysis or comparison.

Crucial limitations in the collection and use of data remain in several fundamental areas. There is a widespread lack of consistent coverage of relevant data in both time and space, with data gaps most pervasive in the poorest countries. Data quality is adversely affected by a lack of methodologies or standard protocols pertaining to data gathering, compilation, storage, analysis and dissemination. Consequently, valid comparisons or cross-referenced analysis are difficult or not even attempted.

Incomplete, spotty or inadequate data also invites a misinterpretation of information. At times this may even be intentional or biased for ulterior motives, such as to demonstrate a certain political viewpoint.

International dimensions of disaster risk management information

One of the primary functions assigned to the ISDR Secretariat by the UN General Assembly is to serve as a global information clearinghouse for disaster reduction. This role as an information hub on the subject is seen as a means to encourage more opportunities for the dissemination of information among a wide range of institutions and to foster relationships based on advocacy, networking and information management.

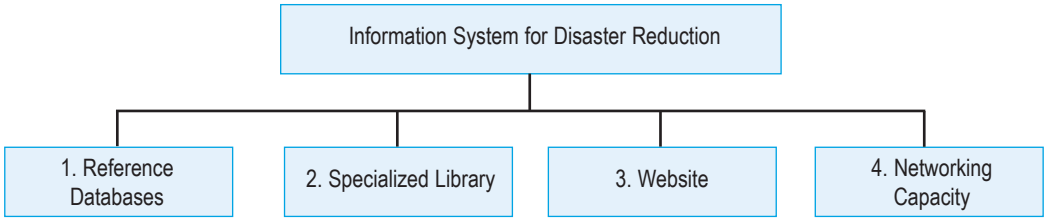
Objectives have been outlined to undertake the systematic collection, analysis and publication of information concerning natural hazards, risk reduction and disaster reduction initiatives. To fulfil the functions of an information clearinghouse for disaster reduction, the ISDR Secretariat must become an effective global focal point for sharing risk reduction information and its management in the UN and beyond. It is thereby strengthening networks, helping disaster reduction practitioners to share information, with challenges remaining to:

- Compile, analyse and disseminate data, information and related products on natural hazards, risk reduction and disaster reduction to organizations, countries, partners and communities in order to promote wider public awareness, professional access and political commitment.
- Provide worldwide access of relevant and accurate information on risk reduction freely, based on input from all stakeholders, through the further development of an interactive ISDR resource centre, including databases, library, web site and knowledge network.

These activities must rely on productive relationships with many specialized organizations and institutions. They embody a complex process of many links and involve several different elements, including:

- Related databases of specialists, organizations, projects and initiatives, country information related to risk reduction experience and information, events drawn from multiple sectors, educational and training activities and facilities.

Figure 4.1
Information system for disaster reduction



Source: UN/ISDR, 2003

- A specialized multimedia library and related documentation services.
- An upgraded web site for disaster reduction.
- Interactive networking and knowledge-based capabilities.

There are numerous examples that illustrate how information management and innovative communication practices have helped advance public understanding and professional involvement in disaster risk reduction in recent years. Several of these more comprehensive initiatives compile and process information on a global basis, although each has its own individual emphasis.

The Centre for Research on the Epidemiology of Disasters

The Centre for Research on the Epidemiology of Disasters (CRED) collaborates with the World Health Organization (WHO). It is located at the School of Public Health of the Catholic University of Louvain in Brussels, Belgium.

CRED maintains a global Emergency Events Database (EM-DAT). It is a comprehensive record of natural disasters which documents more than 12,500 events by type and country of occurrence over the last century. Initially, it was created with the support of WHO and the Belgian government.

The CRED database is widely recognized for its efforts to provide a consistent rendering of the often casual, vague or conflicting information about disasters that is frequently conveyed in different formats. <http://www.cred.be>

Munich Reinsurance

The NatCat service is another highly regarded database that is maintained by the Research and Development Department of Munich Reinsurance (Munich Re), in Munich, Germany. It provides information about major and technological natural catastrophes that have occurred around the world since 1965, although neither the social nor economic consequences of droughts are currently included in its records.

Information derived from NatCat and additional analysis of hazard trends is distributed widely by Munich Re in its publication *Topics*, an annual review of natural catastrophes, published in five languages. Munich Re also provides detailed information to commercial clients and other interested parties about specific disaster events or amalgamated information regarding regional or global exposure analyses and trend studies.

The Munich Re World Map of Natural Hazards has been a valuable source of information for risk management professionals since it was first published in 1978. The Globe of Natural Hazards, most recently updated in 1998, has also proved to be an effective information tool.

Munich Re regularly produces additional publications and has issued a CD-ROM, *World of Natural Disasters*, to advance public knowledge of hazards. By using digital technology and GIS, this CD-ROM provides basic risk identification and evaluation expertise to engineers, government officials and other interested parties. It can be used to identify quickly the predominant natural hazards and related risks at any terrestrial position

Box 4.2
Global Identifier Number

Accessing disaster information can be time consuming and laborious. Not only is data scattered but frequently identification of the disaster can be confusing in countries with many disaster events. To address both of these issues, the Asian Disaster Reduction Centre (ADRC) proposed a unique global identification code for disasters; a Global Disaster Identifier Number (GLIDE).

The Centre for Research on the Epidemiology of Disasters (CRED) and UN-OCHA ReliefWeb have adopted GLIDE for use in their databases and have been working with GLIDE partners for better information sharing. Their partners include ISDR, UNDP, IFRC, WMO, FAO, the World Bank, OFDA/USAID and LA RED.

A GLIDE number is issued every week by CRED for all new disaster events that meet certain criteria. The components of a GLIDE number consist of two letters to identify the disaster type (e.g. EQ for earthquake); the year of the disaster; a four digit sequential disaster number; and the three letter ISO code for country of occurrence. Thus, the GLIDE number for the Gujarat earthquake in India is EQ-2001-0033-IND.

This number is used by CRED, ReliefWeb and ADRC on all their documents relating to a particular disaster. Gradually other partners are expected to include it in information they generate. As more information suppliers join in this initiative, documents and data pertaining to specific events can be retrieved more easily from various sources, or otherwise linked by using the unique GLIDE numbers. GLIDE can also assist by serving as a key for national level disaster datasets to relate consistently to international disaster databases.

In 2003, GLIDE partners agreed to expand the sequential disaster number to six digits and to allow a fifth suffix for a three digit administrative code to identify the disaster-stricken area in the country. It was thought that such an addition would prove useful for national disaster datasets. Several countries will proceed to create national disaster databases accordingly, with the support of UNDP.

A search function already exists on the GLIDE web site to locate disaster information easily by any of the following parameters: disaster type, year, country, and GLIDE number. An automatic GLIDE generator function that will issue a new GLIDE number for the occurrence of new events will be available on the web site. The success of GLIDE depends on its widespread use and its level of utility for practitioners. ADRC has prepared a web site to promote GLIDE and welcomes the views and experience of users to improve its utility. <http://glidenumber.net>

in the world at the click of a button. The CD-ROM also contains comprehensive profiles and basic risk-related reference information about more than 200 states and territories. <http://www.munichre.com>

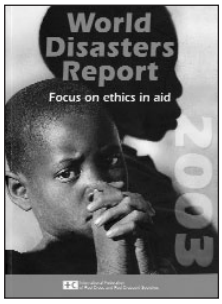
Swiss Reinsurance

Another major global reinsurance company, Swiss Reinsurance (SwissRe), has also maintained specific data on natural hazards and catastrophes since the 1970s. Some of this information is provided publicly through their *SIGMA* publication, published eight times a year. In addition to individual subject-focused publications about natural hazards, SwissRe also publishes an annual review. It summarizes annual data on disaster incidence and analyses trends in risk, exposure and commercial insurance considerations in several languages. Additional risk and disaster-related data is available on SwissRe's free online database, CAT-NET, although potential users need to register prior to accessing the password-protected web site.
<http://www.swissre.com>

ReliefWeb

Another widely used global information resource is ReliefWeb, an electronic database and information service operated by the UN Office for the Coordination of Humanitarian Affairs (OCHA). It focuses primarily on current international emergencies and disasters with humanitarian implications, although it also provides response-oriented information about natural disasters. ReliefWeb provides an excellent and wide-ranging selection of information, press accounts, related contacts and operational information. It also provides archival information drawn from public, governmental, NGO and authoritative sources about various types of emergencies and their consequences. It maintains an archive of specialized maps related to emergency and crisis events, frequently preparing them to address current or localized emergency conditions. However, as its name indicates, it largely relates to emergency preparedness and response interests.
<http://www.reliefweb.int>

Box 4.3
Global reports on disaster, risk and vulnerability

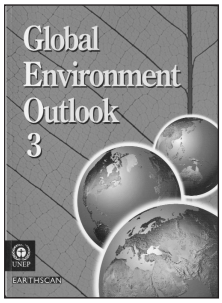


World Disasters Report

One of the most respected sources of information about disasters is the *World Disasters Report*, an annual publication of the International Federation of Red Cross and Red Crescent Societies (IFRC).

Published since 1993, the *World Disasters Report* provides the latest trends, facts and analysis of the world's humanitarian crises. Described by the World Bank as "a very valuable resource for the international community", the report is an indispensable reference work for those searching current information about strategies and tactics in the face of disaster. The report is backed by the resources and expertise of IFRC.

The 2002 edition of the *World Disasters Report* focused on risk reduction. The report examined preparedness and mitigation initiatives from disaster-prone countries around the globe. In addition, the report studied the issue of humanitarian accountability, presented a methodology to assess vulnerabilities and capacities and concluded with disaster data tables. It addressed current issues such as whether disaster preparedness and mitigation pays off in terms of lives, livelihoods and assets saved.
<http://www.ifrc.org>

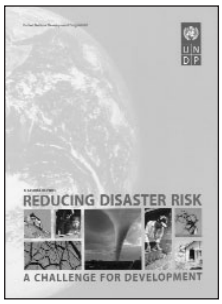


Global Environment Outlook

UNEP has launched the *Global Environment Outlook (GEO)* series, which contains baseline information on emerging environmental issues and threats, as well as policies being implemented at global and regional levels.

The findings and recommendations of the *GEO* series constitute the basis of UNEP activities in early warning, vulnerability and risk assessments. The *GEO-3* report of May 2002 addressed human vulnerability to environmental changes, including elaboration on the specific relationships between the impacts of natural hazards and emerging disasters.

UNEP also produces other reports of regional and thematic scope, such as on small island developing states.
<http://www.unep.org>



Reducing Disaster Risk: A challenge for development

UNDP has been publishing their annual *Human Development Report* since 1989. It has increased public understanding of the social dimensions of development. The Human Development Index and the Human Poverty Index are both based on carefully selected parameters for which data are available and provide alternative indicators to conventional economic measurements such as gross domestic product (GDP).

In 2004 UNDP's Bureau for Crisis Prevention and Recovery (BCPR) launched a publication entitled *Reducing Disaster Risk: A challenge for development*. It aims to shed light on the linkages between development and disaster, addressing the increasing impact of natural disasters on development and the acknowledgement of development paths as determinant configuration factors of disaster risk. It promotes disaster risk reduction by identifying appropriate development policies that integrate both disaster risk management and actions targeting the achievement of the Millennium Development Goals.

As part of this publication, UNDP presented a Disaster Risk Index, which will compare countries according to their relative risk levels over time. The index highlights the level of national progress made on mitigating disaster risk.
<http://www.undp.org/bcpr/disred/rdr.htm>

International Federation of Red Cross and Red Crescent Societies

The International Federation of Red Cross and Red Crescent Societies (IFRC) launched its Disaster Management Information Systems (DMIS) In November 2001. This web site provides a single entry point for disaster management information for members of the International Red Cross and Red Crescent Movement.

Supported by four National Red Cross and Red Crescent Societies, the UK Department for International Development (DFID) and the Ericsson Response Program, the project aims to provide information about disasters in a systematic way and to monitor factors that might signal an impending crisis.

The development of DMIS is a reflection of the *IFRC Strategy 2010*. It demonstrates three strategic directions; responsive and focused on disaster preparedness and response; supportive of well-functioning National Red Cross and Red Crescent Societies; and striving to work together effectively.

While DMIS is restricted in use to the Red Cross and Red Crescent network, it does provides a toolbox of working documents, templates, operational guidelines and links to online data sources sorted by categories. It also provides access to 400 external web sites related to disaster management, as well as to a variety of Red Cross and Red Crescent web-based initiatives.

DMIS is expected to speed up emergency awareness, encourage preparedness measures and enable effective action by providing decision makers with timely information. As the basis for both an organizational and an operational network, it facilitates the exchange of experiences from Red Cross and Red Crescent activities throughout the world.

Specific operational links to data sources during a disaster are grouped, highlighted and then archived for future reference. The preparedness section of the site allows Red Cross and Red Crescent delegates to register information about disaster trends from anywhere in the world and to obtain the latest information and responses to unfolding disaster situations.

During large-scale emergencies, ongoing operational information can be exchanged, such as logistics mobilization details. Contact references are also posted to improve communication among the different actors involved. This interactive tool continues to evolve as new features are added on a regular basis in response to the needs of its users. The password-protected site has almost 1,500 registered users and is accessible to 125 National Red Cross and Red Crescent Societies. The DMIS project team can be contacted electronically. <dmis@ifrc.org> <http://www.ifrc.org>

Global Disaster Information Network

While the objectives of the Global Disaster Information System (GDIN) are yet to be fully realized, this international collaborative association of specialists from governments, international and donor organizations, NGOs, commercial and academic institutions is working to enhance capacities to receive and use disaster information.

GDIN seeks to offer a variety of services that can link users with appropriate information providers and to encourage the use of greater technical compatibility or integration of information systems across geographical regions so that information can be shared more effectively.

While much of its interest revolves around remotely sensed data, GIS applications, mapping and display information, GDIN also tries to assist disaster specialists in obtaining information that may otherwise be difficult for them to locate or to access through individual efforts. It particularly tries to help disaster managers in areas where there are limited resources or limited access to technology through both negotiated international agreements as well as efforts to standardize communication protocols and technical compatibility. <http://www.gdin.org>

Electronic exchange of global experience

Beyond established institutional information capabilities pertaining to disaster risk reduction, there are other forms of publicly accessible and free multidisciplinary Internet-based discussion groups, listserves and related electronic networks. While they are often transitory and dedicated to facilitating either the discussion or exchange of experience related to particular subject matters or a forthcoming global event, they provide a useful global forum and attract additional users to risk reduction information.

One such online discussion forum was organized in May 2002 by an NGO network, the Stakeholder Forum for Our Common Future, and the ISDR Secretariat, prior to the World Summit for Sustainable Development. The theme was, "Links between natural hazards, environment and sustainable development: Taking action to reduce the risk of disasters".

An effort was made to broaden the discussion to a larger group of people than may otherwise have been involved with matters of sustainable development. More than 350 participants from 80 countries registered and many exchanged their views, experiences and concerns.

Numerous topics emerged, including the impact of natural hazards on development and how to reverse vulnerability; risk assessment and early warning systems; fostering community involvement and developing coping capabilities within communities; and the promotion of education and capacity-building.

A wealth of experience unfolded during the one month discussion, as case examples illustrated a variety of specialist knowledge. There were also insightful comments about current limitations in linking risk reduction and sustainable development and the roles and responsibilities that could lead to potential solutions.

Some of these outlooks are included in this global review. Regardless of the individual views expressed, the value of such a forum is the opportunity to exchange views with people around the world who share a professional interest and personal commitment to these issues. <http://www.earthsummit2002.org>

A similar cyber conference was organized in November 2001 by the UN Division for the Advancement of Women on disaster reduction and natural resource management with a gender perspective. Over a six-week period, contributors posted their viewpoints on five different issues.

Subjects related to gender patterns in the use of environmental resources, coping skills, and various opportunities for women's empowerment in the windows of opportunity following natural disasters. The subjects of integrating gender equity goals into disaster prevention and sustainable development initiatives also were included. This international dialogue was the basis for the subsequent 2002 Expert Working Group which met in Ankara, Turkey. <http://www.un.org/womenwatch/daw>

The ISDR Secretariat and the UN Development Programme (UNDP) jointly conducted an electronic dialogue in mid-2003 on a framework to guide and monitor disaster risk reduction. This electronic exchange was considered an excellent means to circulate a work in progress and to engage a wide range of comment about the ideas being considered.

Through this collective endeavour the overall goals encouraging and increasing effective disaster reduction practices were advanced. The online conference provided a forum for stakeholders to exchange views and identify a future course of action needed to develop a more commonly accepted framework for understanding, guiding and monitoring disaster risk reduction at all levels. The wide reach of the electronic exchange brought the global experience of many professional, geographical and institutional groups into the process. <http://www.unisdr.org/dialogue>

The Natural Hazards Disasters Network is yet another form of a managed information service and ongoing discussion group, covering socio-economic, psychological, organizational, scientific and technical aspects of disasters. Its members are drawn from operational agencies and academic institutions throughout the world, although anyone with an interest in the subject can participate. <http://www.jiscmail.ac.uk/lists/natural-hazards-disasters>

The Radical Interpretation of Disaster Experience (RADIX) is a lively web site that provides an electronic venue for discussion, working papers, opinion pieces, resources or links that can help in understanding the root causes and social dimensions of hazards, vulnerability and risks.

This includes issues such as human rights; respect for diversity; the transformation of existing knowledge into action; and links between disasters, economic development and political issues. RADIX maintains a particular emphasis in local community interests and people-centred activities for risk reduction.

The discussion group and documents which are posted bring together groups involved in various ways with disaster risk reduction, even if they have not always occupied common ground or shared information so easily with one another. The diverse community includes scientists, human rights activists, development workers, government officials, business executives and media representatives, each having some experience with risk issues. <http://online.northumbria.ac.uk/geography_research/radix/>

The Gender and Disaster Network is also a vehicle for sharing resources and ideas across regions. It provides a resource bank of international academics, activists, relief workers, and policy makers interested in integrating gender equality into all aspects of disaster prevention, response and reconstruction. A listserve enables members to share ideas and information. Publications posted to the web site include case studies and reports, field accounts, bibliographies, gender-sensitive guidelines, and the proceedings of recent international conferences on women in disasters. <http://online.northumbria.ac.uk/geography_research/gdn>

Regional initiatives

Regional information or documentation centres relating to hazard awareness or risk reduction activities have been established in several locations. A review of some of these centres will illustrate the different approaches and the diversity of interests that are served in different parts of the world. Nevertheless, the value of their products and services all contribute to the growing body of international knowledge on disaster risk management.

Africa

There is no region-wide disaster information centre covering the variety of hazards or risk conditions on the African continent. However, there are several specialized documentation centres that are expanding their activities into related fields of risk.

Box 4.4
Drought information in Africa

The Intergovernmental Authority on Development Drought Monitoring Centre, in Nairobi, Kenya, and the Southern African Development Community (SADC) Drought Monitoring Centre in Harare, Zimbabwe have expanded their scope in recent years.

They are now important regional centres for information about climate conditions and hazards. Periodic climate forecasts are produced by each of these centres and circulated widely among both technical and policy officials in most countries of Southern, Eastern and Central Africa.

Similarly, the Regional Early Warning Programme and the regional remote sensing activities of the SADC Food, Agriculture and National Resources division produce routine and specialized information on drought and related risks affecting food security. SADC also supports project activities related to the environment and land management issues as well as water resource management programmes.

AGRHYMET, the specialized hydrometeorological institute of the Permanent Interstate Committee for Drought Control in the Sahel produces and disseminates information.

These institutions work together to improve the quality of technical information available for policy makers in the region. However, in the broader context of information management, such specialized centres, working within specific professional environments, highlight the problem of incorporating information more systematically into conventional risk reduction communication. <http://www.agrhymet.net>

The Southern African Research and Documentation Centre

The Southern African Research and Documentation Centre (SARDC) is a highly regarded centre. Based in Harare, Zimbabwe, SARDC is an independent regional information and documentation centre that seeks to enhance the effectiveness of key development processes in the region. It pursues this aim through the collection, analysis, production and dissemination of information and by working to enable local capacities to generate and use information.

It has operated as a non-profit foundation since 1987 and its objective is to improve the base of knowledge about economic, political, cultural and social developments and their implications. Information is accessible to governments and policy makers, NGOs, the private sector, the media and regional and international organizations.

The documentation centre contains more than 9,000 subject files on regional issues, a library of books and periodicals, and computerized databases of selected materials. It also maintains specific bibliographic and contact databases on areas of interest.

Specific subject areas related to risk reduction include the state of the environment in Southern Africa and disaster management information devoted to drought. It also provides information on regional socio-economic and political issues relevant to development and governance that have a bearing on risk awareness and management practices.

SARDC maintains the India Musokotwane Environment Resource Centre for Southern Africa (IMERCSA) which provides users with current information on environment and disaster management in Southern Africa. It is also the leading regional centre for global reporting on the state of the environment, producing fact sheets on environmental issues and a newsletter about the Zambesi River basin. It published the comprehensive book, *State of the Environment in Southern Africa*, with the thematic updates, *Water in Southern Africa* and *Biodiversity of Indigenous Forests and Woodlands.*
<http://www.sadrc.net/Imercsa>

With offices in Dar-es-Salaam, Harare and Maputo, and by working with partner organizations in all Southern Africa Development Community (SADC) countries, SARDC is well placed to facilitate seminars, conduct briefings and undertake consultancies. Additionally, SARDC staff and correspondents produce a variety of articles and reports for the Southern African News Features media service. As part of its commitment to develop professional information and reporting capabilities in the region, SARDC also conducts regional training programmes and exchange assignments involving the Southern African media. <http://www.sardc.net>

Latin America and the Caribbean

As elsewhere, the worldwide revolution in digital communications has swept through Latin America and the Caribbean. In a crucial area for disaster and risk management, by 2000 practically all national health ministries in the region were connected to the Internet. Such networks have become essential for responding to the many emergencies in the region.

In a different context, but in providing the foundation for implementing any disaster risk reduction strategies, the UN Economic Commission for Latin America and the Caribbean (ECLAC) has developed a methodology that allows the systematic comparison of disaster data. This has proven to be crucial for building a regional database of major events that required external assistance.

A specific example is provided by the response and reconstruction activities that followed Hurricane Mitch. They may be considered to be the first in which computer-mediated communications played a major role in decision-making. Risk management institutions and professionals are now routinely accustomed to seeking information from a large number of web sites.

Regional Disaster Information Center

One of the most comprehensive sources of information on disaster and risk management in

Latin America and the Caribbean is the Regional Disaster Information Center (CRID), located in San José, Costa Rica. This centre was established from a pilot scheme originally developed by the Pan American Health Organization (PAHO) in 1990, with a mission to reduce disaster vulnerability by promoting a culture of risk reduction and cooperative efforts in risk management activities.

By 1997, CRID had the support of PAHO, IDNDR, CEPREDENAC, IFRC, Costa Rica National Risk Prevention and Emergency Response Commission (CNE) and Médecins sans Frontières (MSF). It offers information and reference documentation online, and in direct consultation at its offices, on a wide range of subjects, in both Spanish and English.

CRID provides governments, professionals and civil society organizations with abundant and unrestricted disaster information. Its web site provides online access to CRID resources as well as links to other disaster information resources, responding to more than 120,000 information requests annually.

Additional products available from CRID include the Virtual Disaster Library CD-ROM in English and Spanish, and the LILACS bibliographic database, updated periodically. Furthermore, CRID produces specialized bibliographies on specific disaster related issues. So far, 30 issues of this *Bibliodes* series have been published and distributed to several thousand users in both print and electronic versions.

Other information products developed by CRID include a variety of training modules on information management and digitizing documents, provided online and by CD-ROM. Furthermore, CRID produces specialized bibliographies on specific issues such as gender issues in disaster contexts. The centre also provides information management services and provides technical advice to sister organizations on the development of web sites and other information products.

With funding from ISDR, PAHO and the US National Library of Medicine, CRID is implementing a project aimed at creating better information management capacities in El Salvador, Honduras and Nicaragua.
<http://www.crid.or.cr>

Box 4.5
Regional Disaster Information Center, Latin America and the Caribbean (CRID)

The Regional Disaster Information Center (CRID) is a highly-regarded regional institution, which gathers, processes and disseminates high-quality information, and serves as a focal point for training and knowledge engineering related to bibliographic information technologies.

A primary aspect of all its activities is the building of additional institutional capacities for the better management and wider dissemination of disaster information, and the management of national or local disaster information centres. While its efforts contribute to the institutionalization of a regional disaster information system, CRID also promotes the concept of decentralization and disaster information exchange so that institutions and users can access materials more easily. In order to fulfil these functions CRID provides the following information services:

- assists a wide variety of institutional and individual users to search and find disaster and health-related information available through physical or electronic media;
- electronic access to an extensive collection of documents and other source materials;
- publication and distribution of information products such as bulletins, bibliographies and other materials for both public and technical use;
- development and delivery of training for disaster management information centres, in such areas as the use of databases, controlled vocabulary for disaster-related information and use of the Internet;
- design, production and distribution of training materials;
- collaboration with other institutions interested in disaster information management
- management of information projects; and
- organization of information displays and participation in specific events.

The Coordinating Centre for the Prevention of Natural Disasters in Central America

The Coordinating Centre for the Prevention of Natural Disasters in Central America (CEPREDENAC) web site contains continuously updated information on plans, programmes and projects in the region.

The web site contains disaster statistics and analysis for the region, as well as links to the web sites of each of the national disaster organizations in Central America and many other risk and disaster management organizations active in the region.

As the regional coordination centre for disaster prevention, CEPREDENAC has an important responsibility in encouraging economic and social planners working at national, regional and international levels to incorporate all information available in project design.

This includes information about hazards and risks and their cost-benefit analysis for development and infrastructure projects, leading to possible design modifications for more durable investments.

In 1999, CEPREDENAC produced a detailed inventory of available hazard, risk and vulnerability maps and related information available to decision makers regionally and investors worldwide. This inventory of more than 300 different cartographic references is presented in a conventional database format. A simplified version is available on the CEPREDENAC web site, and an interactive format allows users to conduct searches and queries online.

Source categories include:

- type of map support, digital format, original software;
- thematic nature of map (hazard, vulnerability, risks);
- scale on which map is displayed, geographical coverage, year of last update;
- institution in charge of compiling map information; and
- means of accessibility, reciprocity conditions.

The inventory includes institutions located outside the region that have produced additional cartographic materials about Central America. The relational format of the database allows searches by country, institution and type of hazard. <http://www.cepredenac.org>

The Latin American Network for the Social Study of Disaster Prevention

The Latin American Network for the Social Study of Disaster Prevention (LA RED) created the disaster inventory programme called DESINVENTAR. This innovative software permits the storage and recovery of statistical analysis and graphic presentation of information about damaging events at the smallest territorial scale.

Through an agreement with CEPREDENAC, DESINVENTAR has become the software used by all of the national disaster organizations in the region. It will be introduced in the Caribbean under the auspices of the Association of Caribbean States (ACS) and CEPREDENAC.

In addition to the disaster inventory, the LA RED web site contains publications, reports about ongoing projects and additional information about social science initiatives in vulnerability and risk reduction throughout Latin America and the Caribbean. <http://www.desenredando.org>

The Caribbean Disaster Information Network

The Caribbean Disaster Information Network (CARDIN) was established in 1999 at the University of the West Indies in Mona, Jamaica. By drawing on the experience of CEPREDENAC and CRID, CARDIN has pursued similar information objectives.

Box 4.6
Caribbean Disaster Information Network

The Caribbean Disaster Information Network's (CARDIN) focus is to provide wider access and coverage of disaster information in the region and to facilitate the dissemination of disaster-related information to the general Caribbean public. It strives to do this by working through the Internet, by publishing a newsletter and by document delivery services. It also intends to create a database of disaster-related information that is available on the Internet, in CD-ROM and in print format that will provide essential resources for policy makers, practitioners, researchers and the general public. CARDIN offers the following services:

- documentation centre;
- document delivery;
- online search for disaster information;
- reference services;
- electronic journals;
- links to selected full-text databases;
- dissemination of disaster information to the public through a web site and newsletters;
- creation of full documents and scanned images pertaining to disaster-related issues in the Caribbean for wider electronic circulation; and
- expanded working relationships with other agencies for more effective coordination of disaster information activities within the region.

CARDIN serves as a subregional disaster information centre and as the focal point for the exchange of disaster information in the Caribbean. CARDIN provides important information and communication links between the various national disaster management organizations in Caribbean countries. <http://www.cardin.uwimona.edu.jm>

North America

The Natural Hazards Research and Applications Information Center

The Natural Hazards Research and Applications Information Center at the University of Colorado, United States, was founded 30 years ago to "strengthen communication among researchers and the individuals and organizations concerned with mitigating natural disasters".

Its *Natural Hazards Observer* is a free publication published ten times a year to provide current hazards and risk reduction information, resource and institutional contacts. It publishes research initiatives and findings across the entire range of professional disciplines and jurisdictional responsibilities involved with risk issues, predominantly in North America.

Disaster Research, an e-mail newsletter and *Natural Hazards Informer*, a peer-reviewed series that summarizes current trends in natural hazard interests, are available on the centre's web site. The centre also has an extensive specialized library which is catalogued on the web site as well as a wealth of material related to hazards research and the mitigation of natural disasters.

There are many other noteworthy disaster risk management or hazard research centres in the United States, covering different subject areas or specializations. As interest increases, new centres dedicated to various aspects of risk management are being established.

While many exist as part of a university or academic institution, others have been established as charitable institutions, foundations, professional or scientific organizations, NGOs or commercial enterprises. Practically all of them are engaged in the exchange and dissemination of information related to risk reduction and virtually all such centres have web sites and additional information materials.

An extensive list of these sources of hazard and disaster information, institutes for study in related fields and all of their contact information are available on the Natural Hazards Research and Applications Information Center web site. <http://www.colorado.edu/hazards>

Box 4.7
North American Map of Natural Hazards and Disasters

During the later years of the 1990s, Emergency Preparedness Canada and its successor, the Canadian National Office of Critical Infrastructure Protection and Emergency Preparedness (OCIPEP) coordinated research with the Mexican National Centre for Disaster Prevention (CENAPRED) and the US Geological Survey to produce the North American Map of Natural Hazards and Disasters.

This comprehensive and informative series of maps drew on information from a number of existing sources and was published with very wide circulation by the American National Geographic Society (National Geographic, July 1998). The distribution of different natural hazards was combined with population characteristics to provide a simplified picture of risk and vulnerability throughout North America.

Beyond the public education values served by the map, the joint exercise in producing it was instrumental in initiating cross border dialogue and the sharing of knowledge between hazard experts and national, provincial and local organizations with interests in supporting hazard awareness and risk reduction in the three countries. <http://www.nationalgeographic.com>

Asia

In Asia, barely a start has been made to compile the vast range of regional information available on disaster risk reduction. There are important institutional focal points for the subject such as the ones that follow, but there are many more academic and technical facilities that address risk matters in their own areas of professional expertise or within the context of individual country needs.

Asian Disaster Preparedness Center

The Asian Disaster Preparedness Center (ADPC) is a regional resource centre dedicated to disaster reduction for safer communities and sustainable development in Asia and the Pacific. Located in Bangkok, Thailand, ADPC is recognized as an important focal point for promoting disaster awareness and developing capabilities that foster institutionalized disaster management and mitigation policies.

ADPC maintains a specialized library of disaster-related materials. The library database can be accessed online through its web site. It also publishes a quarterly newsletter, *Asian Disaster Management News*, for the disaster management communities in Asia and the Pacific.

It supports regional information exchange, networking and capacity-building by providing a range of information and documentation resources on urban disaster mitigation, climate variability, community-based disaster mitigation and flood preparedness among other subjects.

ADPC distributes CD-ROMs, case studies, newsletters, videos and other public awareness materials under its regional programmes and projects.
<http://www.adpc.net>

Asian Disaster Reduction Center

By collaborating with partners in Asian countries the Asian Disaster Reduction Center (ADRC) in Kobe, Japan accumulates and provides disaster reduction information throughout the region. The body of information available at ADRC provides a basis for conducting research in Asian disaster reduction, particularly as it relates to multidisciplinary and multinational cooperation.

ADRC has developed a unique geographical information system for disaster management called VENTEN with the objective of providing a common structure for referring to disasters and related data.

It has also developed a comprehensive database on disaster and risk management in collaboration with existing institutions including CRED and ReliefWeb. ADRC also draws on the information resources of its members and advisory countries.

A network of Asian NGOs called the Asian Disaster Reduction and Response Network has been formed by ADRC to exchange information and to promote more collaborative relationships. There is also a bi-weekly ADRC newsletter. Also, by including an extensive list of related institutional links in its web site, ADRC seeks to further opportunities of cooperation among existing institutions.
<http://www.adrc.or.jp>

Pacific region

In addition to the programmatic and information services provided by the South Pacific Applied Geoscience Commission (SOPAC) and the South Pacific Regional Environmental Programme (SPREP) the Pacific Disaster Center is also engaged in the applied uses of information and related services for disaster reduction.
<http://www.sopac.org.fj>
<http://www.sprep.org.ws>

Pacific Disaster Center

The mission of the Pacific Disaster Center (PDC) is to provide applied information research and analysis support for the development of more effective policies, institutions, programmes, and information products for the disaster risk management and humanitarian assistance communities in the Asia and Pacific regions and beyond.

These activities are crucial as more than 80 per cent of lives lost to disasters in the past decade have occurred in the Asia and Pacific regions. As disaster losses are often due to interactions between changing natural environments and rapidly growing societies, by using state of the art technologies PDC joins data and produces information products that relate hazard information with human conditions and needs.

Recognizing that natural and human-induced disasters are predominantly local issues with regional, national or global impacts, PDC works in conjunction with its managing partner, the East-West Center in Honolulu, to create an extensive network linking US research and

technology organizations with specialists in the Asia and Pacific regions. This cooperation fosters the establishment of viable personal and institutional relationships among regional decision makers who then work together on real-life issues.

PDC's strategic programme focuses on four areas: decision and policy support, risk and vulnerability, institutional capacity development, and humanitarian assistance support. Through these programmes the Pacific Disaster Center promotes the partnerships and technology required to create disaster information networks and disaster resistant communities in its areas of activity.

The innovative use of information, technology and applied research in support of comprehensive disaster risk management is central to these strategic areas. PDC applies advanced digital technologies, including remote sensing, GIS technology, disaster modelling, and Internet-based information distribution. These activities have several purposes:

- Promote proactive planning that includes hazard mitigation as a key element of sustainable development.
- Foster partnerships to raise awareness among the many segments of the disaster management community.
- Increase the operational efficiency of organizations by introducing innovative and appropriately scaled information resources, tools, and analyses.

PDC's highly skilled professional team is strategically located on the islands of Maui and Oahu, Hawaii. <http://www.pdc.org>

Europe

There are many European institutions involved with risk reduction information management and dissemination. However, as there are many overlaps in organizational relationships and subject matter, they compose a mosaic of sources with many different audiences. Following is a selection of some of the information centres and initiatives. Additional European institutions and projects which deal with information management in particular fields are reviewed in discussions about regional cooperation and research (see chapters 3.3 and 4.4).

Council of Europe

There are many information sources affiliated with the Council of Europe and with the EUR-OPA Major Hazards Agreement:

- European Natural Disasters Training Centre (AFEM) is located in Ankara, Turkey. Its main goal is to reduce the destructive effects of hazards through research, training and education at all levels, from policy makers and operational managers to field workers associated with disaster preparedness and response. It gives particular emphasis to the dissemination of information on earthquakes, floods and technological disasters to political leaders, practitioners and the public. It organizes seminars on disaster prevention and management, television broadcasts and other awareness activities, in collaboration with the Oxford Centre for Disaster Studies. <http://www.europarisks.coe.int/afem50.htm>
- European Centre for Geodynamics and Seismology (ECGS) is in Walferdange, Luxembourg. It acts as a link between scientific research and its application to the prevention and interpretation of hazards. <http://www.ecgs.lu>
- Euro-Mediterranean Centre on Insular Coastal Dynamics (ICoD) is in Valletta, Malta. It concentrates on education, research and information-related activities. <http://www.icod.org.mt/>
- European Centre for Research into Techniques for Informing the Population in Emergency Situations (CEISE) is located in Madrid, Spain. Its main area of work is to inform the public in emergency situations. <http://www.protecccioncivil.org>
- European Centre of new Technologies for the Management of Natural and Technological Major Hazards (ECNTRM) is located in Moscow, the Russian Federation. One of its objectives is the use of space technologies for forecast, prevention and relief in major natural and technological disasters. <http://www.europarisks.coe.int/ecntrm50.htm>

- European Centre on Training and Information of Local and Regional Authorities and Population on the Field of Natural and Technological Disasters (ECMHT) is in Baku, Azerbaijan. It provides training and information to local and regional authorities in the field of major hazards. <http://www.europarisks.coe.int/ecmht50.htm>

European Space Agency

Space-based and related remotely sensed information pertinent to disaster risk reduction is managed and disseminated by several information centres in Europe. One of these, the European Space Agency (ESA), has undertaken several initiatives to support disaster and risk management. ESA surveyed existing disaster management activities and established the Disaster Management Database (DISMAN) to provide information about the primary natural disasters in the 18 countries which belong to ESA.

DISMAN synthesizes information about each country and issues country reports and risk monographs. Summaries are prepared by type of disaster and survey the most significant disasters in each country. The database has also identified organizations and companies in the countries with key roles in different phases of disaster management, as in forecasting and planning, crisis management or rescue activities, and in the conduct of damage assessment.

To provide current information from its satellites, ESA routinely monitors reports of natural disasters and special events, updating satellite orbital plans to obtain the best imagery for specific needs. <http://www.esa.int>

ESA also has established MEDNET, a network of high resolution seismographic stations primarily installed in Mediterranean countries. It is coordinated by the Istituto Nazionale di Geofisica in Rome, Italy. <http://mednet.ingv.it>

After the UNISPACE III conference in Vienna, in July 1999, ESA and the French space agency CNES initiated the International Space Charter on Major Disasters. Each agency has committed resources to support this collaborative effort in information access, which became operational in November 2000.

The agreement provides the basis for a unified system of acquiring space data and delivering it to those areas affected by natural or human-induced hazards through authorised users. An authorized user can contact a single source to request the mobilization of the agencies' various space and associated ground resources to obtain data and information on an actual or threatening disaster situation.

European Commission

Launched by the European Commission and European space agencies, (including ESA) for an initial period of 2001-2003, the Global Monitoring for the Environment and Security initiative seeks to bring together the needs of society related to the issue of environment and security with the advanced technical and operational capability offered by terrestrial and space-borne observation systems. In compliance with the goals of the European Research Area, the aim is to deliver to users high-level and technical information about the environment and to develop security policies.

Related information capabilities provide such products as guidelines for entire risk management operational systems that relate to sustainable development policies, protection from environmental threats and natural disasters, and their respective concerns to security in Europe. GMES information also contributes to raising the awareness of hazards and related risks. The continuous monitoring of resources and environmental conditions, detection and assessment of changes or threatening events, and means for verifying the impact of policies and practices are the three primary areas of attention. By bringing these various parameters together, the programme seeks to become the focal point of attention of a range of stakeholders in various fields related to environment monitoring. <http://gmes.jrc.it>

The European Commission also is part of the Global Disaster Information Network (GDIN) and its Mediterranean working group, EU-MEDIN. These collaborations bring together organizations and specialists from many fields, including scientists, government ministers, disaster management authorities, local

community leaders, researchers, members of the press, as well as representatives from the international banking community, the UN system, and others. EU-MEDIN develops regional disaster information networks and databases for the Mediterranean to facilitate timely, easy and reliable contacts with disaster managers in the region. <http://www.eu-medin.org>

In the framework of the Euro-Mediterranean Partnership, Italy has launched an initiative for closer cooperation to mitigate the impacts of natural disasters. In GDIN's sixth annual conference held in Washington in March 2004, sessions were held with relevance for continental information applications in disaster risk management in such areas as GIS and remote sensing, NGO and community needs and early warning.

National information programmes

Individual countries have established their own distinctive approaches to institutionalizing information functions for disaster reduction. Information needs of countries vary and there are reasons for different emphases.

The examples that follow demonstrate some of the challenges that countries have faced. In all of the cases cited, improved hazard and disaster risk information was an essential precursor to the development of strategic national disaster risk management programmes.

Case: South Africa

In South Africa, the University of Cape Town's Disaster Mitigation for Sustainable Livelihoods Programme (DiMP) has developed a disaster information management system for the Monitoring, Mapping and Analysis of Disaster Incidents in South Africa (MANDISA).

The project is co-financed by OFDA/USAID and DFID. Its objective is to create a system that can document hazards, vulnerabilities and trends related to small to medium-scale disasters and to organize that information for better decision-making.

Previously, information about small disasters was fragmented or non-existent, with the result that it was frequently overlooked. Moreover, as information about these smaller disaster events is stored in different government services, it has proven difficult to create a consolidated profile on municipal disaster occurrences and losses either by type, location or consequences.

Smaller events are now considered to have disproportionate impacts on already marginalized communities, so consolidated information on such events is very important.

In 1999-2000 a team of researchers identified more than a dozen sources concerning disaster losses in Cape Town alone, containing more than 10,000 records of disasters. This was in glaring contrast to only 20-30 disasters that had been officially declared during the same period.

One of the telling observations of the research was that, with the exception of two electronic sources, all other information was on paper. Such incompatible sources of information highlight the challenges of creating effective, synthesized disaster information systems. This has made integrated disaster reduction planning virtually impossible. The information collected is now maintained in a database and linked to GIS technology on a publicly accessible web site.

Since 2001, MANDISA has been consolidating data on disaster events that occurred in Cape

Box 4.8
MANDISA database, South Africa

The Monitoring, Mapping and Analysis of Disaster Incidents in South Africa (MANDISA) database was conceived with the following considerations in mind:

- Public access to information about local patterns of disaster risk is empowering and facilitates community participation in decision-making.
- Disaster incidents can occur at different scales, ranging from household to provincial and national levels.
- Disaster risk is driven by the interaction between triggering hazard factors and underlying conditions of social, economic and environmental vulnerability.
- Disaster impacts can occur in different socio-economic sectors and therefore may be recorded in a wide range of formats or institutional locations.
- Disaster risk can be reduced by minimizing vulnerability through ongoing initiatives that achieve multiple development objectives.

Town from 1990-1999 and has been displaying them with related information in tables, maps, graphs and photos. Users can query the database online and generate additional information about trends, locations and patterns of disaster risk.

It is anticipated that this will enable municipal planners and residents to consider disaster risks more strategically, just as crime, public health, traffic accidents and other forms of risk are considered to be important developmental priorities underlying broader aspects of basic human security. Improved access to information has created a more readily understood concept of hazards. <http://www.mandisa.org.za>

Case: China

China's National Disaster Reduction Plan (NDRP) aims to establish a comprehensive information system for the entire country. It seeks to strengthen the institutional abilities of sharing information, communication technology and operational experience among the many government departments and agencies.

In 1997, the central government authorities approved a project to create the China National Center for Natural Disaster Reduction (CNCNDR). It acts as the comprehensive national disaster information system serving the state council, all ministries and government commissions, and it links central government authorities with provinces and municipalities. A purpose designed facility was officially opened in 2002.

The system incorporates data from satellite remote sensing systems and provides comprehensive management system displays of disaster information. It forms the basis of assessment and decision-support systems by drawing on the widest possible range of professional and technical expertise throughout the country.

This wealth of material is analysed by the technical specialists across the many professional disciplines involved at the National Academy of Sciences. Through this process, CNCNDR makes full use of the disaster reduction information and operational experience of all the relevant ministries, commissions, research institutions and social groups.

It provides senior officials with comprehensive information, professional services and technical guidance for more effective decision-making in matters of disaster risk management. Moreover, CNCNDR is also expected to play an important role in professional training and public education in fields concerned with national risk reduction.

Case: India

India has embarked on a strategic plan to improve the extent and availability of information for risk management activities. The government of India's High Powered Committee on Disaster Management plans to develop a national natural disaster knowledge network.

The details of an India Disaster Resource Network (IDRN) are being developed as a precursor to a fully established network of networks, able to store, manage and disseminate information. It is envisaged to connect and facilitate an interactive, simultaneous dialogue among government departments, research institutions, universities, community-based organizations and individuals throughout the country working with hazards in all aspects of disaster management.

The system is intended to serve as a common repository for accumulated experience, with the advantage that the network may then also be used for distance learning. By including access to libraries and other resource institutions, these digital services will be able to provide much wider access to global databases, training materials and early warning systems.

Current preliminary efforts are concentrated on improving information flows related to immediate response requirements in the event of a "L-3 level" disaster, an event in which a state government becomes overwhelmed and the national government would be required to supplement the state's own efforts.

As the programme is developed further, it is also anticipated that more technical, academic and professional institutions will become motivated to link into an integrated professional network that spans multiple professional sectors of interest.

Case: Australia

The Australian Geological Survey Organization (AGSO) has been working with Emergency Management Australia (EMA) to establish the Australian Disaster Information Network (AusDIN). AusDIN is a consortium of national agencies, state emergency authorities, universities and private enterprise representatives.

AusDIN is working to develop a network that provides information for crisis management including risk assessment, mitigation, planning, response and recovery. This Internet-based service is being developed to provide information easily and widely. In the international arena, the framework will be linked with GDIN information systems around the world.

AusDIN is just one part of a more comprehensive Australian undertaking to improve the management of information for disaster and risk management purposes. Additional non-technical approaches are being developed to foster networks and forums for people involved in the provision of disaster information.

One such related initiative has been undertaken by the Urban Geoscience Division of Geoscience Australia, the national agency for geoscience research and information. The Australian Disaster Management Information Network (ADMIN) undertakes comprehensive assessments and numerical modelling of hazards in urban areas and addresses issues of concern to urban communities that require geoscientific information.

The geophysical network carries out synoptic observations of earthquakes, tsunamis, geomagnetic fields as well as nuclear explosions. It seeks to increase national capacities for the distribution of comprehensive technical data and information for better disaster risk reduction and response.

The *Australian Emergency Management Manual* series, developed by Emergency Management Australia over recent years, has proven to be a highly regarded means to assist in the management and delivery of support services in disaster contexts. Built around individual subject areas, each of 38 manuals present principles, strategies and actions informed by practical experience, and relate to a variety of hazards.

Volumes recently added to the series reflect an increasing attention given to the social and economic dimensions of risk management practices. *Economic and Financial Aspects of Disaster Recovery* presents national best practice guidelines. *Planning Safer Communities – Land Use Planning for Natural Hazards* relates integrated land-use ideas for practical application at local levels of activity. *Disaster Loss Assessment Guidelines*, developed jointly by EMA and the Queensland Department of Emergency Services, provides practitioners with a comprehensive approach to assess the economic impacts of disasters in a broader regional context. Additional information about the manuals can be obtained from EMA. <http://www.ema.gov.au>

Another useful information portal in Australia is an Internet gateway to resources and links from the University of New England, in New South Wales. Information related to on-line study and discussions is available on a web log. <http://radio.weblogs.com/0111775/>

Related information packaged as a Risk Management Approach to Emergency Management, includes resources including summaries, readings, links and assignment questions. <http://users.senet.com.au/~jsalter/a_risk_management_approach_to_emergency_management.htm>

Case: Russian Federation

The Russian System of Disaster Mitigation (RSDM) information programme is establishing a comprehensive national information network on emergencies throughout the country. This system is being developed by EMERCOM, working through networks of various government bodies responsible for providing data about natural hazards. It aims to establish the basis for integrated data exchange and the systematic storage of operational and statistical data. Analytical as well as operational information about natural hazards and the management of emergency events is expected to be shared between central and regional authorities, providing cumulative data for decision makers.

An electronic information network was established connecting the emergency operational centres with

other government departments, the EMERCOM Emergencies Management Centre, and regional emergency management centres. This network will be extended to additional administrative authorities in the Russian Federation, to individual municipalities, regional executives, with eventual linkages made to early warning and disaster mitigation centres throughout the Commonwealth of Independent States (CIS).

In 2001, an automated system of consulting services was initiated to provide information services about safety and disaster risk reduction to the public as well as decision-making bodies responsible for emergency management and various organizations. One of its features incorporates data on legislation pertinent to disaster risk reduction measures.

In the Russian Federation, EMERCOM maintains an Internet portal to provide public information about the history, goals, structure and activities of EMERCOM, as well as statistics on natural and technological disasters in Russia. It elaborates on existing legislation and contains basic information about safety issues. A hotline releases daily information updates on specific emergencies that occur anywhere in the country.

One of the engaging initiatives is the Young Rescuer. The page on the Internet presents games which provide children with a basic knowledge about hazards and emergencies, and encourages communication among them. It also invites members of the public to ask specialists questions about possible risks or to seek additional information about hazards. EMERCOM also publishes a journal, *Public Defence*, as another means of disseminating information. <http://www.emercom.gov.ru>

Case: France

PRIM.NET is a French educational multidisciplinary Internet portal from the ministry of land-use planning and environment. It promotes natural and technological disaster prevention. It underlines the close relationship between humans and the natural environment in the framework of sustainable development. It is a forum for teachers, students and citizens where they can find useful information. <http://www.prim.net>

Technical information and hazards

Aside from the specific requirements of early warning, there are other examples of information centres devoted to specific hazards. Typically they convey frequently updated technical data as well as more general information about the changing events and circumstances pertaining to their individual hazard interests.

They all fulfil a public information function and many are engaged in providing specialist reference material or advice to policy makers. A selection of these hazard information centres is provided.

While most of them focus on a single type of hazard, the range of professional sectors and considerations they cover is typically quite extensive and often includes scientific and environmental disciplines as well as social and economic dimensions of local communities.

Integrated hazard information

In the United States, the NASA Earth Observatory is a particularly useful and award-winning source of information related to natural hazards, climate, water resources, the environment and natural resources, human habitats and land use. Its mission statement explains that the purpose of the Earth Observatory is "to provide a freely-accessible publication on the Internet where the public can obtain new satellite imagery and scientific information about our home planet. The focus is on Earth's climate and environmental change." The web site is designed for particular use by public media and educators, and in that respect any materials published on the Earth Observatory are freely available for re-publication or re-use, except where copyright is otherwise indicated.

The Earth Observatory contains data and images, feature articles, news, reference materials, and details about specific missions and experiments. Within the specific area of natural hazards, the Earth Observatory notes that scientists around the world use NASA satellite imagery to understand the causes and effects of natural hazards better. The goal in sharing such images is to help people visualize where and when natural hazards occur, and to help mitigate or reduce their effects.

One feature of the site provides a map every week that displays current locations of natural hazards observed by NASA satellites, with icons linked to both the latest images and additional information about any of the extreme events noted. People can also subscribe to a free daily or weekly service that advises about the latest events and images on the Earth Observatory web site.

The range of these interests, their combined relevance to disaster risk reduction, and an expressed commitment to provide reference material freely for public information and educational purposes underline the excellent value of the web site. <http://earthobservatory.nasa.gov/>

NASA's web site on space weather is another interesting resource. As electronic mechanisms and processes increasingly control and manage much of the physical infrastructure of the world, geomagnetic storms, solar flares, and other elements that compose space weather are increasingly understood to represent legitimate risks to planet earth. <http://helias.gsfe.nasa.gov/weather.html>

The US Geological Survey (USGS) Center for Integration of Natural Disaster Information (CINDI) is another facility which collects and integrates hazard information and disseminates it to the public. Its web site provides information about drought, earthquakes, floods, hurricanes, landslides, volcanoes, wildfire and geomagnetism.

With outreach, research and response dimensions, CINDI is able to provide near real time monitoring of hazards. It integrates a variety of technical information drawn from many sources and then communicates with technical teams and decision makers.

Following a disaster, the centre can combine remotely sensed data with archived information to assess the nature and extent of impact from a particular event. The compiled information is also available internationally for interdisciplinary research that contributes to the improved use of data for hazard and risk assessment. It can also be used to develop risk management strategies by local or national officials.
<http://www.cindi.usgs.gov>

Back on earth but still in a global context, the UN Environment Programme (UNEP) Global Resources Information Database (GRID) initiated a Project for Risk Evaluation, Vulnerability, Information and Early Warning (PREVIEW) in 1998. The project aim was to collect and disseminate data, information and methods that could be used through public access to identify risk and vulnerabilities related to natural and complex hazards. The project has since developed three components:

- PREVIEW-IMS is an application for visualizing spatial information about the global occurrence of tsunami, wildfires, volcanoes, floods, cyclones and earthquakes in relation to other socio-economic parameters. This tool is intended to visualize the distribution of multiple hazards and related issues as well as to provide the opportunity for accessing and downloading all supporting data.

Box 4.9
NASA Earth Observatory website

Examples of the comprehensive data, images and information services and weblinks provided by the Natural Hazards information listserve of the NASA Earth Observation website are listed below. The website reflects past and present natural hazards occurring worldwide.

- In the News: <http://earthobservatory.nasa.gov/Newsroom/>
- Latest Images: <http://earthobservatory.nasa.gov/Newsroom/NewImages/>
- NASA News: <http://earthobservatory.nasa.gov/Newsroom/NasaNews/>
- Media Alerts: <http://earthobservatory.nasa.gov/Newsroom/MediaAlerts/>
- Headlines from the press, radio, television: <http://earthobservatory.nasa.gov/Newsroom/Headlines/>
- New Research Highlights: <http://earthobservatory.nasa.gov/Newsroom/Research/>
- New Data: <http://earthobservatory.nasa.gov/Observatory/>
- Updated Data: <http://earthobservatory.nasa.gov/Observatory/Datasets/>

Source: <http://earthobservatory.nasa.gov/>.

- PREVIEW-Net is a gateway providing links to more than 250 organizations with reliable data and relevant information or reports that can be accessed through 16 types of hazard classifications.
- A general information component provides public access to a variety of articles, maps and other information products related to risk and vulnerability issues.

Additional activities include research analysing trends in disaster occurrence in relation to elements of global change, vulnerability assessment for tropical cyclones and landslides. More information products will become available relating to the frequency of hazards, prevalence of vulnerability and various risk factors, and the evaluation of a specific population's risk exposures.

All of these activities are undertaken in collaboration with other technical institutions and international organizations, including the Norwegian Geotechnical Institute, Columbia University, the European Union Joint Research Centre, WHO, WMO, and UNDP's Bureau for Crisis Prevention and Recovery. <http://www.grid.unep.ch/preview>

Innovative commercial groups are developing information products using advanced monitoring techniques, electronic technology and visual materials to assist the media, government agencies and emergency managers to understand environmental issues better. One such company, StormCenter Communications, aims to enable the media and educators to expand public awareness about the environment and issues related to it, including natural and environmental risk factors.

This commercial endeavour provides a unique approach of using media, environmental science and meteorological expertise packaged specifically to meet the expanding role of public weather reporting and emergency management communications. It seeks to utilize the latest capabilities in remote-sensing and scientific data from government and commercial sources. Expert science writers and graphics designers translate and package this information ranging from international to local scales in formats, images and explanations that can be used easily and understood by a wide variety of users.

StormCenter produces both weather and environmentally related information products for the media, educators or other interested user groups involved with public outreach activities. They include innovative satellite imagery, interviews, centralized weathercasts, purpose-designed graphics, animations, and video packages built around environmental awareness issues.

The concept relates to a television station's weather report, a newspaper's news section, or a teacher in a classroom providing their audiences accessible and engaging science overviews about issues that affect them directly. These include such hazard concerns as flood potential, wildfire locations, tornado paths, or likely strike zones of approaching storms. Broader environmental topics are a crucial element of the strategy, like the changing conditions of watersheds, altered land use, the agricultural impacts of variable climate conditions or changes in the coastal environment that can threaten the well-being and livelihood of local communities.

Envirocast is a suite of products and services developed specifically for broadcasting use, providing environmental and remote-sensing imagery, graphics and information for the television industry. The focus of this suite of products is Envirocast TV which delivers broadcast-ready earth observation satellite imagery for use on air through its media partners and by decision makers. Imagery is chosen that addresses important environmental and earth science situations that are critical to communicating accurate information. In addition to the media's use, decision makers can focus on local implications related to major natural and technological disasters and hazards.

Studio Earth productions deliver live updates on breaking environmental news developments around the world via the Internet by utilizing advanced streaming video technology to target decision makers in industry and government, including agricultural interests and emergency managers.

Some of StormCenter's other approaches and registered products display the innovative possibilities that commercial commitments can bring to enhancing public access and knowledge about environmental conditions and related risk

reduction issues. Earth Update is a set of materials including television news content on earth and environmental topics, associated web-based content, an interactive CD-ROM and other educational materials aimed at improving public understanding of environmental issues that affect peoples' lives. <http://www.stormcenter.com>

Climate change

Climate information, including probabilistic and deterministic forecasts, as well as long-range climate change projections have traditionally been produced by meteorology departments and then communicated in various forms to disaster managers and sectoral agencies.

Seasonal forecasts can play an important role in reducing vulnerability as the longer lead time affords decision makers time to plan appropriate interventions to prepare for and mitigate the impacts of extreme climate events. Nevertheless, the potential application of this information for decision-making has yet to be fully realized.

This is especially true in the case of probabilistic seasonal forecasts for which the systematic use of information coordinated across disciplines is essential. In recent years, however, institutional capabilities have been developing rapidly as the connections between the El Niño events and local weather conditions are modelled with greater skill.

In part, continuing challenges remain to integrate end-users into the information system. While user groups and related stakeholders are commonly involved in design phases, resulting management information systems could be expanded to create more opportunity for both the users and producers of climate information to maintain a dialogue about their respective information needs and decision-support tools.

If the production and application of climate information are viewed as a joint problem-solving exercise, then interpersonal communication between potential partners also becomes a critical component of information management. The value of bringing the users and producers of climate information together in an end to end system lies in building a shared understanding of the role of climate information in disaster management and vulnerability reduction initiatives.

With a greater appreciation of the types and timing of disaster management decisions, producers of climate information are better positioned to prepare more tailored information. Likewise, through discussions with the technical staff responsible for generating forecasts and other climate information, user groups have the opportunity to understand the processes better, as well as the associated assumptions and limitations of climate information. Only then can the improved technical interpretation of climate information lead to making more effective policy decisions.

This is the aim of the Extreme Climate Events (ECE) programme undertaken by ADPC, and funded by OFDA/USAID and the US National Oceanic and Atmospheric Administration (NOAA). The programme aims to demonstrate the applicability of seasonal forecasts in Indonesia, Viet Nam and the Philippines through building capacity of the national meteorological agencies and climate-sensitive sectoral agencies.

Building on training modules developed by the East-West Center in Honolulu and working closely with the International Research Institute for Climate Prediction (IRI) and partners in national governments throughout South-East Asia, the ECE programme brings the users and producers of climate information together to learn from each other. Jointly they develop valued decision-support tools based on climate information.

Moreover, its effort to reduce vulnerability to extreme climate events, the ECE programme works to promote the institutional mechanisms needed to sustain such dialogue. As an initial step, the significance of two-way communication should be recognized and reflected in the design of information management systems.
<http://www.adpc.net/ece/>

Another important initiative with global implications has been pursued by the WMO's Inter-Commission Task Team, its technical commissions and member states. In 2001, they began work to create a group of associated Regional Climate Centers (RCC). Once established, RCC will increase collaboration

among climate, meteorological and hydrological research communities. They will facilitate the widespread availability of climate information pertaining to long-term forecasting.

Work is continuing to define the organizational and functional responsibilities of RCC. This endeavour will draw on established national meteorological and hydrological services of individual countries, as well as the WMO Regional Specialized Meteorological Centers (RSMC). The initiative is an indication of institutional moves to address emerging global needs for both technical and public information about changing perceptions of risk.

In recent years, the Regional Climate Outlook Forums have played a key role in defining the requirements of RCC. The distinctive requirements of different geographical regions around the world are a crucial consideration in defining the objectives of RCC.

As a conceptual framework for RCC emerges, specific regional requirements will be considered, as well as assessments being made of the operational and technical abilities available to meet them.

A specific institutional development that reflects such a regional interest is the International Research Center on El Niño Phenomenon (CIIFEN), established in Guayaquil, Ecuador in January 2003. Its creation resulted from a resolution of the UN General Assembly and has been realized with the support of the government of Ecuador, WMO and ISDR.

CIIFEN brings together information on El Niño and its impacts in order to provide to regional and national partners with climate data processing, probable scenarios and information for the application of scientific knowledge applicable for national and sectoral disaster risk management plans and activities. It strives to reduce losses in agriculture, fisheries, health, economy, trade, tourism, infrastructure and environment. Initially, the primary focus will be given to the needs and interests throughout the eastern equatorial Pacific Ocean and among the countries in the western areas of South America.

In addition to becoming the operational centre in Ecuador, CIIFEN includes a scientific committee and an international board to facilitate the implementation of its activities. As such, the centre expects to serve as a coordination mechanism, involving the participation of global climate prediction centres, UN agencies, regional and national institutions and individual specialists. These various institutions will contribute to the structure of CIIFEN and work to secure the necessary financial support.

Hydrometeorological hazards

Information about hydrometeorological hazards is widely available through institutional sources around the world. Current information as well as archived data related to individual countries is accessible through every national meteorological and hydrological service.

A wide variety of products, including 10-30 day forecasts, are available from the three World Meteorological Centres located in Melbourne, Moscow and Washington, DC.
<http://www.bom.gov.au>
<http://www.mecom.ru/roshydro>
<http://www.nws.noaa.gov>

Specialized geographical products and information related to specific hazards are compiled and widely disseminated by RSMCs.

There are 24 RSMC located in Algiers, Beijing, Bracknell, Brasilia, Buenos Aires, Cairo, Dakar, Darwin, Jeddah, Khabarovsk, Melbourne, Miami, Montreal, Moscow, Nairobi, New Delhi, Novosibirsk, Offenbach, Pretoria, Rome, Tashkent, Tokyo, Tunis/Casablanca and Wellington.

There are also eight designated RSMC for the provision of computer-generated models for analysing environmental crises and for providing hydrological or meteorological guidance in emergency situations. These centres provide specialized transport, dispersion and deposition models with respect to various geographical regions in accordance with internationally recognized standards. They are located in Bracknell, Toulouse, Montreal, Washington DC, Beijing, Obninsk, Tokyo and Melbourne.
<http://www.wmo.ch>

UNEP/GRID in Geneva has developed a global database specifically for tropical cyclones called the PreView Global Cyclones Asymmetric Wind Speed Profile. This dataset provides users with comprehensive related information about the technical parameters of wind speed, central pressure and other variables obtained from six different reporting centres. A model for wind speed profiles was developed from data over 20 years from 1980-2000 in order to provide a consistent measure for wind speed categories, following the Saffir-Simpson scale. With this development, each individual cyclone can be identified and mapped. This geographical information can be downloaded freely.<http://www.grid.unep.ch/data/grid/gnv200.php>

Hydrological information is also available from many regional centres as hydrology and water-related issues are the focus of many international agencies. One such centre with a global focus is the Centre for Ecology and Hydrology (CEH) in the United Kingdom. <http://www.nerc-wallingford.ac.uk>

Extensive information and widespread institutional links related to drought and associated environmental conditions can be found through the International Drought Information Center affiliated to the National Drought Mitigation Center at the University of Nebraska, in the United States. The linkages provided inform about a wide variety of educational, research, policy and documentation opportunities engaging scientists and policy makers around the world involved with drought management and related preparedness issues. <http://www.drought.unl.edu>

Wildfire and related hazards

Fire research, fire ecology and the results of bio-geo-chemical and atmospheric research of the last decade provide sufficient knowledge to support decision-making in fire policy at most levels of management responsibility.

However, in many countries, knowledge and expertise are not readily accessible for developing adequate fire policies and related measures of operational management.

The prolonged and severe fire and smoke episode that occurred in South-East Asia in 1997-1998 demonstrated that the available knowledge about fire and the related management expertise was utilized only to a limited extent.

These circumstances led to confusion and uncertainty at national, regional and international levels of responsibility. In turn, this resulted in delayed decisions and the late application of appropriately targeted response to the emergency. This can be explained by the lack of an adequate fire information system for South-East Asia.

The international community first proposed the establishment of a global fire management facility in 1996. On the basis of these recommendations, in 1998, the German Office for the Coordination of Humanitarian Assistance of the ministry of foreign affairs established the Global Fire Monitoring Centre (GFMC) at the Max Planck Institute for Chemistry in Freiburg, Germany.

The GFMC collects information and monitors activities of the fire science and management community, the engineering and technical professions, policy makers, and others interested in developing related technologies.

It provides timely information in long-term strategic planning for the prevention of potentially disastrous wildland fires as well as enabling preparedness measures and appropriate responses for fire emergencies. A worldwide network of institutions and individuals generates GFMC products at both national and global scales. All information is collected, interpreted and posted on the GFMC web site. The information is updated frequently and archived for future reference and research purposes.

Primary GFMC products and services include early warning of fire danger; near real time monitoring of fire events; synthesis of fire information; archive of global fire information; facilitation of links between institutions involved in fire research and policy development; and an emergency hotline for providing assistance in rapid assessment for responding to wildland fire emergencies. <http://www.fire.uni-freiburg.de>

UNEP/GRID also developed a methodology to produce weekly reports on fire status during the

latter years of the 1990s based on existing sources of public information from web sites of agencies including NOAA, NASA, ESA and national meteorological agencies. While this practice ceased in April 2002, UNEP/GRID in Geneva currently produces an electronic web page portal through which users can access the latest information on early warning and current status of individual wildfires in different regions of the world. This page is linked to other related or specialized wildfire web sites including GFMC, the MODIS Land Rapid Response System and 20 other selected web sites that provide data, information or reports about wildfire activities. http://www.grid.unep.ch/fires/>

A related information tool, the Global Burned Area Interactive Mapping Application (GBA 2000) enables users to visualize and download data of global burnt areas. This project is associated with the Global Vegetation Monitoring Unit of the European Union's Joint Research Centre and is conducted in partnership with seven other organizations including UNEP/GRID. Users can integrate maps of burnt areas with other information such as country or locality boundaries as well as land cover and land-use data. The web site provides free access and the possibility to download GBA 2000 data. <http://www.grid.unep.ch/activities/earlywarning/preview/ims/gba/index.htm>

Seismic hazards

There are many seismological and seismic engineering institutes around the world, widely known among practitioners involved in technical and information services. Two examples that are particularly engaged in the dissemination of information about seismic hazards are cited here.

The Earthquake Hazards Program of the US Geological Survey (EHP/USGS) is part of the National Earthquake Hazards Reduction Program led by the Federal Emergency Management Agency (FEMA).

The objective of the programme is to provide relevant earthquake science information that will help reduce deaths, injuries, and property damage from earthquakes. Particular emphasis is given to understanding the characteristics of the hazard and by providing knowledge that can help to mitigate losses. <http://www.earthquake.usgs.gov>

The US Earthquake Engineering Research Institute (EERI) is a national non-profit, technical society of engineers, geo-scientists, architects, planners, public officials and social scientists. Its objective is to reduce earthquake risk by advancing the practice of earthquake engineering.

EERI seeks to accomplish its objective by improving the understanding of the impact of earthquakes on the physical, social, economic, political and cultural environments. It advocates comprehensive and realistic measures for reducing the harmful effects of earthquakes.

EERI is recognized as the authoritative source for earthquake risk reduction information in the United States. By working through partner organizations it is involved in contributing to earthquake risk reduction information worldwide.

The institute is best known for its field investigations and reconnaissance reports detailing the effects of destructive earthquakes. Often, EERI serves as the coordinator for investigations undertaken jointly by several organizations. Leading earthquake investigators from many countries belong to EERI.

For many years, EERI has been engaged in a project supported by the US National Science Foundation to maximize the learning process from destructive earthquakes. Preliminary information on the effects of destructive events is published in their monthly newsletter. Detailed reports on major earthquakes are published as supplements to *Earthquake Spectra*, EERI's quarterly journal. EERI also sponsors post-earthquake technical briefings in an effort to reach professional communities throughout the United States.

In addition to its publications, EERI has produced more than 50 slide sets covering specific earthquakes and their impacts, earthquake-resistant design, loss reduction measures and mitigation of earthquake hazards. Videotapes produced by EERI include technical briefings on the Armenia, Loma Prieta and Kobe earthquakes, and additional comprehensive reports on later major earthquakes such as those in Turkey, India and Iran are available on CD-ROM. <http://www.eeri.org>

Volcanic hazards

The World Organization of Volcano Observatories (WOVO), a commission of the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI), is building a volcano database.

WOVO is providing information to researchers and the public on volcanic activity that scientists are currently monitoring. This will help people to understand that monitoring a volcano is not simply a matter of deciding if an eruption is imminent, as the information will clarify what can and cannot be forecast.

Initially, the WOVOdat database will provide an historical record so that observatories can conduct their own research for two years before providing data to WOVOdat. Eventually, it is anticipated that observatories will realize the benefits of sharing data in real time.
<http://www.volcano.undp.nodak.edu/vwdocs/wovo>

In a separate initiative, efforts are underway to update a global compendium on current information about the effects of volcanic eruptions and mitigation activities. This global compendium will be available on the Internet. Pictures will illustrate the problems, while text will provide details and suggest possible mitigation measures.

Other outlets with useful global volcanic hazard information are the Volcanism Programme <http://www.volcano.si.edu/gvp/reports/notices/index.htm> and the Volcanic Ash Global Advisory Centre<http://www.cmc.ec.gc.ca/cmc/CMOE/ vaac/A-vaac.html>.

Future challenges and priorities

Information management and communication of experience

The information services and programmes described in this section provide a basis to identify areas for improvements in information management and the communication of experience in disaster risk management. Future challenges in this field concern the following:

- availability of information;
- necessary capacities to use data;
- improvements in data quality;
- clearing house responsibilities;
- expanded access to information; and
- future technology.

Availability of information

There is currently abundant information available globally on disaster risk reduction. But that does not necessarily translate into its widespread availability or utility. Nor is it particularly well targeted for all users.

In many places and cultures there is little relevant information conveyed in local languages or suited to the actual living conditions of people exposed to natural hazards. Language barriers must also be overcome for existing information to be accessible.

Among other specific subject areas, a case in point is the growing field of gender and disasters to which writers from every region have contributed. Much of this dialogue remains internal, however, due to limited funds for translation.

Documents and dialogue at international conferences on many web sites are often only in the dominant language of the region concerned, and frequently in English only. This is a common limitation of risk reduction programmes and dialogue which greatly constrains opportunities for communication across regions.

The abundance of information also creates a problem for non-specialized users to ascertain the relative value or quality of specific information. This is particularly true if they are unaware of the originating source or broader professional context of the various sources. Useful information demands that databases be kept current, bibliographic resources be continually expanded and that search criteria be consistent.

Necessary capacities to use data

Frequent observations are made by country authorities about the inability of many institutions to assist in enabling them to develop a broader exposure to the types of relevant information that exists. Much remains to be done in providing greater familiarization of the wide variety of available information, where to find it and how to access it in the most efficient manner.

An initiative of considerable benefit would be a national audit about risk-related information needs, availability and limitations. International organizations could help by providing guidance about existing sources or means of obtaining gender-sensitive and culturally inclusive information in all areas of concern.

A key area for additional future support lies in enhancing the institutional capacities necessary to produce statistics related to risk factors and disastrous events in developing countries. Indeed the benefits would be multiplied, with the appreciation of this need in relation to the various dimensions of sustainable development.

While much of this may revolve around the creation of locally available statistical and analytical skills, equal attention and incentives could productively be given to ensuring terms of professional engagement that can sustain the growth of institutional abilities.

A common problem experienced in many developing countries is the high level of staff turnover, resulting in the failure to capitalize on individual efforts or to maintain a sense of methodological rigour. Both are necessary to build a cumulative stock of experience and gain the consistency of routine procedures for data collection. This, and the expanded use of existing regional or subregional information centres and their experience in linking suppliers of information with practitioners, would be particularly valuable.

Improvements in data quality

There is a need to work towards the standardization and systemization of all issues related to the accuracy and technical soundness, political neutrality, appropriateness of methodologies and consistently applied processes related to the collection, analysis, storage, maintenance and dissemination of data. In addition, there is a need to improve systematic reporting of risk factors and disaster occurrence.

More focus is required on the interaction between data compilation and its intended use. This particularly requires that more effort be given to ensure that the intended end users and practical applications of the information are considered foremost when determining data needs in the early stages of all programme designs.

Clearing house responsibilities

There is a glaring need for an international capacity to fulfil clearing house functions specifically related to the identification, ordering and dissemination of hazards and disaster risk management information.

This role could foster the exchange of relevant information through the use of directories, catalogues and bibliographies, as well as through linked professional networks. It would direct and connect a very wide range of users and practitioners. Such facilities as ReliefWeb and GDIN exist, but concentrate on international disaster response or disaster preparedness, rather than on matters of risk reduction and related experience.

The ISDR Secretariat is in the process of strengthening its web site and resource centre to build a comprehensive and accessible series of directories and links that can form the basis of a global clearing house for disaster reduction information. By pursuing this effort globally, information gaps, irrelevant data and geographical shortfalls in information availability may be more easily identified and addressed.

Such a coordinated approach can also contribute to establishing commonly accepted protocols and procedures for recording and exchanging disaster risk reduction information. Conventionally understood or agreed nomenclature and consistent search procedures should be developed to facilitate information searches related to key words, or to obtain contact details of widely recognized specialist institutions and international experts in key areas of risk reduction.

Experience gained over the years from the evolution of ReliefWeb as an acknowledged information-rich resource could be beneficial to the development of a similar comprehensive information platform dedicated to disaster reduction.

A PreventionWeb does not yet exist but by placing such a facility within ISDR it could become a powerful instrument to serve the different constituencies associated with disaster risk reduction worldwide.

Expanded access to information

Beyond the technical limitations of information systems, more attention needs to be devoted to the human dimension of communication. There is a need to support and expand local, national and regional documentation centres and library services.

Policies and facilities that encourage a wider opportunity for community-based involvement in information processing and dissemination should be developed. This can be achieved through the preparation of local risk maps based on community needs and values, public access information portals, or facilities that enable the wider exchange of locally-derived risk information among communities.

It can also be promoted through strategies that reduce gender, age and economic barriers to the use of new information technologies. These include literacy and education for women as well as training in computer skills, and the development of community-based computer centres and related training in low-income regions and neighbourhoods.

In bringing information to people most at risk, greater attention must be given to ensure that the costs associated with the availability or exchange of disaster information are affordable. This is particularly important when applied to low and medium income countries, or among more isolated and distant communities.

The widespread use of mobile telephones and the economies associated with their use offer promising opportunities to marry technology with local capacities. Effective use of radio and the broadcast media is another way of expanding traditional means of communication, updated by such innovative devices as the wind-up radio, or through the widespread popularity of video cassettes, and increasingly CD-ROMs and Digital Video Discs.

Future technology

Greater public use of information systems can lead to more access to risk management information tailored to the needs of specific users. Both distance learning and the increasingly common examples of artificial intelligence interfacing with electronic applications have extended the reach of information services to distant communities.

The applications offered by the latest information technology provide powerful interactive tools for the disaster risk management community. Applications such as electronic conferencing and distance learning via the Internet now allow the immediate sharing of documents and data on demand, increasing the efficiency, timeliness and overall utility of information available to a larger number of people.

Other advanced technological applications could be developed further to enhance information about hazards and risk reduction. GIS, remote sensing data and satellite imagery in particular can help considerably to assess vulnerability, enhance mapping, monitor threatened areas systematically, and to improve the understanding of hazards.

While space technology has advanced rapidly in recent years, a number of countries still lack the human, technical and financial resources required to conduct even the most basic space-related activities. A need remains to provide the benefits of available space technology to all countries. Several programmes, including those implemented by the UN Office for Outer Space Affairs (UN/OOSA) are proceeding in this direction.

A crucial area in which space-based assets can have a major impact is in the provision of unique forms of information for disaster reduction. While emergency relief operations demand near real time applications which satellites are not yet able to address fully, the assessment of natural hazards and deployment of tools for the management of disaster risks are currently well-suited to benefit from the increased application of both existing and forthcoming space-based applications.

In this respect, entities such as UN/OOSA, the Committee on the Peaceful Uses of Outer Space (COPUOS), the Committee on Earth Observation Satellites (CEOS), EUR-OPA, and the European Commission's Directorate General Joint Research Centre already contribute much to extending the use of high technology information systems.

Similarly, there are many examples of important and technologically advanced information products for hazard monitoring and disaster risk management being provided routinely by several individual space agencies, including NASA, and the Canadian, European Union, Russian Federation, Indian, and Chinese space agencies.

4.2 Networking and partnerships

Comprehensive disaster risk reduction covers a wide range of disciplines, sectors and institutions, calling for diverse and expanded forms of partnerships. The achievements from networking and partnerships can be far more powerful than individual or specialist contributions.

Thanks to global communications, creating networks between government agencies, the public, the private sector and professional bodies is technically easy. However, these networks can only be successful if participants display the same commitment to share their information and experiences openly.

Networks and partnerships ranging from communication exchanges to fully fledged and funded partnerships have great potential. This section examines:

- *building links to reduce risk – extended partnerships and networking;*
- *networking support for community partnerships;*
- *cross sector coordination and collaboration; and*
- *commercial sector and partnership interests*

Building links to reduce risk – extended partnerships and networking

There is a very wide range of actors who deal with disaster risk management. An important challenge is to develop ways to link these actors.

Multidisciplinary research, multisector planning and multi-stakeholder participation are fundamental in addressing the many factors of risk reduction. Benefits that accrue from networking include improved efficiency and cost-effectiveness, a unified strategic framework for decision-making and an appropriate division of responsibilities. Additionally, cutting-edge knowledge from academic and research institutions can be linked with practical initiatives undertaken by other organizations. Examples of productive technical and research networks are reviewed in chapter 4.4.

Fostering the association of community groups with larger organizations will ensure that local needs, capacities, cultural perceptions and traditional knowledge become more integrated in national, regional and international initiatives.

The spectrum for collaboration varies from sharing information to undertaking joint strategic planning and programming. The latter is the more difficult to achieve but it is also more effective. Some collaborative examples include:

- communication networks, forums for dialogue;
- institutional partnerships, memorandums of understanding between agencies and organizations;
- integrated databases;
- formal joint mandates, legislation, policies and plans by public authorities;
- multisector advisory groups;
- multidisciplinary research projects; and
- research conferences.

Case: ProVention Consortium

The ProVention Consortium is a global coalition network of governments, international organizations, academic

ISDR and partnerships

One objective of ISDR is to stimulate multidisciplinary and multisectoral partnerships and expand operational networks by engaging public participation and professional interests throughout all aspects of disaster risk reduction.

institutions, the private sector and civil society organizations dedicated to increasing the safety of vulnerable communities and to reducing the impact of disasters in developing countries. It functions as a consortium to share knowledge and resources among members on disaster risk management, acting as a broker to forge links and partnerships so that practical efforts, and benefits, are shared.

Its goal is to support developing countries in reducing the risk and social, economic and environmental impacts of natural and technological disasters on the poor. Through such collaboration and related activities ProVention produces pioneering solutions to the challenges of disaster risk management in developing countries. This is achieved by:

- forging linkages, partnerships and fostering closer interaction between members of the consortium;
- developing and demonstrating innovative approaches to the practice of disaster risk management;
- advocating for disaster risk management among senior policy makers in international organizations, national governments and the private sector; and
- sharing knowledge and information about best practices, tools and resources for disaster risk management.

Since its launch by the World Bank in 2000, ProVention has produced a number of innovative tools for integrating disaster risk management into development efforts by working as a flexible network that is able to connect actors from different sectors and backgrounds. Approaches include improved documentation of the longer-term social and economic impacts of disasters; models that integrate disaster risk management into development planning; methodologies for better assessment of disaster impacts; and strategies for more effective management of disaster risks.

Projects are designed to encourage innovation, promote partnerships and influence decision makers through a variety of activities that include research studies, pilot projects, education and training activities, advocacy initiatives and policy development. Specific activities advance policy and practice in disaster risk management in the following three categories, with current initiatives indicated:

- Risk identification and analysis – assessing hazards, vulnerabilities and capacities
  - Methodology and standards for damage and needs assessments: Development and promotion of global standards and methodologies for collecting and processing data on building and infrastructure damage, household losses, community impacts and recovery requirements.
  - Identification and analysis of global disaster risk hotspots: Global scale prioritization of international risk identification and disaster reduction efforts through the identification of geographic areas of highest disaster risk potential.
  - Measuring risk management: Development of guidelines for assessing natural hazard risks and the net benefits of mitigation through cost/benefit analysis.
  - Vulnerability and capacity assessment tools: Development of standards and methodologies for social vulnerability and capacity analyses.

- Risk reduction – avoiding hazards and reducing vulnerability
  - Learning lessons from post-disaster recovery operations: Identifying lessons for ongoing and future efforts of the international community in providing assistance for post-disaster reconstruction and recovery, including strategies that avoid the re-creation of risk. Case studies conducted in Honduras, India, Mozambique and Turkey.
  - Reducing flood risk in Africa: Strengthening community flood resilience through local partnerships in Sudan.
  - Urbanization and disasters in Africa: Analysis of urban risks and reduction strategies.

- Risk sharing and transfer – protecting investments and sharing the costs
  - Innovations in managing catastrophic risks: Promoting innovative risk transfer and financing mechanisms such as insurance that can reduce vulnerability to disaster impacts and serve a key developmental role in the country.
  - Transferring risk through microfinance and microinsurance: Application of microfinance and microinsurance as resources for safer communities through pilot testing in India.

In order to sustain commitments in all of these categories, the consortium also supports applied research grants for disaster risk management. It encourages innovative research projects and promotes aspiring professionals in developing countries dedicated to reducing disaster risks.

A secretariat manages all ProVention activities. Members decided that by rotating the secretariat among designated participants every few years, participation could be enlarged, bringing fresh perspectives to ProVention efforts, thereby increasing wider ownership of the consortium's objectives.

Early in 2003, the ProVention secretariat was transferred from the World Bank's Disaster Management Facility in Washington, DC to the International Federation of Red Cross and Red Crescent Societies (IFRC) in Geneva. This transfer presents new opportunities for advancing disaster risk reduction through the global network of IFRC and other civil society organizations. <http://www.proventionconsortium.org>

Case: Africa Knowledge Networks Forum

The Africa Knowledge Networks Forum (AKNF) is an initiative led by the UN Economic Commission for Africa to facilitate the sharing of knowledge and to encourage research partnerships among professional networks. Target audiences include the end users of knowledge such as policy makers, educators, leaders of civil society organizations and representatives of the private sector. <http://www.un.org/depts/eca>

The challenge of attaining and sustaining higher levels of growth to reduce poverty in Africa remains overwhelming. Sustained growth in the future will depend on new capacity being created, focused particularly on institutional development, skills enhancement, knowledge production and application. All of these areas can be enhanced by modern information technology, and it is in such roles that African countries must make quantum leaps.

It is widely recognized that both increased knowledge and more local content are needed within Africa to solve the pressing problems of public policy, enrich teaching curricula, invigorate civil society, foster good governance, and to stimulate the private sector. These objectives all contribute to strengthening the integration of African societies and economies, especially in the context of the intensely competitive global environment. Success is dependent on linking the producers of knowledge to those institutions and skilled individuals engaged in using that knowledge.

The Africa Knowledge Networks Forum seeks to associate existing networks with the aim of strengthening indigenous policy-oriented research and analysis for more effective use by African decision makers. The forum seeks to provide a continual link between African research networks, policy makers and educational institutions. By serving as a portal it can support centres of African expertise, thereby pooling resources for more effective production and sharing of knowledge.

AKNF will be particularly important for providing technical support to the African Development Forum process, the UN Economic Commission for Africa (ECA) partnership launched in 1999 to promote consensus around primary challenges shared among Africa's development stakeholders. In this respect, it can contribute to setting agreed priorities for future development assistance. The forum will meet annually to review progress and to approve future work plans, with its initial strategy proceeding covering 2000-2003. <http://www.un.org/depts/eca/adf>

By increasing the dialogue between knowledge producers and users, AKNF can also strengthen applied research and advisory services to African policy makers, civil society organizations and private sector entities. The forum's comprehensive database of multidisciplinary expertise will be pivotal to linking the supply and demand for professional communication of experience across the continent.

AKNF will be supported by activities of ECA's new Information Technology Centre for Africa (ITCA), conceived as a central node in the networking landscape. It will focus initially on establishing various databases derived from data maintained by existing networks, and creating a web-based directory of African web sites that

promote networking activities. The creation and management of discussion lists will contribute to the further integration and expanded purpose of multiple information providers.
<http://www.un.org/depts/eca/tca>

Networking support for community partnerships

In 1992, a group of social scientists, NGOs and people interested in the social dimensions of risk reduction in Latin America came together to create the Latin American Network for the Social Study of Disaster Prevention (LA RED). It was initially conceived as a mechanism to facilitate comparative research of natural disasters from a social perspective. It has developed into the focal point for hundreds of individuals and institutions working in disaster and risk management across Latin America and the Caribbean, influencing thinking and action.
<http://www.desenredando.org/>

A similar network in South Asia was inspired by the ideas of LA RED, and has been organized by people committed to promoting alternative perspectives on disaster and vulnerability as a basis for disaster mitigation in their own region. Named Duryog Nivaran (disaster mitigation in Sanskrit), it aims to reduce the vulnerability of communities to disasters and conflicts by integrating alternative perspectives in the conceptual, policy and implementation levels of disaster mitigation and development programmes.
<http://www.duryognivaran.org>

Periperi – Partners Involved in Enhancing the Resilience of People Exposed to Risk in Africa, is another network. It was established in 1997 by the Disaster Mitigation for Sustainable Livelihoods Programme (DiMP) at the University of Cape Town, with the support of OFDA/USAID and the UK Department for International Development (DFID). Originally composed of 16 organizations from five Southern African countries, Periperi provides opportunities for a variety of organizations to work together across disciplines and national borders. These share the benefits of experience, and facilitate communication about the organization's work to integrate risk reduction principles and technologies into ongoing sustainable development activities.

Periperi views risk as an all-inclusive field, involving hazard scientists, development practitioners, and policy makers among its collaborators. As such it serves as Southern Africa's network for risk reduction and sustainable development. Its publications include *Learning About Livelihoods: Insights from Southern Africa*, that is also available on video, and *Urban Vulnerability: Perspectives from Southern Africa.*
<http://www.egs.uct.ac.za/dimp>

Rising Tide UK is a network of small groups and individuals dedicated to taking local action on climate change and building a national movement against climate change. It reaches out to the wider public to empower them to take personal action, form their own campaigns, and participate in the activities of the groups in the network. Rising Tide UK prepares a monthly summary of extreme weather events that occur during the year.
<http://www.risingtide.org.uk>

In another context, the UN-HABITAT Programme for Best Practices and Local Leadership provides an excellent example of a partnership initiative that can guide and motivate local communities to utilize networks in ways that can advance hazard awareness and risk management practices. <http://www.unchs.org>

A Database of Best Practices for Human Settlements and a combined electronic search facility is maintained by UN-HABITAT in collaboration with The Together Foundation. The database is an excellent multidisciplinary compendium of experience drawn from around the world. Records can be grouped or selected by any of the following individual criteria, a combination of them or by sub-categories:

- scale – global, regional, national, provincial/state, metropolitan, city/town, neighbourhood or village;
- ecosystem – arid/semi-arid, high plateau, river basin, coastal, island, tropical/sub-tropical, continental or mountain;
- themes – poverty eradication, economic development, social services, environmental management, infrastructure communications and technology, housing, land use management, urban governance, civic engagement and cultural vitality, gender equity and equality, disaster and emergency, production and

consumption patterns, urban and regional planning, technology tools and methods, children and youth, architecture and urban design, older persons, use of information in decision-making;
- country – or when grouped, as a subregion or adjacent area; and
- selected text – or specific project activity title.

As each of these criteria has some bearing on social and economic vulnerability in a variety of habitats, the database displays a wealth of relevant experience about hazard awareness and disaster risk management practices. It is anticipated that because of this relationship, activities which exemplify best practices for creating resilient communities may be considered in the future as an explicit category. <http://www.bestpractices.org>

The information material contained in the database is supplemented by additional information contributed by nominations for the associated Dubai International Award for Best Practices to Improve the Living Environment. This biennial international competition is sponsored by the Dubai Municipality and ten awards of US$ 30,000 are made for outstanding practices. Additional information about the Dubai International Award can be obtained by e-mail <info@dm.gov.ae> or from the award web site. <http://dubai-award.dm.gov.ae>

Productive networks for disaster reduction can also be built around other social dimensions. The Gender and Disaster Network consists of women and men interested in gender relations in the context of disaster and risk management such as those related to earthquakes, floods, hazardous materials events, tornadoes, famine, cyclones and other hazardous events. The network's goals are to document and analyse gender experiences before, during and after disasters, and to conduct interdisciplinary and collaborative research projects.

Research and practice that reduce the loss of life, injuries or damage to property for women and girls can make a difference. The goal of the Gender and Disaster Network is to promote and encourage such activities. Members participate from many countries, including El Salvador, India, Japan, New Zealand, South Africa, Switzerland, the United Kingdom and the United States. <http://online.northumbria.ac.uk/geography_research/gdn/>

Box 4.10
The Mary Fran Myers Award

The Gender and Disaster Network invites nominations annually for an individual who should be recognized for efforts to advance women's careers in emergency management and academic endeavour for promoting gender disaster research.

The Mary Fran Myers Award was established in 2002 by the Gender and Disaster Network. It recognizes that vulnerability to disasters and mass emergencies is influenced by social, cultural, and economic structures that marginalize women and girls. The award has been named for Mary Fran Myers, the co-director of the Natural Hazards Center at the University of Colorado in the United States. She received the award in 2002 in recognition of her sustained efforts to launch a worldwide network among disaster professionals, for advancing women's careers and for promoting research on gender issues in disaster research in emergency management and higher education. <http://online.northumbria.ac.uk/geography_research/gdn/>

Case: Mozambique

A different form of partnership is required to address the vulnerabilities of rural environments. As is the case among many inhabitants of developing countries, most Mozambicans live in a precarious balance between subsistence and desperation. Very small fluctuations in climatic conditions, localized flooding, or the outbreak of disease in neighbouring villages can plunge a normally stable family economy into severe difficulty.

To identify particularly vulnerable populations the Vulnerability Analysis Group was formed in Mozambique. Chaired by the government's Department of Early Warning and Food Security, it also includes the Nutrition Division in the Ministry of Health and the UN World Food Programme (WFP).

The group works together with local communities to investigate the factors that contribute to chronic vulnerability. The joint initiative has analysed nutritional indicators as a basis for their evaluation and has then used this information to compile detailed profiles of food security conditions in almost all districts of the country.

A number of other partners have contributed to related initiatives. The UN Food and Agriculture Organization (FAO) provided support to monitor food stocks in the country. In a complementary initiative, an Agricultural Markets Information System, managed by Michigan State University in the United States, has been supported by USAID for nearly a decade. The system researches food security conditions, particularly in relation to rural markets and smallholder cash crops. This programme is currently developing provincial price information systems that can promote the commercialization of farm products.

The Famine Early Warning System Network (FEWSNET), also funded by USAID, works closely with these programmes. It has conducted several studies of local food economies, including in those areas most affected by flooding in recent years. The project operates in conjunction with the University of Eduardo Mondlane in Maputo and has produced the *Disaster Atlas for Mozambique*.

An earlier initiative, the Agence Européenne pour le Developpement et la Santé (AEDES), was an emergency information system created by MSF during the drought in 1992. It later evolved into a national vulnerability information system.

Case: India

The Sphere Project is an international inter-agency collaboration working to improve the quality of assistance to disaster victims, and enhance the accountability of humanitarian response agencies to their beneficiaries, members and donors. In India, the Disaster Mitigation Institute (DMI) has been associated with Sphere since 1998, as one of the 14 pilot agencies.

As an example of the beneficial opportunities provided by the network, DMI complemented its own efforts of promoting and using the Sphere handbook by many activities including national training courses, local capacity-building initiatives, in-house publications and development of training materials related to the specific needs of India and South Asia.

Additional partnerships were developed to further this Sphere in India campaign by working together with the support of Catholic Relief Services to involve 30 professionals from 18 local, national and international voluntary agencies, donors and government officials. These included such varied participants as UNICEF, IFRC, National Centre for Disaster Management (NCDM), the Self-Employed Women's Association, Developing Initiatives for Social Human Action, Oxfam, Concern Worldwide, the British Red Cross, Emergency Food Security Network, Sadvichar Parivar, Discipleship Centre, Hind Swaraj Mandal, Caritas India and Save the Children Fund.

Beyond discussions and meetings, many of these organizations committed themselves to furthering a process of institutionalizing Sphere standards in the region. NCDM proposed a partnership with DMI to conduct training in administrative training institutes across the country. Other organizations planned regional meetings on food security and the related Sphere standards. A pool of training resources and materials has been proposed. UNICEF proposed the development of a local chapter dedicated to the standards for emergency education of children. CRS initiated a process by which other interested organizations could contribute their experiences electronically to the revision process of the Sphere handbook. Finally, DMI documented these various collaborative initiatives and disseminated the experiences for expanded access.

Case: Central America

The Central American Mitigation Initiative (CAMI) is an umbrella programme launched in 2001 by OFDA/USAID. Over a three-year period, US$ 12 million will be distributed to NGOs to fund disaster reduction activities. IFRC, the Corporate Housing Foundation, CARE International, Catholic Relief Services and other agencies operating in the region concentrate on local involvement.

Working primarily through municipalities, the programme strives to create mechanisms to motivate greater commitment by national institutions at local levels. Risk reduction is the primary focus, and while preparedness and disaster response problems are also addressed, they are integrated into the overall perspectives of reducing risks.

One of the more innovative CAMI projects is conducted by CARE International with partners in Guatemala, El Salvador, Nicaragua and Honduras. With an overall budget of more than US$ 3.5 million and support from OFDA/USAID and the Canadian International Development Agency (CIDA), the project provides training and technical support to develop a range of risk reduction activities in core municipalities in high-risk zones of the four countries.

Benefiting from its association with LA RED, which provided technical and advisory support for the project, CARE expects to fashion its other development projects in the region with more attention given to risk reduction.

During a recent drought in El Salvador, small grants were provided for severely affected population groups to develop pilot Integral Sustainable Production (ISP) units. These ISP units promote crop diversification, foster improvements in commercial practices and create opportunities for improved food storage by utilizing crop techniques that are environmentally friendly.

Based on the initial experience with this project, CARE-France presented a proposal to the European Union to finance similar schemes in two other departments of the country, to improve the food security of 1,000 extremely poor families. The projects are based on the participation of the population working through collective schemes using common lands to minimize their risks. This approach represents an alternative to the reliance on emergency food relief.

Case: Guatemala

The Peten region in Guatemala contains one of the largest tropical forest reserves in Latin America. Uncontrolled forest fires during the annual dry season endanger the livelihoods of the local population and have lead to large-scale destruction of forest ecosystems and biodiversity in northern Guatemala.

The government of Guatemala has embarked on a major programme to promote fire prevention and more effective means to combat fires when they do occur. The programme is supervised by the executive secretary of the presidency and involves the participation of several other government institutions.

The Project for the Local Prevention and Control of Forest Fires (PRECLIF) is a complementary project which promotes improved prevention and control of forest fires at the local level, employing local techniques in risk management.

The project trains residents of local communities to implement measures that can reduce the risk of fires, working in conjunction with the municipal committees in charge of forest fires.

The project has also supported other activities to strengthen community organizations such as the establishment of a radio network that links six rural communities to the National Coordinating Agency for Disaster Reduction in Guatemala (CONRED).

PRECLIF has encouraged new and useful relationships between the Global Fire Monitoring Center at the Max Planck Institute of Chemistry in Freiburg, Germany and the Guatemalan institutions involved with forest fire prevention and control. Professional visits have been exchanged and a successful workshop was held in Peten to share experiences in forest fire prevention, management and control.

There are other disaster risk reduction programmes focused on the three active volcanoes in Guatemala. The slopes of two of them are home to local communities where Project PREVOL aims to strengthen the work of CONRED and the Centre for Disaster Research and Mitigation (CIMDEN) in reducing risks from volcanic hazards.

CONRED and CIMDEN have been implementing preparedness activities for possible eruptions of the Pacaya and Fuego volcanoes. With the support of the humanitarian office of the ministry of foreign affairs of Germany, PREVOL has sought to expand activities to improve disaster preparedness and risk reduction.

In addition to providing basic early warning equipment and training local emergency committees in 19 communities, PREVOL has

"Partnerships between central and local authorities, and public and private sectors are the most effective means to reduce the impact of hazards."

Source: US Federal Emergency Management Agency, Basic Principles, 1996.

been able to assist CIMDEN by improving its methods and abilities to conduct volcanic surveillance. This has included the supply of additional scientific instruments to complement efforts by the National Seismic, Volcanic, Meteorological and Hydrological Institute of Guatemala in monitoring volcanic activity at Pacaya.

The partnership has emphasized the crucial role of linking activities in disaster-prone areas with the interests of the national disaster reduction agency to encourage risk reduction. In this respect, all of the operations in PREVOL have been conducted by personnel from the risk management department of CONRED, ranging from the installation of equipment, local community organization and training and the design of risk reduction measures. Similarly, a priority has been placed on developing the capabilities of national institutions to ensure the sustainability of the project.

Cross-sector coordination and collaboration

Case: United States

Project Impact, promoted by the US Federal Emergency Management Agency (FEMA) in the late 1990s was a good example of a partnership approach that led to wider understanding and increased acceptance of the principles of disaster risk reduction. Project Impact was actually designed to change the way the United States dealt with risks before disasters occurred (see box 3.8).

In 2001, FEMA's Mitigation Bureau was merged with the national flood insurance programme to become the Federal Insurance and Mitigation Administration. Funding for Project Impact has since been reallocated and the United States has radically redefined its perceptions of public risk. In 2003 FEMA was merged into the newly created Department of Homeland Security.

Other professional partnerships remain to reinforce disaster risk reduction activities across the United States as every state has an office of emergency services. Both the Network of State Hazard Mitigation Officers and the National Emergency Management Association which serves as a professional association of state emergency management directors, link wide ranging professional interests and disseminate information across the country.

Subsequently, and in a more recent reflection of changing emphasis in the United States, in mid-2003, the Subcommittee on Disaster Reduction (SDR), part of the US National Science and Technology Council, published *Reducing Disaster Vulnerability through Science & Technology*. This interim report of SDR reviews the government's current efforts to increase the nation's disaster resiliency and identifies issues and opportunities for the future. The SDR report is a vital tool for understanding risk reduction for both natural and technological hazards.

Among other interests, the report identifies six broad areas that require continued energy and appropriate resources in order to achieve a disaster-resistant United States:

- leveraging existing knowledge of natural and technological hazards to address terrorism events;
- improving hazard information data collection and prediction capability;
- ensuring the development and widespread use of improved hazard and risk assessment models and their incorporation into decision-support tools and systems;
- speeding the transition from hazard research to hazard management application;
- increasing mitigation activities and incentives; and
- expanding risk communication capabilities, especially public warning systems and techniques.

The report reveals that SDR is now in the process of establishing a coordinated strategic national framework for science and technology research and application development for disaster risk reduction. *Reducing Disaster Vulnerability through Science & Technology* is available on the SDR web site. <http://www.sdr.gov>

The Global Alliance for Disaster Reduction (GADR) is another example of a civil society multidisciplinary network initiative. It has brought together the shared interests of more than 1,000 professionals in disaster reduction and the related aspects of sustainable development, representing regional, national and international organizations. The alliance is organized as an informal global network under the institutional leadership of the Global Institute for Energy and Environmental Systems at the University of North Carolina at Charlotte, in the United States.

GADR has several objectives. It seeks to mobilize intellectual and material resources to address issues which will enable businesses and public agencies to reduce the impacts of natural and technological hazards. Efforts of its members serve as catalysts for ongoing national and international projects. This is accomplished by providing opportunities for expanding technical and political capacities, building multinational networks, convening forums and conferences, and encouraging the implementation of programmes that can reduce the impacts of hazards.

By drawing on their varied experiences in different country settings, individual members have contributed to the preparation of almost 40 subject and regional blueprints consisting of proven practice and demonstrated expertise. Together with the compilation of a methodological toolbox, the blueprints are intended to motivate and guide policy makers and practitioners in the wider application of disaster risk management practices.

Through such activities, the overall intention of the network is to cause major shifts in disaster risk management outlooks and practice from ones that concentrate predominantly on the impact of hazards to ones that are more attentive to preventing disasters. This strategy can be advanced through the engagement of all relevant professional disciplines, national and regional planning activities and a variety of educational programmes. <http://www.gadr.giees.uncc.edu>

Case: India

Following the 2001 earthquake in the Indian state of Gujarat, effective partnerships emerged through the collaboration of NGOs, government authorities, representatives of industry and the affected communities. One example is the Gujarat Rehabilitation Project, a partnership between CARE-India, the Federation of Indian Chambers of Commerce and Industry (FICCI) and the government of Gujarat.

The reconstruction process in Gujarat did not conform to previous or traditional approaches for organizing large-scale public works. There was a need to foster collaboration between national and international interests as well as to promote joint economic, governmental and community approaches for efficient reconstruction implementation. There was a conscious effort to ensure that local communities would be involved in the process and that their needs would be represented at every stage in the rehabilitation process.

As a result, emphasis was given to address the acute shelter needs and to rehabilitate basic services including those related to health and essential livelihood activities. The partnership demonstrated an opportunity to bring a combination of highly skilled professional and technical resources to the project along with government, NGO and community inputs.

The initiative emphasized the values of community participation, developing additional livelihood opportunities and incorporating improved risk reduction measures to minimize the effects of future hazards. The primary motivation of forming such a partnership was the shared interests of the collaborators to motivate a high level of community participation immediately following the disaster and to be responsive to the requirements of sustaining livelihoods in a manner that would establish a safe community environment.

The fact that all plans for housing and community facilities were designed to meet construction standards for both earthquake and cyclone resistance, and that they were approved by both the communities and the appropriate government technical departments, illustrates practical measures that contribute to the future reduction of risks.

Additionally, by working during a transitional period between response and rehabilitation, the stakeholders could develop better opportunities for community mobilization, vocational training, the establishment of temporary community infrastructure, and in restarting essential community activities like schools and markets.

Commercial sector and partnership interests

It is impossible to ignore the increasing economic demand for businesses to become more efficient. Tight production schedules, just-in-time logistics and far-reaching international trading practices expose businesses to potential disruption or loss through natural disasters. There has been a growing commercial awareness of a correlation between disaster preparedness, risk reduction and business survival.

More than 60 per cent of the small retail businesses affected by the Northridge earthquake in California in 1994 were no longer in business six months later. Six years after the Great Hanshin earthquake in Kobe, Japan in 1995, the heavily damaged port of Kobe was still unable to regain its previous competitive standing as the third busiest Japanese port.

Motivated by a desire to protect their own assets or their competitive standing in markets, commercial enterprises have invested heavily in business continuity services designed to assess and mitigate physical or operational risks to their businesses. In recent years there have been important corporate initiatives to promote disaster reduction activities in the common interest. Examples include the Business and Industry Council for Emergency Planning and Preparedness (BICEPP), Disaster Recovery Business Alliance (DRBA), Public Private Partnership – 2000 (PPP 2000), Public Entity Risk Institute (PERI) and the Institute for Business and Home Safety (IBHS).
<http://www.bicepp.org>
<http://www.sustainable.doe.gov/freshstart>
<http://www.usgs.gov/ppp2000/>
<http://www.riskinstitute.org>
<http://www.ibhs.org>

A study was conducted for DFID by the Benfield Hazard Research Centre of the University College London in 2001 to review the extent and features of corporate social responsibility manifested in disaster risk reduction activities. It concluded that while the potential for public-private partnerships is promising, in almost all cases they are difficult to establish and sustain without a common understanding and commitment to risk reduction. This can be very difficult to achieve considering the different values and expectations of commercial, government, and public interest organizations <http://www.benfieldhrc.org>.

Following several serious technological accidents in the 1980s, and especially responding to the Bhopal disaster in India in 1984 that killed 2,500 people and affected 300,000 more, the chemical industry developed a partnership programme to enhance its emergency and safety plans, establishing closer relationships with nearby communities.

This initial idea of strategic and mutually beneficial relationships between corporations, leading industrial associations such as the International Council of Chemical Associations, and UNEP was transformed into an international programme in 1988. Named the Awareness and Preparedness for Emergencies at Local Level (APELL) programme, the initiative has become a landmark example of joint collaboration, managed since its founding by UNEP.

APELL's aim has been to prepare surrounding communities for the potential eventuality of an industrial accident by raising awareness, organizing training sessions and preparing emergency response plans through a participatory process. One of the primary means employed is to enhance communication and collaboration between local authorities, industries located within a community and the nearby inhabitants of the area.

APELL is both a process and a programme. As a process, it consists of the local application of several methodological tools to assist decision makers to develop risk awareness, training and response plans. The overall goal of the process is to give local people and emergency services the means to become aware of the risks and to be prepared to react so as to minimize losses in case of an accident.

When a risk is identified, the local authorities or industry officials create a coordinating group of all

relevant partners, including representatives of the community. Locally generated regional or national workshops and seminars are organized with experts to start the process.

The group then implements APELL in a ten step process:

1. Identification of stakeholders
2. Evaluation of hazards
3. Assessment of risks
4. Review of their own emergency plans by participants
5. Identification of gaps and tasks
6. Improvement and integration of existing plans into overall community plans
7. Obtaining approvals and endorsement from the community and local authorities
8. Education and training
9. Establishment of follow-up procedures
10. Dissemination of the plan for community education

Several specialist strategies have been documented to guide this process. Initially, an *APELL Handbook* was produced in 1988, which has since been translated into several languages. That has been followed by *APELL for Port Areas*, released in 1996; *TransAPELL, Guidance for Dangerous Goods Transport: Emergency Planning in a Local Community*, published in 2000; and *APELL for Mining*, released in 2001.

Networked relationships among national and international organizations have developed programmes to implement local APELL processes, motivated particularly by UNEP's Division of Technology, Industry and Economics. APELL is promoted through the collaboration and operational networks of many industrial interests, inter-governmental organizations and government institutions.

Together, working in their common interest, they provide a range of technical and human support, guidelines, publications and brochures to any interested local actor, thus helping to start local processes. Many national APELL centres have worked to integrate their principles in legislation and to encourage local action.

Since 1988, APELL programmes have been implemented in more than 30 countries and 75 industrialized communities, especially in Latin America, Asia and the Middle-East. Future plans call for more partnerships to be created, along with the development of an enhanced information system and increased operational support.
<http://www.uneptie.org/pc/apell/home.html>

Case: Brazil

Many industrial facilities are located very close to the inhabited and commercial areas of the Brazilian municipality of São Sebastião where more than 60,000 people live. APELL processes were implemented there raising considerable interest throughout the community. Multisectoral participation involved a big petrol company, municipality services, the state environmental agency, both national and local civil defence organizations, and members of the public from the local community.

A risk assessment was conducted, an emergency plan developed and distributed, and a municipal decree was promulgated establishing an emergency day. Four emergency simulations took place in 2001 and 2002, involving several thousand people. School evacuation exercises were organized, and drawing and writing contests were promoted to increase the awareness of children. Training was also provided for the environmental agencies.

Consolidated feedback on all the activities was evaluated and then used to draw the lessons and best practices for improving future capabilities. In December 2002, a regional meeting was organized in the municipality to expand local experience and methods of collaboration for more than 20 port areas in Brazil.

The International Labour Organization (ILO) emphasizes another form of multisectoral collaboration and partnership based on the joint and mutual interests of labour, business and governance collaborating in disaster contexts. In recent years, its response to flooding in Mozambique and massive earthquakes in India integrated gender concerns into a focus given to employment-intensive reconstruction. Women working as small traders, subsistence farmers, artisans, and home-based workers in the informal sector were engaged. These initiatives were developed proactively in collaboration with community groups, government offices and employers in the region.

Case: Mozambique

Evidence of productive network relationships involving business interests can also be found within countries. The national disaster management policy of Mozambique recognizes that the potential impact of disasters on commerce and agribusiness could threaten the national economy. As the resources available to state enterprises relative to the business community diminish, and as private businesses assume more responsibility for providing essential services to the society, the private sector must become a more crucial partner in all aspects of disaster risk management.

With this in mind, the National Office for the Management of Disasters (INGC) has made collaboration with the private sector a priority. Most significantly, the threat of serious industrial accidents has increased with the development of large-scale industrial projects such as refineries and pipeline construction.

The potential human and economic consequences of a severe cyclone damaging principal urban centres also need to be considered in collaboration with the private sector and its economic interests. Such calculations should factor heavily in national economic policies for assured growth and in measures that can protect essential public infrastructure.

With the growing economic impact of disasters, the private sector should be encouraged to become active in its own risk management practices and in the disaster risk reduction measures of society. By lending their important political and economic influence to advocate for national strategies that can protect critical infrastructure and property assets on which their own businesses depend, they will also advance their own strategic commercial interests.

Future challenges and priorities

Networking and partnerships

The major challenges are to stimulate networks of shared commitments and partnerships at local, national, regional and international levels across professional interests. A need for coherence in achieving these partnerships is a challenge to be addressed by ISDR. There are several areas where improvements can be made:

- Enhance relationships by linking risk reduction actors with those of ecological management, social development and economic growth in order to ensure sustainable development.
- Provide incentives to strengthen national, regional and international coordination and networks for information exchange. Promote collaboration that will increase multidisciplinary disaster reduction capacities.
- Encourage the establishment of national committees and related organizational platforms for disaster reduction with active community involvement and the participation of all relevant sectors. This should be encouraged to facilitate common approaches, the collection of information, undertaking risk assessments and support for the development of coherent strategies and action plans.
- In academic circles, stimulate cross-disciplinary efforts, networks and partnerships for integrated and applied research in all relevant areas of risk management. These include gender studies, cultural and social behaviour that increase resilience to hazards, early warning systems, hazards research and the multiple factors of vulnerability analysis.
- An overarching challenge is to pursue a common and widespread understanding of disaster risk and risk reduction practices among an expanding and increasingly diverse range of interests.

4.3. Education and Training

Priority emphasis must be given to education as an essential part of disaster reduction strategies. Education is a crucial means within local communities around the world to communicate, to motivate, and to engage, as much as it is to teach. Awareness about risks and dangers needs to start in early education before abilities to address them can become part of growing civic and professional responsibilities as people mature. The various dimensions of disaster risk within a community can be addressed and continuously reinforced, passed between generations, through formal educational programmes and professional training.

People's understanding and the exercise of their professional skills are essential components of any risk reduction strategy. An investment in human resources and increasing individual capabilities across generations are likely to have more lasting value than any specific investments made in technical measures to reduce risks.

This section will examine the following aspects of risk reduction education:

- *basic role of education and training;*
- *primary and secondary schooling;*
- *disaster and risk management training centres;*
- *academic and educational programmes;*
- *professional trades and skills training; and*
- *capacity-building.*

Basic role of education and training

Past experience has revealed the enormously positive effects of education for disaster risk reduction. Children who know how to react during an earthquake, community leaders who have learned how to warn their neighbours in a timely manner, and societies familiar with preparing themselves for natural hazards all demonstrate how education can make an important difference in protecting people at the time of a crisis.

Education for dealing with risk and disaster preparedness represents a long-term goal. Cultural norms and values as well as related risk perceptions must shift, a process which cannot happen overnight. Education requires a constant and consistent approach, beginning at an early age and continuing through generations.

Over the last two decades, interest in risk management has emerged from the earlier study of specific hazards, the responsibilities of civil defence authorities and the largely structural nature of physical protection. Education and training about disaster and risk management could no longer be considered as an area of specialist scientific study. During this period, the institutional emphasis related to education and training has changed dramatically.

New hazards and the more complex conditions of risk require that increased attention must now be given to a wider public involvement in learning about risk reduction. Institutional facilities and the professional relationships required for educating future generations equally are becoming more diverse.

Academic research has become much more focused on the transfer of knowledge and experience. This necessitates a much closer association between specialists and populations at risk. This has prompted more participatory research in which women and other highly vulnerable populations are involved, leading to the production of community-generated vulnerability and capacity assessments. As growing attention is given to environmental concerns in basic and early education, new opportunities emerge to introduce subject matter about risk and preventive behaviour into classrooms.

More attention has been devoted to the social and economic conditions of vulnerability. As a result, conventional thinking about disaster management has become much more closely linked to basic developmental issues. By looking beyond the physical attributes of hazards alone, a greater emphasis has been placed on matters associated with risk factors and preparedness strategies.

On a professional level, the very concept of a disaster manager, fostered in the 1980s and early 1990s, no longer sufficiently conveys the expanded roles and responsibilities involved in contemporary strategies of disaster risk reduction.

Where disaster management training programmes have been established already, the frames of reference and the intended audiences are expanding. More attention is being given to integrating disaster risk reduction into national development planning processes and in creating more resilient local communities.

A need remains to accommodate the combined influences of environmental and land management issues, climatic uncertainty, changing demographics and the pressing demands for sustainable livelihoods.

These concepts are now being conveyed increasingly through both educational efforts which concentrate on improving knowledge and understanding, and through a variety of training programmes which seek to improve skills and abilities.

It is clear that disaster risks can only be managed on a multidisciplinary basis that narrows the gaps between researchers and practitioners, teachers and students. While there is a much greater need for wider dissemination of professional and technical knowledge, there is at least as much need for study and understanding about the underlying social and economic dimensions of risk too.

Professional training will play a growing role as public and political authorities recognize that effective risk management strategies require many different skills. Such an investment in the development of human resources can only be sustained to the extent that the value of risk management becomes institutionalized, and likewise is reflected throughout a growing range of educational curricula for students of all ages.

A glance at the US National Oceanic and Atmospheric (NOAA) education web site gives some idea of the many types of educational resources and additional web sites that are available to teach about these issues and natural hazards. <http://www.education.noaa.gov/>

Primary and secondary schooling

To inform and insure the future of all communities, education for disaster reduction needs to begin with youth. Disaster reduction education at the primary and secondary levels fosters awareness and better understanding about the immediate environment in which they and their families live and work. Children are widely known to be influential and effective communicators, and more often than not lessons learnt at school are later transmitted to the home. There are many documented occasions when the safety of a family, or the insistent prodding of a child to protect an important element or feature of the household, have been traced back to a "safety lesson" learned at school.

Numerous opportunities exist whereby educational programmes can be used to introduce hazards, surrounding conditions of vulnerability and community risks. While the sophistication and complexity of educational material for children certainly increases with age and the level of their schooling, teachers can use their imagination to integrate disaster reduction into even the most elementary curricula.

"One of the most significant trends affecting disaster preparedness and response is the transformation that has occurred in disaster management… Once focused equally on war readiness and planning for disasters and viewed as the exclusive purview of individuals with military backgrounds, 'civil defence' has evolved into the profession of emergency management – a profession that requires diverse skills, ranging from the ability to develop formal disaster plans, to skills in community outreach and organisational development, the ability to mobilize political constituencies, and knowledge of new and emerging technologies. The professionalization of the field has been accompanied by the development of new organisations, specialty fields and credentialing processes, as well as the growth of college and university curricula focusing on principles of emergency management. With this ongoing evolution in disaster management, disaster research must continue to document how and why disasters occur as well as their immediate and long-term impacts."

Source: K. Tierney, 2001.

As much as wise public health behaviour, fire safety, and civic responsibility are routinely taught in schools, knowledge about local weather conditions, nearby geological risks, or careful use of natural resources are equally pertinent to developing a culture of prevention through educational programmes. School subjects in science, geography, environment, reading, health, social studies, communications, and even art all provide openings in which hazard and risk awareness can be cultivated.

Support for educational programmes to feature disaster risk reduction issues and to motivate the participation of youth in the subject through schooling also can be advanced through international initiatives. In this respect, UNESCO is planning to conduct an international programme on education for disaster reduction during 2004 to correspond with the global preparations for the World Conference on Disaster Reduction to be held in Kobe-Hyogo, Japan in January 2005. It will also contribute to the UN International Decade of Sustainable Education scheduled to run from 2005 to 2015.

As universally regarded institutions of cultural value in all societies, schools also provide a powerful example for the community. In times of crisis, many times schools serve as a place of refuge; as much as they also serve at less critical times as a community place for elders to gather and discuss important matters for the future of the community. Because of these features, school facilities can themselves serve as examples of safe construction, good and protected location, or as a place to bring different parts of the community together for shared contributions in maintaining a safer public environment.

Institutionally too, educational bodies have an important role to play in stimulating and maintaining practices that serve the public interest. Teachers are often admired community leaders, whose opinions and dedication are respected in matters of public interest that extend beyond the classroom. For this reason, the extent to which teachers embrace, and communicate, the importance of a safe school building, protection from physical harm, and an informed and actively involved group of citizens of all ages can become a strong influence in creating a disaster-resilient community.

The examples that follow give some indication of the variety of activities in disaster risk management education and training.

Box 4.11

American Red Cross *Masters of Disaster* Curriculum for Disaster Safety

The American Red Cross, with generous support from the Allstate Foundation, has developed a curriculum that not only teaches students about disaster safety, but helps teachers meet their required objectives as well! Teachers have a lot to cover to meet the learning objectives prescribed by their school system, and that is why we have developed the *Masters of Disaster* curriculum—to help teachers integrate important disaster safety instruction into their regular core subjects such as language, arts, math, science, and social studies.

This is not additional material for teachers to work into an already packed school day. Rather, the *Masters of Disaster* curriculum, which is aligned with the National Education Standards, supplements the lessons teachers are already teaching. At the same time it provides students with information to help them prepare for disasters and stay safe during and after a disaster in their home, school, or community.

The *Masters of Disaster* Curriculum Kit contains ready-to-go lesson plans, activities, and demonstrations on disaster-related topics that teachers can incorporate within core subject areas. A teacher can show students how to plot latitude and longitude on a map by using the curriculum's lesson on how to track a hurricane. They can augment instruction on the water cycle with activities in the lessons on floods. A teacher working with students on word recognition and decoding can choose to use the vocabulary section of the curriculum.

While strengthening students' core academic skills in science, math, social studies, and language arts (including reading, word comprehension, and spelling), the Masters of Disaster curriculum educates them about hazards that cause injury, death, and damage in the United States. The materials are designed for flexibility, so that teaching teams can integrate hazard-related lessons into the core academic subjects. The curriculum focuses on: general disaster preparedness, hurricanes, floods, tornadoes, lightning; and earthquakes.

Source: <http://www.redcross.org/disaster/masters/intro.html>.

Box 4.12
Education through practice

Established in 1997, Association Prévention 2000 aims at raising awareness and promoting education on natural hazards, particularly – but not exclusively – among schoolchildren in France and Nicaragua. Many of its activities revolve around disaster mitigation and exploring innovative uses of the Internet and information technology to promote the understanding and techniques of disaster reduction. Its main instrument is an Internet site with considerable documentation on natural disasters, considered by many as one of the pre-eminent sources of French-language information on natural disasters.

Association Prévention 2000 is a key player in the education group of the French Association for Natural Disasters Reduction (AFPCN), as well as being a member of the jury for scholars organized every year by the French ministry of the environment. It also motivates young people aged between 10-15 years to inquire from their elders about previous natural disasters in their communities, and then to produce local hazard maps. Many French cities such as Orleans and Tours have become official partners of this initiative. Adolescents aged 16-17 who are interested in pursuing hazard reduction projects can be assigned a scientific partner nominated by AFPCN to oversee their projects.

An Ambassador Network was launched in 2001 to bring together all French schools with educational activities related to disaster risks. The French ministry of education has recognized this pilot project as a valuable instrument in the field of environmental action. Now comprising more than a dozen schools, it produces a newsletter 'Mitig'info' destined for disaster risk professionals in French-speaking regions of the world.

<http://www.prevention2000.org>

Disaster and risk management training centres

There are a number of highly regarded disaster management training institutions that have evolved from an earlier emphasis on operational activities. Previous attention devoted to contingency planning and community preparedness has been reoriented towards motivating local participation and multidisciplinary outlooks that can create disaster-resistant communities.

Centres have been organizing a variety of training programmes for the past 15-20 years. Today, graduates from these programmes often constitute the core of disaster professionals in many developing countries, particularly in Africa and Asia.

Often through their efforts, earlier training has provided impetus to the creation of national training programmes or centres within individual disaster-prone developing countries. Current trends in national training reflect efforts to impart instruction for further extension of risk reduction practices through community-level practices, often through the use of locally developed training materials. These initiatives also foster the growth of smaller informal training sessions adapted to local situations and needs, often drawing on local case examples.

Another variation on this type of training for disaster risk management which also reflects admirable examples of capacity-building is represented by the efforts in Cambodia and Viet Nam. In both of these countries exposed to frequent natural hazards, sustained efforts have been committed to institutionalizing training capabilities within the ongoing programme activities of their National Red Cross and Red Crescent Societies.

Structured programmes are conducted at both national and local community levels of activity to increase subject knowledge as well as the necessary communication and motivational skills of trainers. All necessary training materials are in place, and have either been developed or translated into local languages. Past experiences and various examples of community activities to identify risks, prepare for forthcoming seasons of heightened exposure to likely hazards, and lessons learned have all provided insights for the development of locally relevant case examples.

Both of these programmes have demonstrated the beneficial values of a methodical and sustained approach to institutional training conducted throughout the country landscapes by a recognized and highly regarded national institution. The esteem represented by the national societies provides legitimacy and professional credibility to the subject. The voluntary and community-based nature of Red Cross and Red Crescent work invites a high degree of dedicated public involvement.

These elements in themselves contribute to an ongoing national effort in public awareness in local communities, reinforced to a common standard of information and expectation by excellent practical disaster preparedness manuals. It is a justifiable mark of pride in both of these programmes that while earlier training was prompted and conducted by international agencies or external NGOs, the core training capabilities are now undertaken fully by nationals of the respective countries.

Box 4.13
Training centres

With broad regional or global relevance:

- Asian Disaster Preparedness Center in Bangkok, Thailand
- Asian Disaster Reduction Center in Kobe, Japan
- Disaster Management Center at the University of Wisconsin in Madison, United States
- Emergency Management Australia Institute in Mount Macedon, Australia
- International Institute for Disaster Risk Management in Manila, Philippines

More specific subregional or national focus:

Asia
- Bangladesh Disaster Preparedness Center in Dhaka, Bangladesh
- Centre on Integrated Rural Development for Asia and the Pacific in Dhaka, Bangladesh
- International Centre of Integrated Mountain Development in Kathmandu, Nepal
- National Centre for Disaster Management at the Indian Institute of Public Administration in New Delhi, India
- National Institute of Rural Development in Hyderabad, India
- Uttaranchal Disaster Mitigation and Management Centre in Dehra Doon, India

Africa
- Africa University in Mutare, Zimbabwe
- African Centre for Disaster Studies at Potchefstroom University in South Africa
- Disaster Management Institute of Southern Africa in Gauteng, South Africa
- Disaster Management and Mitigation Unit of the National College for Management and Development Studies in Kabwe, Zambia
- Disaster Mitigation for Sustainable Livelihoods at the University of Cape Town, South Africa

Box 4.14
Red Cross and Red Crescent education for preparedness and disaster risk management

The International Federation of Red Cross and Red Crescent Societies is devoting energy to disaster education in many countries. Activities include:

- educating geography and social studies teachers in the Caribbean so they can include disaster education in their classrooms;
- working with tertiary institutions in Pacific island states to incorporate disaster management topics in their curricula;
- developing games and drama exercises as a means of imparting disaster preparedness information to children in the Pacific; and
- using television cartoons to convey messages to adults and children in Central Asian countries.

Academic and educational programmes

Natural hazards have generally been studied in the physical sciences or expressed in terms of physical forces considered by technical disciplines such as engineering. Historically, there has been less academic interest in studying the social and economic effects hazards have on societies.

Noteworthy exceptions in the United States included the early exploration of sociological aspects of disasters in the mid 1960s at the Ohio State University Disaster Research Center. Such thinking, coupled with the social and physical dimensions of geography, later led to the creation of the Natural Hazards Research and Applications Information Center at the University of Colorado in 1974.

Parallel developments occurred in Europe during the 1970s as a variety of technical specialists contributed ideas that led to the creation of the Centre for the Research and Epidemiology of Disasters (CRED) in the School of Public Health at the Catholic University of Louvain in Brussels in 1972.

In 1978, the ideas of a multidisciplinary group of researchers called the London Technical Group led to the creation of the International Disaster Institute, a specialist research centre, in London.

Academic programmes related to hazard studies and emergency management have expanded widely over the past ten years but only in some parts of the world. The University of Colorado's Natural Hazards Center lists more than 60 centres that study hazards and disasters. In addition, an equal number of academic institutions are listed that offer either graduate or undergraduate programmes in emergency management, mostly in the United States.
<http://www.colorado.edu/hazards>

The US Federal Emergency Management Agency promotes the professionalization of emergency and disaster risk management through skills training programmes, support for the development of professional certification and degree programmes in higher education. These activities include the development of college-level courses introducing key concepts and theories across the curricula of colleges and universities. Instructor's guides for all these college courses are available online.
<http://training.fema.gov/EMIWeb/edu>

ADRC in Kobe, Japan, identifies more than 70 training institutes and other programmes available around the world. It cites education programmes for technical specialists and programmes run by national and professional organizations including academic institutions that offer short-term professional courses in various aspects of disaster management. <http://www.adrc.or.jp>

University of Portsmouth, United Kingdom

One academic programme that reflects the development of contemporary programmes in disaster risk management is the Bachelor of Science degree in Disaster Risk Management, offered since 2002 by the School of Environmental Design and Management at the University of Portsmouth in the United Kingdom. The course focuses on disaster preparedness and mitigation, economics and financial planning and other means that can reduce vulnerability within the wider context of disaster risk awareness, appraisal, reduction and management. Intended to be multidisciplinary in orientation, the programme addresses four broad themes: disaster studies, natural hazards, international development and risk management. Related units of instruction contribute skills in areas including data analysis, GIS technology, economics, and research management so that tools and techniques can be applied for effective disaster risk management practices. <http://www.port.ac.uk/edam>

University of East Anglia, United Kingdom

Individual courses were offered by the Overseas Development Group at the University of East Anglia in the United Kingdom during 2003. This reflects the emerging interests in relating disaster risk reduction to matters of climate change, sustainable development and environmental management issues.
<http://www.odg.uea.ac.uk>

The course Integrated Approaches to Climate Change Management is conducted in conjunction with the Tyndall Centre for Climate Change, also located at the University of East Anglia. It provides a comprehensive introduction to the concepts, techniques and tools available for integrated assessment of the challenges presented by global climate change and its management in the short, medium and long term. The overall objective of the course is to provide participants with the background knowledge, skills, and concepts needed for their work in specifying and implementing integrated climate change management systems across a wide variety of national and regional settings. The course is designed in the context of the objectives of the UN Framework Convention on Climate Change.
<http://www.odg.uea.ac.uk/pages/course_integrated.html>

The scope and content of the course *Indicators for Sustainable Development* correspond to the current global interest in indicators of all kinds. Sustainable indicators are now used in almost all regions to determine the essential viability of development programmes and to determine future objectives. This course explores the current use of indicators and teaches a practical, participatory and holistic approach to their development. Key areas covered include the current use of various indicators in a wide range of global contexts, their use and applications, and the critique of good and poor practices. The course reviews alternative methods for developing indicators of all kinds and teaches systemic sustainability analysis. This

Box 4.15
Disaster risk reduction education in Latin America and the Caribbean

- The University of Antioquia in Colombia is home to the WHO/PAHO Collaborating Centre for Education in Public Health. The faculty of social sciences offers a masters degree in contemporary social sciences and risk management.
- The Center of Studies on Disasters and Risk at the University of the Andes in Bogota, Colombia offers a postgraduate programme in risk assessment and disaster prevention.
- The University del Valle in Bogotá, Colombia offers a postgraduate programme in integrated risk management.
- The Institute of Technology in Ejido, Venezuela offers a technical degree in emergency management and disaster response.
- The Central University of Venezuela Faculty of Medicine has included subjects on emergency and disaster preparedness in the undergraduate curriculum for many years.
- The Cuyo National University in Mendoza, Argentina offers a postgraduate degree in prevention, planning and integrated management of risk-prone areas.
- In Chile, the first postgraduate course on journalism and disaster management has been initiated.
- The National University of Costa Rica offers a masters degree in natural disaster mitigation for Central America, (established through the cooperation of the Swedish Agency for Research Cooperation with Developing Countries in association with other Central American state universities).
- The University of Costa Rica offers a series of courses related to hazards.
- The National Autonomous University of Nicaragua is designing a masters degree in prevention and mitigation of natural disasters.
- The Del Valle University in Guatemala is designing a masters degree related to disaster emergency preparedness and response.
- The University of West Indies' Jamaica and Trinidad and Tobago campuses offer disaster management courses as part of bachelor degree programmes. At the Mona and Cave Hill campus, masters degree programmes on the environment include disaster management components.

holistic approach to the development of sustainable indicators can be applied to participants' own country or professional contexts.
<http://www.odg.uea.ac.uk/pages/course_indicators.html>

The course Disasters and Development: Hazard, Risk and Vulnerability Assessment introduces and evaluates the claim that in many cases poverty and disasters are interdependent. Unsustainable development practices contribute to many kinds of disasters. These disasters in turn increase poverty leading to increased vulnerability through the adoption of unsustainable survival and coping strategies. Proactive risk management is considered as a counter-measure including disaster preparedness and mitigation planning activities. The course is designed for development professionals, emergency planners, government policy and decision makers, civil defence officers and aid workers interested in becoming more attentive to risk issues. Topics include methods to identify hazards and risks, assessing risk exposure and the incorporation of risk considerations into policy decisions to reduce potential risk impacts and prevent disasters.
http://www.odg.uea.ac.uk/ pages/course_disaster.html>

Case: Switzerland

There are several academic programmes in Switzerland that are representative of courses of technical study available to pursue training in various dimensions of disaster risk management. One such course is composed of postgraduate studies in the analysis and management of geological risks organized by the Faculty of Sciences of the University of Geneva in association with the Swiss Federal Institute of Technology in Lausanne.

This training is intended primarily for geologists, geographers, geo-technicians, civil engineers and land-use planners. It has the objectives of developing their expertise in the field of natural risk mitigation by integrating it in the planning of sustainable development. The programme offers a multidisciplinary approach to develop solutions for a society confronted with natural risks. It engages specialists who can advise public interests and the private sector to take preventive measures which can reduce the impact of natural disasters. The programme involves consideration of multiple risk assessments related to earthquakes, floods, volcanic eruptions and landslides; the practice of natural disaster mitigation measures; and the overall strategy of mitigation management.
<http://www.unige.ch/hazards/cerg>

Box 4.16
Disaster risk reduction education in Asia and Pacific Regions

Asia

- Indira Gandhi National Open University in New Delhi, India offers a certificate on disaster management at undergraduate level, and a post-graduate diploma in disaster management. <http://www.bangaloreeducation.com/courses/cdm.htm>
- The Centre for Environmental Planning and Technology in Ahmedabad, India offers a course in urban disaster management in the School of Planning. <http://members.tripod.com/~rsharma>
- The Centre for Environmental Science and Engineering (CESE) at the Indian Institute of Technology (IIT) in Mumbai, India offers post-graduate programmes and activities pertinent to natural hazards and disaster risk reduction. The centre offers advanced degrees in technology involving course work followed by research and also offers interdisciplinary doctoral programmes. These programmes are designed to address the needs and challenges of major industrial interests, governmental sectors, international and UN agencies including the World Bank, UNDP and UNEP. <http://www.iitb.ac.int/centre~cese>
- The Centre of Studies in Resources Engineering (CSRE) is another centre at IIT, Mumbai. Since its inception in 1976, it has been involved in developing remote sensing technologies and their applications for natural resources management and environmental monitoring practices. The centre has also done pioneering work in the area of low-cost GIS applications. <http://www.csre.iitb.ac.in/>
- Moratuwa University in Sri Lanka includes concepts of disaster management in courses conducted by the departments of town and country planning, architecture, and building economics. <http://www.mrt.ac.lk/academic.shtml>
- Ruhuna University in Sri Lanka offers a general and special undergraduate degree programme in natural hazard management within the Department of Geography. <http://www.ruh.ac.lk/Uni/Hss/geography/ge_courses.html>
- The Bandung Institute of Technology in Bandung, Indonesia offers several courses which relate to architecture and environment, and urban planning issues. <http://archnet.org/courses/>
- The Coastal Resources Institute at Prince of Songkhla University in Thailand is an institute with a commitment to establishing coastal management that leads towards sustainability. Interdisciplinary methods and tools are applied to consultancy, research and development in media-based activity areas. <http://www.psu.ac.th/corin/>

Pacific

- The Centre for Hazard and Risk Management – Risk Frontiers, (formerly, the Natural Hazards Research Centre) at Macquarie University in Sydney, Australia has a mission to create strategic risk management and training solutions for insurance companies and their clients by means of leading research into natural perils and their consequences. <http://www.es.mq.edu.mq.edu.au/NHRC/>
- The Centre for Disaster Studies at James Cook University in Queensland, Australia is a multidisciplinary research unit presently housed in the School of Tropical Environment Studies and Geography. The centre addresses both public interests and professional needs in the fields of emergency management and meteorology for the benefit of city councils and other researchers.<http://www.jcu.edu.au/>
- The Earthquake Hazard Centre at Victoria University in Wellington, New Zealand is a non-profit organization located in the School of Architecture, supported by the Commonwealth Science Council. It acts as an information network and dissemination centre for earthquake-resistant construction in developing countries. It shares basic earthquake engineering knowledge that is readily available in some countries with professionals working in construction-related fields in developing countries. <http://www.ehc.arch.vuw.ac.nz/>

Another approach for disseminating educational opportunity is being pursued by the Natural Hazards Competence Centre (CENAT) at the Swiss Federal Institute for Snow and Avalanche Research in Davos, Switzerland. It was created in 1995 as a focal point for international and national institutions working in the field of natural hazards and to foster interdisciplinary research on the causes of natural hazards and their effects. It also coordinates the work of specialists by forming specialized teams for teaching and research purposes. The centre is made up of university institutes which are themselves part of the Swiss Federal Institutes of Technology. A virtual campus project has been conceived to offer an electronic learning course in coping with natural hazards based on the combined curricula of the seven CENAT partner university institutes. <http://www.cenat.ch/cenat.html>

Other regional variations of these approaches also exist, although comprehensive listings of formal programmes are not so readily available. However, selected examples demonstrate the type and range of postgraduate programmes in disaster risk management that are currently available in Latin America and the Caribbean, Asia, and Pacific regions.

Professional trades and skills training

In Asia, the past 30 years have seen a remarkable growth in the number of professionals trained in different science and engineering branches related to geological, hydrometeorological and climate hazards. There are now many more people with the skills to assess and interpret the physical phenomena of natural hazards, even in smaller developing Asian nations.

However, the teaching of science and engineering only infrequently proceeds into matters of hazard and risk assessment. When the subject is addressed, the courses tend to teach mostly structural mitigation and feature largely physical means of controlling the effects of natural hazards, such as the utility and construction of check dams, flood embankments or retaining walls.

While modern science widely acknowledges that societies are increasingly complex, there is little corresponding attention paid in formal educational programmes to the social, economic or political factors associated with risk management. Accordingly, there is still a lack of social scientists, community-based leaders or broadly informed public administrators practicing in the field of risk reduction.

Asian Urban Disaster Mitigation Programme

One exception is the Asian Urban Disaster Mitigation Programme (AUDMP), implemented under the auspices of ADPC in eight Asian countries. This programme's approach to education includes the development of generic curricula on urban disaster mitigation, which can be adapted and institutionalized at national and local levels through other partnered training institutes.

An array of training programmes, methods and tools have been produced over the past eight years including courses on floods, earthquakes and technological hazards. Other courses have emphasized community-based approaches to disaster reduction and most recently, risk communications. Courses for safer construction techniques for masons have also been developed. In Asian countries, it is more likely to find specialized institutions related to disaster management created by state authorities <http://www.adpc.net/audmp>.

Education about sustainable development

An online discussion prior to the 2002 World Summit on Sustainable Development considered how best to promote education and capacity-building for the management of risk reduction. It considered means to incorporate disaster risk reduction in sustainable development practices.

The discussion also reflected a common understanding that education is linked to safety in many immediate and long-term ways. It noted that education must involve public awareness of hazards, advocacy for creating a culture of prevention, development of school curricula and professional training.

However, it was also observed that the issue is not simply one of recommending more education. There is equally a need to address the ways in which these various forms of education and training can link and complement one another.

START – IIASA Fellowships

Another example of building professional capacities in the field of applied environmental change and disaster risks is represented by an innovative public-private partnership. The System for Analysis, Research and Training (START), based in Washington DC, is working in partnership with the International Institute for Applied Systems Analysis (IIASA) in Laxenburg, Austria with the financial support of the David and Lucille Packard Foundation.

Together they provide an opportunity for applicants to participate in the Advanced Institute on Vulnerability to Global Environmental Change. The programme has three components comprising a three-week seminar conducted at IIASA, one-year research grants for successful Institute Fellows, and a workshop that culminates in the presentation of the Fellows' research.

This programme invites the participation of young scientists and professionals under the age of 40 years from developing countries,

although subject to available funding, exceptional applicants from industrialized countries may be considered. The Advanced Institute is multidisciplinary and applicants with backgrounds in social science, natural science, engineering, management and public policy are encouraged to participate. <http://www.start.org>

Local collaboration in construction practices

A disproportionate exposure to risk is concentrated in developing countries where a dramatic potential for loss can be attributed to unsafe buildings. Most of these buildings are constructed informally. The involvement of certified technicians or the application of formal engineering practices in these constructions is limited, often due to economic realities.

The problem of safer construction becomes one of conveying sound, risk reduction building practices to the building owner. One mechanism that has been used is by working closely with local artisans, carpenters, masons and other skilled tradesmen who provide most technical expertise in construction.

As they are local residents themselves, they can work as motivators for both current and future improvements. To accomplish this type of risk reduction training, it is necessary to recognize the role of these artisans more fully and to engage them in better understanding about the issues involved.

Box 4.17
Practical training in Nepal

The Kathmandu Valley Earthquake Risk Management Project was implemented by the National Society for Earthquake Technology (NSET) in Nepal. Engineering students participated in a building inventory and vulnerability analysis programme during their summer vacation.

More than 100 students were involved in the programme and learned different aspects of safer construction in earthquake-prone areas, which had not otherwise figured in their engineering curriculum.

Even such an informal exposure to risk issues and student recognition of the relevance to their studies demonstrates a potential for future courses for the younger generation. <http://www.nset.org.np>

Box 4.18
Regionally-based training capabilities

LÍDERES is a vulnerability reduction course taught in Spanish and targeting the Latin American disaster management community. It is organized by PAHO/WHO and taught almost exclusively by specialists with an international reputation. It aims to strengthen the managerial skills required by disaster risk reduction practitioners. The content of the LÍDERES course is constantly evolving and is revised in response to the needs of its audience. <http://www.idg.es/lideres>

UNICEF, LA RED and the Latin American Social Science Faculty (FLASCO) collaborated on a project in 1998 to introduce reforms in the local curricula of risk and disaster education, subsequently published in Educación y Desastres. <http://www.desenredando.org>

These and similar programmes often have their roots in earlier training programmes for local leaders and artisans first developed during the mid-1990s. These include such activities as those promoted by the Core Shelter Construction Programme in the Philippines, as well as parallel approaches adopted in Nepal through the National Society for Earthquake Technology. In both instances, these practical approaches to local acceptance and furthering artisan training have been successful with considerable interest shown by the participants. They have also led to a replication of the principles in neighbouring communities.

In Latin America and the Caribbean, there has been a growth in educating and employing professionals with skills necessary for risk reduction from within the region. This is in contrast to an earlier reliance on external technical advice and abilities. This practice of developing local capabilities has been encouraged by international agencies.

Capacity-building

Capacity-building can be achieved through means such as training and education, public information, the transfer, provision or access to technology or other forms of technical assistance intended to improve institutional efficiency.

In disaster risk reduction, the concept also relates to the training of disaster managers, the transfer of technical expertise, the dissemination of traditional knowledge, strengthening infrastructure and enhancing organizational abilities.

UN University Centre on Human Security and the Environment

An important and innovative approach to addressing these issues is demonstrated by the decision taken in 2002 to create a United Nations University (UNU) Research and Training Centre on Human Security and the Environment in Bonn, Germany. This new institution is being organized through the joint commitments of the German ministry of education and research, the North Rhine Westphalia state ministry of education, the City of Bonn, and the United Nations University system to foster interdisciplinary research, training and capacity-building.

By creating a new global centre of expertise that brings together the multiple interests in human security and environmental issues in 2004, it is anticipated that it will become a focal point for international networking. With inter-sectoral initiatives it will be able to develop innovative and integrated approaches to further the wider dissemination of the subject.

It is envisaged that specific emphasis will be given to the following types of activities:

- support research and training with a primary orientation towards applications;
- develop methodologies related to integrated risk assessment and management, with particular regard given to traditional and local knowledge;
- encourage policy dialogue among researchers, politicians, policy makers, and other stakeholders for context-specific issues;
- foster regional cooperation and partnership within and between industrialized and developing countries, bridging technological and knowledge divides between North and South outlooks and abilities;
- facilitate cooperation and coordination of the many efforts of pertinent institutions of excellence worldwide; and
- pursue unbound research of a complex nature that embodies social systems, environmental concerns, and political constructs that combine in ways that are decisive for human security.

In a broader context, most UN programmes are geared to support capacity-building. In 2001, UNDP strengthened disaster reduction capacities in over 60 countries. Programmes included building local capacities for disaster reduction in Central America and Jamaica, developing a new national risk and disaster management system in Haiti, and strengthening national disaster offices in the Caribbean.

UNDP also developed regional strategies for disaster management in Southern Africa Development Community (SADC) countries and among other countries in South-Eastern Europe. It addressed flood risk reduction in the Tisza river basin for Hungary, Romania and Ukraine, and drought risks in Iran, Tajikistan and Uzbekistan. UNDP also supported capacity-building programmes in Albania, East Timor, Romania, Madagascar and Malawi, among many others.

UN Disaster Management Training Programme

The UN Disaster Management Training Programme (DMTP), currently administrated by UNDP, supports capacity-building efforts in the UN system, international organizations and individual disaster-prone countries. Workshops have promoted the establishment of national or regional centres and strengthened their capacities to study technological and environmental hazards, seismic protection, crisis prevention and preparedness.

DMTP has conducted more than 70 workshops involving 6,000 participants in Africa, Latin America and the Caribbean, Asia and the Pacific, the Middle East and the Commonwealth of Independent States.

Its training materials include 22 modules, 27 country case studies, simulation exercises, trainers' guidelines, and videos. They encompass a wide range of topics including learning about disasters, techniques for risk assessment and perspectives about the links between crisis and development.

The training modules have been produced in English, French and Spanish, with selected modules also translated into Arabic, Bahasa Indonesian, Chinese, Portuguese, Russian, and Vietnamese. <http://www.undmtp.org>

Latin America and the Caribbean

The Organization of American States (OAS), PAHO and other organizations including LA RED have sought to build capacity through expanded education opportunities in Latin America and the Caribbean over many years.

Pan American Health Organization (PAHO)

PAHO's Catalogue of Disaster Publications and Information Resources contains a detailed description of all PAHO disaster training materials such as books, CD-ROMs, slides and videos.

It lists other sources of information, including the Virtual Health Library for Disasters and principal web sites that contain PAHO publications and multimedia content. The catalogue is available on the Internet and print copies are available on request. <http://www.paho.org/english/dd/ped/Publication_eng.htm>

There has been much progress in risk management in the public health services of the region. All ministries of health in Latin America and the Caribbean now employ at least one official who is in charge of disasters. In many countries there is an entire department or agency devoted to the subject.

In Argentina, Bolivia and Chile, new water and sewage concessions require participating private sector companies to meet disaster reduction criteria in the construction, operation and maintenance of water and sanitation systems.

Vulnerability studies have been carried out in Brazil, Chile, Costa Rica, Ecuador, Peru and Venezuela to examine water supply and sewage systems. This has led to an increased availability of current technical information and a growing demand for training in disaster reduction in this field.

EDUPLANhemisférico

Another comprehensive inter-American strategy demonstrates joint efforts to reduce the education sector's vulnerability to natural hazards. Launched by the Unit for Sustainable Development and Environment of the Organization of American States (USDE/OAS), working with PAHO in 1993, EDUPLANhemisférico employs various means to protect schools.

While its multiple approaches are more fully presented in terms of protecting vital infrastructure (see chapter 5.3.), the programme also features a commitment to improve the curriculum related to reducing risks. It encourages the addition of more elements pertaining to understanding vulnerability and risk reduction in primary, secondary and higher education throughout the Americas so that individuals and various professional interests are prepared to work together for disaster reduction.

LA RED

LA RED too, has developed methodologies for training local authorities in risk management which include individual training modules and information materials. They are being applied in many countries in the region and also have been adapted to local conditions.

Africa

Risk reduction efforts in South Africa require a considerable amount of inter-sectoral collaboration. As such, a training and capacity-building working group has been established so that one body can monitor disaster management training and research throughout the country.

The working group has compiled a comprehensive framework for all types of formal and non-formal disaster management training and other capacity-building programmes. It is also in the process of establishing a body to set standards for disaster management training consistent with the accreditation requirements of the National Qualifications Framework and the South African Qualifications Authority.

Schools can play a vital role in expanding community outreach for hazards awareness and risk reduction, although it is often a challenge to insert the subject into other course curricula. Past experience demonstrates that a limited perception of local hazards and disaster reduction is frequently attributed to a lack of training, awareness, education, and self-reliance within the body of communities.

An effective educational programme conducted through the schools not only teaches children their basic subjects, but also reaches deep into the community through them, their parents and teachers. In the case of Africa, much work can be done in the future to include hazard and risk awareness into basic school programmes through standard environment, geography and science subjects.

Although the African continent does not yet have the breadth of institutions devoted to capacity-building specifically related to disaster risk reduction found elsewhere, there are some important examples that demonstrate a growing interest in the area.

University of Capetown, South Africa

The Disaster Mitigation for Sustainable Livelihoods Programme (DiMP) is located in the Department of Environmental and Geographical Science at the University of Cape Town in South Africa. Initiated in 1996, the programme follows the university's mission statement that stresses teaching should be linked to the new challenges in society, educating for life.

The specific purpose of the DiMP programme is to educate people in the field of disaster management in order to counter the increasing losses stemming from natural disasters in South Africa. In this regard, DiMP is very relevant to the country's contemporary disaster management legislation which calls for more attention to be given to disaster prevention and mitigation.

DiMP focuses on research activities as well as teaching programmes of all kinds. The programme offers undergraduate and graduate degree studies as well as professional short-term training courses throughout the year. The programme encourages interdisciplinary competencies, synthesizing the physical and social dimensions of disaster issues. In May 2003, the university's Department of Environmental and Geographical Science outlined a Masters Degree in Disaster Risk Science which will commence in the 2004 academic year. While its full realization will depend on necessary financial commitments, it will represent the first graduate degree of its kind in Africa. <http://www.uct.ac.za/>
<http://undmtp.org/inventory/pages/sa_inventory/sa_uni_cape.html>

Potchefstroom University, South Africa

Similar interest in cross-sectoral capacity-building is demonstrated by the activities of the African Centre for Disaster Studies (ACDS) established within the School for Social and Government Studies of Potchefstroom University in South Africa, in January 2002. It aims to address the need for world-class training, education and research in disaster-related activities within South Africa and the wider African context. ACDS seeks to achieve social development and sustainable livelihoods within the context of excellence in disaster training, education and research.

ACDS offers short courses in all aspects of disaster studies with a particular focus on disaster risk reduction in order to minimize risk and vulnerability to hazards in communities most at risk. Longer academic programmes include a one-year certificate course in disaster studies, and from 2004 an undergraduate degree course in disaster management will be offered.

In addition, the ACDS develops capabilities through disaster research and consulting activities in the field of disaster management by making use of local and international expert knowledge. It strives to increase community involvement and local development of capacities through risk and vulnerability reduction activities.
<http://acds.co.za/>

Asia and the Pacific

Sharing experiences and collateral learning through organized training programmes enable disaster managers to learn from each other's experience throughout the country. In India, the National Centre of Disaster Management in Delhi, the Assam Administrative Staff College and other administrative staff training institutes elsewhere in the country conduct disaster management and preparedness training.

The Disaster Mitigation Institute, India

Other institutions invest in building national capabilities by emphasizing local experiences that can be linked more widely to national expertise. The Disaster Mitigation Institute (DMI), based in Ahmedabad, Gujarat is such an example. Its mission is to reduce the impact of disasters on communities by raising awareness, helping to establish and strengthen sustainable institutional mechanisms, enhancing knowledge and skills, and facilitating the exchange of information and experiences obtained through local learning.

DMI is one of an emerging type of institute which seeks to provide a particular focus for disaster managers and to encourage wider participation at the grassroots, national and international levels of activity. Courses reflect both national and local orientations by adapting, testing and then applying existing and emerging frameworks for community-based disaster risk management.

Its training programmes are motivated by the recognition that without mainstreaming mitigation, attention to urban risks will continue to be oriented around emergency assistance. As a consequence, risk identification, reduction and means to spread risks are unlikely to be on the urban agenda.

The primary aims of DMI's national courses are to build national capacities in disaster reduction by sharing local knowledge and experiences, using interactive and participatory training methods. Course materials are developed in the context of South Asia.

Objectives include:

- examination of different disaster risk management models and approaches;
- analysis of community-based approaches in disaster risk management;
- identification of various risk reduction measures that can be undertaken by a community and the transformation of them into community action plans;
- learning lessons by sharing local experiences; and
- promotion of commonly accepted standards or norms for community involvement in disaster management practices.

Participants are attracted from throughout India as well as from organizations elsewhere. Courses are also conducted in various locations in order to attract local, community-based NGOs as well as individual professionals working in disaster management, government and UN agencies.

The institute also publishes *Afat Nivaran*, a monthly in Gujarati, bringing together the experience and insight of government and NGOs with community workers involved in disaster mitigation and risk management activities. *Vipada Nivaran*, a quarterly published in Hindi, reaches out to decision makers with key ideas and experience from the field. DMI is preparing a code of conduct based on a household livelihood security model for urban settlements that focuses on the main themes of income and productive activities, infrastructure, environment, political-and legal systems, information, legislation and implementation practices.
<http://www.southasiadisasters.net>

Local collaboration for training

The School Earthquake Safety Initiative is being implemented by the UN Centre for Regional Development (UNCRD) Hyogo Office in Kobe, Japan, in association with the Earthquake Disaster Mitigation Research Centre in Miki, Japan. It focuses on five cities in four countries in Asia: Bandung and Bengkulu, Indonesia; Chamoli, India; Kathmandu, Nepal; and Tashkent, Uzbekistan.

The objective of the initiative is to develop disaster-resilient communities through self-help, cooperation and education. The initiative aims to promote disaster education among children, parents and teachers.

This approach to public education also encourages widespread community involvement in retrofitting school buildings. As a visible and highly valued community asset, a safer school can save the lives of children during disasters and can also be used for relief activities. Schools are important in every aspect of disaster management from promoting a culture of prevention and disaster reduction through ongoing community activities.

In December 2001, the Philippine Institute for Volcanology and Seismology (PHIVOLCS) and UNESCO held a training course in collaboration with the Philippine Commission on Higher Education, UNU and ADRC. The programme was aimed at school commissioners, government education officials, and NGO officials. It concentrated on disaster management and schools, and included a module on best-practice earthquake evacuation. It is expected that disaster preparedness will be reflected in more school curricula across Asia.

Future challenges and priorities

Education and Training

In formal education programmes and professional training activities, the shift from a primary focus on hazards to a broader integration of risk awareness, analysis and management has only just begun.

Major disaster events in recent years have shown the need for greater education in risk management. More sustained focus on informal training and community-based capacity-building is essential.

Priorities of disaster risk education must be integrated in routine education and training programmes. These include:

- proceeding beyond a consideration of emergency response;
- incorporating risk education in national development programmes;
- educating about the social dimensions of risk;
- adopting an institutional basis to transmit experience; and
- sustaining commitment to risk reduction education and training.

Proceeding beyond a consideration of emergency response

There has been a progressive acceptance of the distinction between emergency services required to respond to disaster and the more diverse responsibilities related to risk reduction. Both national and international commitments are necessary to invest in human resource development dedicated to risk reduction, first and foremost to support initiatives in the most disaster-prone countries.

A continued expectation, or reliance of external emergency assistance in response to individual disastrous events will impede any efforts to educate and involve future generations more fully in disaster risk management. The significant imbalance in financial allocations and international emergency assistance during disasters compared to the meagre amounts committed to local capacity-building must be redressed in order to develop effective education and training programmes.

Incorporating risk education in national development programmes

Risk is seldom taught in a systematic way or from a multidisciplinary context. A critical challenge for more effective education and training is the need to broaden the base of association. The subject of disaster risk needs to be integrated in education about national economic growth and development.

Educating about the social dimensions of risk

The socio-economic conditions of vulnerability, matters of social equality related to risk, and local community participation are not yet integrated systematically in education programmes. An emerging trend of advanced academic studies that attract both students and working professionals from a variety of fields including technical, social and administrative disciplines should continue to be encouraged and supported.

A long-term vision is needed to expand educational and training processes in support of creating a broad culture of prevention. This requires commitment to the full and equal access for women and men to professional scientific training and expanding efforts to develop new generations of community educators attentive to local risk issues.

Adopting an institutional basis to transmit experience

Responsibilities in identifying, monitoring and managing risk remain insufficiently represented in educational and professional contexts. While specific aspects of financial risk management are routinely included in economics, financial investment and insurance curricula, parallel approaches to risk management in the technical, environmental or social contexts of a society are much less in evidence.

There is also considerable scope to address risk management in public administration education. This could provide a more sustained basis for making risk management an essential element in government practice. Much more can be accomplished by introducing risk awareness into secondary and even primary education through innovative programmes of teaching science, geography, ecology and civic responsibility.

Future challenges in education revolve around developing individual capabilities and collective institutional capacities. Local communities must be aware of the risks to which they are exposed. They then need to institutionalize the technical and managerial abilities to assess and monitor risk and the political and popular structures to manage risk.

Sustaining commitment to risk reduction education and training

Investment in the development of human resources can be sustained only to the extent that the values of risk management are embedded in education programmes. There is a pressing need for innovative means to convey transformed organizational relationships and to accommodate the mosaic of the many different interests involved in shaping people's understanding about disaster reduction. Accomplishments will depend on the extent that professional abilities are expanded for the future, with an increasing expectation that more substantial private sector involvement will be necessary.

4.4 Research

Research has historically been an important element in understanding the nature of hazards and more recently their consequences on human well-being and societies overall. Typically early study concentrated on understanding various threats to people's safety better and developing means to increase the protection of their property and productive assets. There is now growing attention being turned to larger physical, social, economic and environmental conditions of vulnerability that unequally distribute the nature of risk itself, across the world or within individual societies.

With more professional interests becoming associated with the many subject areas that impinge on assessing risks or the related functions necessary to reduce people's exposure to risk, the variety and compound dimensions of applied research also become more numerous. The use of a much wider body of knowledge, divergent experiences, and increasingly sophisticated lines of enquiry are all now considered crucial to effective disaster risk reduction.

Numerous gaps and many impediments remain in translating academic study into practice, or developed experience into policy. The necessary abilities and resources committed to doing so may be distributed quite unequally around the world, and often may be particularly limited in those areas where the threat of severe hazardous events is particularly high.

Education, training, advocacy, public information and policy formulation, civil administration, networked organizational relationships, information management and widespread communications all relate to, and indeed should benefit from the multiple roles of research in disaster reduction.

This chapter will discuss some of these dimensions of research with examples illustrating important aspects in the following sections:

- *current trends and evolving interests in disaster and risk reduction research;*
- *technical and research networks;*
- *strategic approaches to research for disaster reduction;*
- *national commitments to foster disaster research;*
- *specialized hazard and disaster risk reduction research interests; and*
- *benefits of action research.*

Current trends and evolving interests in disaster and risk reduction research

Other than the study of the earth and its physical forces pursued primarily through research in the natural sciences, epidemiology and considerations of public health commanded early attention to the effects of risks on matters of public interest. Historically, in response to the threats of natural phenomena, societies have always sought to protect those physical elements critical to their wealth and power, discovering new and improved ways of doing so. The benefits of engineering research have progressively expanded to develop more applications to safeguard societies' ever-expanding physical infrastructure and critical facilities.

Hazards research has since expanded additionally into the wider study of human behaviour to different types of threats or exposure, with the social sciences emerging as even more pertinent areas of enquiry. As the costs of disasters to societies have escalated, and not infrequently

become recurrent, economic analysis of disaster consequences, their related costs and benefits have become more pressing.

Technological innovation has fueled new and additional areas of enquiry that relate to improved public access to information, explanation and understanding that is essential for the wider exchange of knowledge and experience. The expansion of these multiple dimensions of professional activities involved with disaster risk management has required that more attention be devoted to applied research, especially during the past three decades.

Successful disaster reduction and management require all of these research components: comprehensive knowledge about hazardous events; the likelihood of their occurrence and the possible impacts they can have on societies; and the social, economic and environmental implications related to vulnerability.

Technical and research networks therefore have an important role to play in seeking to convey the benefits of analysis drawn from multiple disciplines and academic interests to policy-makers and practitioners in the field. They also can encourage relationships with people most immediately exposed to hazards and field workers so that studies can be informed by their practical experience. As knowledge and experience multiply, with questioning and analysis becoming more specialized or complex, a global research need for disaster risk reduction is emerging to relate the various interests, languages and methods of different disciplines.

One consequence of this is an increased evidence of national authorities determining a structured, intersectoral and multidisciplinary national research agenda. These may be motivated within a country by a particular area of academic study, such as seismic engineering in Iran, or from the body of professional interest such as that motivated by the Institute of Civil Engineers in the United Kingdom. In an international context, the often influential relationships engendered by national research academies or international scientific unions can also be instrumental in encouraging intellectual and material investments to be made in larger societal interests.

In other research environments where there has been a welcome expansion of multidisciplinary research pertaining to applied hazard and disaster risk studies, there is often a need to develop commonly understood concepts and more broadly appreciated objectives. One current expression of this need has been the increased attention given internationally, and within different subject areas, to develop various conceptual frameworks and methodological structures or approaches. While even the activity of creating them invites expanded dialogue on the subject, once constructed they can help to frame, guide and monitor collective institutional or professional efforts in disaster risk reduction for greater demonstrated effectiveness.

A key and timely example of this is the joint effort in 2003-2004 by ISDR and UNDP, working with other collaborating institutions, to develop a framework for understanding, guiding and monitoring disaster risk reduction. The ultimate goal of this collective and iterative endeavour is to encourage and increase appropriate and effective disaster reduction practices along commonly perceived conceptual and methodological expressions. The institutional dialogue it has encouraged as well as the wider global professional discussion invited through an electronic conference on the subject have demonstrated the considerable interest the topic holds and the rich experience it has unleashed. <http://www.unisdr.org/dialogue>

Similarly, UNDP is engaged in preliminary but rigorous efforts to devise a broadly accepted basis for a *Disaster Risk Index* based on commonly understood criteria or evaluative parameters. In support of this activity, UNEP-GRID has worked to standardize the use and display of hazard data by type and scale. By using GIS techniques these efforts have produced a consistent body of data and products that are freely available upon request for individual country use at either national or sub-national levels.

The ProVention Consortium has embarked on a programme to identify criteria and appropriate methodologies that could be applied to assess natural hazard risks and the net benefits of mitigation. This research is timely in its efforts to measure both the potential and the actual benefits of disaster reduction as increasing attention is paid to results-based programming initiatives by international donor and development assistance agencies.

In a similar vein, the Inter-American Development Bank (IADB) is also sponsoring an effort during 2003-2004 to identify broadly applicable criteria for the evaluation of accomplishment in disaster risk management practices with particular relevance in the Americas, although the process will certainly have wider applicability elsewhere. Efforts to document effectiveness also infuse other crucial international development agendas that have distinctive impacts on the exposure of all societies to contemporary disaster risks.

In terms of data that is essential for research as well as policy determination, CRED is establishing a consistent methodology for maintaining and disseminating disaster data globally through the expanded use of its EM-DAT database. This type of methodological and data-driven research contributes to a more consistent maintenance, analysis and wider reporting of hazard and disaster occurrence data by individual countries.

Similarly, the systematic recording of localized hazard events is being pursued by LA RED through its development of the disaster inventory programme DESINVENTAR. This programme is now in use in much of the Americas. Other NGOs are doing similar work with locally relevant data management systems in their own immediate areas, such as the Disaster Mitigation Institute and Duryog Nivaran in South Asia, and MANDISA in Southern Africa.

In each of these cases, there is a commitment to strive for a more consistent and widely acknowledged basis for the maintenance and use of hazard and disaster-related data that has become essential to advance crucial disaster risk research that must form the basis of any viable and sustainable disaster reduction strategies. It is also anticipated that in time these consistent approaches to data identification, collection and reporting can encourage more consistently maintained composite national databases of disaster events built up from localized experience and perspectives.

Another area of contemporary research interest for disaster risk reduction is the sociology of hazard and disaster impacts. This is particularly relevant to understanding the multiple and often related aspects of vulnerability, and the more considered identification of vulnerable groups of people within larger social or demographic groups. These research interests are related closely to matters of social justice, equality and in some expressions to rights-based entitlements for protection, human security, and sustainable livelihoods.

It is widely accepted that the impoverished segments of a society, women, ethnic or other social minorities, and other similarly disadvantaged groups within populations are much more exposed to the risk of loss and deprivation by hazardous events. Much research attention is now being focused on documenting and analyzing such conditions, often motivated by the desire to advocate for the implementation of more effective and equitable risk management practices as well as over-arching development objectives.

An extension of this concern that proceeds into another area of critical research for disaster reduction is the relationship of globalization policies to the creation or perpetuation of even greater levels of vulnerability to disasters. This interest applies to the set of socio-economic and environmental relationships and consequences that prevail both among as well as within, individual countries. Research is focusing increasing attention on the numerous consequences of global economic and trading practices believed to have a seriously adverse effect on increasing the levels of human vulnerability worldwide.

While there is considerable political relevance to such lines of enquiry, it is evident that powerful elements of the modern global economy undoubtedly exert important influences in contributing to the perceived levels of expanding levels of human vulnerability to disaster risks. For example, disaster researchers are increasingly studying the consequences of diverse macro-political issues. Areas of study include the role of multinational or private sector corporate interests; the consequences of national indebtedness; the expansive global consequences of unmanaged consumption and trade in natural resources; commercial privatization policies; inequitable agricultural subsidies; global marketing of genetically modified organisms; and the reduction of biodiversity.

Box 4.19
Efforts to develop systematic frameworks

There are many current and complementary international efforts being pursued to develop systematic methodological frameworks, assessment criteria, and indicators for guiding and measuring accomplishments pertinent to risk reduction:

- UNDP Human Development Report <http://www.undp.org>
- UNDP *Reducing Disaster Risk: A challenge for development*, including Disaster Risk Index <http://www.undp.org/erd/disred>
- ProVention Consortium <http://www.proventionconsortium.org>
- IFRC World Disasters Reports <http://www.ifrc.org>
- The UN Development Group Common Country Assessment framework, and The UN Development Assistance Framework <http://www.undp.org>
- ISDR global reviews of disaster reduction initiatives and Review of Yokohama Strategy and Plan of Action, requested by UN General Assembly, Res/56/195, Res/57/257 <http://www.unisdr.org>
- The UN Millennium Development Goals and related indicators <http://www.un.org/milleniumgoals>
- The World Summit for Sustainable Development Plan of Implementation and follow up activities <http://www.johannesburgsummit.org>
- The UN DESA and Commission on Sustainable Development work programme on indicators of sustainable development <http://www.un.org/esa/sustdev/isd.htm>
- UNEP Global Environmental Outlooks <http://www.unep.org/geo>
- SCOPE/UNEP work on sustainability indicators <http://www.unep.org/earthwatch>
- UN-HABITAT housing and urban indicators <http://www.unchs.org/guo>
- The World Health Organization health for all indicators <http://www.who.int>
- Disaster Risk Reduction conceptual framework developed in the context of the Andean Disaster Prevention Programme by Andean country governments, supported by the Andean Development Bank <http://www.grupo-lia.com/preandino/>
- Disaster reduction accomplishment criteria, the Asia Urban Disaster Mitigation Programme <http://www.adpc.ait.ac.th/audmp/m&e.html>
- The Pacific Island States Comprehensive Hazard and Risk Management Program (CHARM) <http://www.sopac.org.fj>
- Environmental Vulnerability Index, of the Programme of the South Pacific Applied Geoscience Commission, and the South Pacific Regional Environmental Programme <http://www.sopac.org/Projects/Evi/index.html>
- European Environment Agency's environmental indicators <http://www.eea.eu.int/all_indicators_box>
- The European Commission Humanitarian Office Composite Vulnerability Index <http://www.disaster.info.desastres.net/dipecho>
- OECD environmental indicators, outlooks and performance reviews <http://www.oecd.org>
- World Bank social indicators and environmental reviews <http://www.worldbank.org/data>, <http://www.worldbank.org/poverty/data> and <http://www.worldbank.org/environment>
- The IISD Consultative Group on Sustainable Development Indicators <http://www.iisd.org/cgsdi/>
- The UN World Water Development Report and the World Water Assessment programme: indicators for integrated water assessment <http://www.unesco.org/water/wwap/wwdr/index.shtml>
- Total Disaster Risk Management outcome of Asian Conference on Disaster Reduction 2003, Kobe, including elements for the Yokohama review process <http://www.adrc.or.jp/5th/Asian_Conference_2003/top.htm>.

As many of these issues have a pervasive influence on the development of government policies and practices crucial to risk reduction, the associated research interests extend far beyond the more traditional considerations of the physical forces of natural hazards alone.

RADIX is an activist web site, supplemented by a free subscriber mailing list devoted to "radical interpretations of disasters *and* radical solutions" focusing on the conditions of vulnerability to disasters in developing countries. It welcomes dialogue from all interested parties and often provokes spirited comment following major international disaster events. Overall, it provides a stimulating glimpse into the extent of the various possible relationships between contemporary global economic policies, the manifestations of government power and their consequential influences on increased vulnerability to disasters. <http://online.northumbria.ac.uk/geography_research/radix>

Technical and research networks

Many of the organizations referred to throughout this publication are involved with some dimension of research interests, whether they are dealing with subject analysis, programme implementation, information management, education, or technical and scientific matters. Some, like LA RED, began expressly as a network of researchers engaged in social studies of disaster prevention and then

expanded its involvement into additional related programmatic areas of activity.

Others, such as the Natural Hazards Research and Applications Information Center at the University of Colorado, have earned their valued reputation by providing the means and the access to information. This has enabled researchers and practitioners to work more effectively together to realize the complementary values of specific knowledge and practiced experience.

Other organizations and institutions play crucial roles by collecting, analysing and disseminating a constant stream of information in their respective areas of interest, essential for the research undertaken by others. Perhaps most significantly, research is one of the key gateways by which today's students become the next generation of practiced professionals – and teachers – in disaster risk reduction.

With such a wide and diverse range of research interests in the many subject areas relevant to disaster risk reduction, it is not possible to list even a sizeable fraction of all the institutions and facilities involved. Therefore the following list is intended only to suggest the scope and richness of the many institutions that are actively engaged in the pursuit of knowledge and improved practices to create a safer world. Additional organizations that embody some elements of research can be reviewed in the directory of organizations contained in the annexes.

Benfield Hazard Research Centre, United Kingdom

Benfield Hazard Research Centre (BenfieldHRC) is an example of a leading European multidisciplinary academic hazard research centre with over 40 researchers and practitioners, based at University College London. The centre facilitates the improvement of natural hazard and risk assessment and the reduction of exposure to natural catastrophes through the rapid application of new research and practice. It provides means to transfer leading natural hazard and risk research, practice, and innovation from the academic environment to the business world, government and international agencies.

In this respect, it represents a mutually rewarding association between academic research, professional endeavour and commercial interests. It is located at one of the top three multi-faculty teaching and research institutions in the United Kingdom and has been sponsored for the past seven years by Benfield, a pre-eminent independent reinsurance and risk advisory business.

BenfieldHRC comprises three groups: geological hazards; seasonal forecasting and meteorological hazards; and disaster studies and management.. The first group focuses on seismic, volcanic and landslide risks. The second group provides forecasts of weather events, and in particular tropical cyclones. The third programme addresses socio-economic vulnerability to disasters and disaster management, principally considering matters of mitigation and preparedness.

BenfieldHRC maintains a specific website providing seasonal forecasting of hazards. <http://forecast.mssl.ucl.ac.uk/shadow/tracker/dynamic/main.html>

The centre's research reflects organizational perceptions and emerging interests in disaster reduction. One of its studies reviewed the extent to which development NGOs have embraced organizational perspectives and programme commitments pertinent to disaster risk management. Subsequent work addressed similar issues but in a different organizational context by focusing on corporate social responsibility and disaster reduction. By drawing on case examples, both of these studies proved to be insightful surveys of prevailing views. Their conclusions can be found on the centre's web site under disaster studies and projects.

BenfieldHRC produces a number of publications that can be obtained electronically. These include the quarterly newsletter *ALERT*, the series of thematic papers, *Issues in Risk Science*, and an ad hoc collection of technical papers. Event and post-loss reports published by the centre include the Central and Eastern European floods of July 1997; global warming, viewed in 1998; the UK floods of 1998; the regional impacts of the 1997-1998 El Niño; and hurricane occurrence in the Caribbean.

Box 4.20
Selected work undertaken at Benfield Hazard Research Centre, United Kingdom

Seasonal Weather Forecasts
The prediction of weather and extreme weather is ongoing in BenfieldHRC meteorological hazards and seasonal forecasting group. This work includes long-range forecasting of UK and European temperature, precipitation and storm; tropical cyclone activity in the Atlantic Ocean, North-Western and South-Western Pacific Ocean; tropical cyclone occurrence in the United States, the Caribbean islands, Japan, and Queensland, Australia.

Project RUNOUT
This international study funded by the European Union focused on large and extensive landslides. The study concentrated on developing a unifying physical model for large landslide phenomena and designing strategies for optimizing monitoring networks and mitigating landslide risk. Field studies were conducted in Tessina, Italy; Barranco de Tirajana, Gran Canaria, Spain; and Köfels, Austria. These observations were supported by further investigations at Vajont, Italy and Bad Goisern, Austria.

Project CARIB
Funded by the DFID, Project CARIB aims to reduce the vulnerability of small volcanic islands to future eruptions. In view of the emergency on Montserrat, the project is focused there and on the neighbouring Caribbean islands of St. Vincent and Guadeloupe. The primary aim of the project is the production of a volcanic emergency manual, designed to be used at times of volcanic crisis, and improve communication among scientists, civil authorities, and the media.

Tsunami Risk
This study was undertaken jointly with Coventry University and funded through the TSUNAMI initiative of the UK Government and a consortium of insurance and reinsurance companies. The results of the study included production of a risk atlas and an assessment of the tsunami generated by the 1964 Alaska earthquake. A more thorough examination of the tsunami threat in the North Atlantic Ocean can be accessed on the BenfieldHRC web site.

Project Volcalert
More than 5 million people live within sight of an active volcano in Europe. Although sophisticated techniques are available for monitoring volcanoes, short-term eruption forecasts are invariably empirical. This approach is plagued by large uncertainties and can create later confusion during a volcanic crisis. Project Volcalert aims to develop innovative models for quantifying eruption precursors. These models will then be used to develop practical forecasting techniques and to communicate forecasts more effectively to non-specialists and the public.
<http://benfieldhrc.com/VolcAlert/Website/Root/home.htm>

The centre provides an important and heavily-used information service to the media, including all the major UK radio and television news services, and others in Europe, the United States, and elsewhere. News coverage that benefitted from BenfieldHRC expertise and informed comment includes the 1999 Izmit (Turkey) and 2001 Bhuj (India) earthquakes, the October 2000 UK storms and floods, a train fire in the Austrian Alps, and the eruption of Mount Etna in 2001. BenfieldHRC members have also provided expertise and content on natural hazards to the NOW global web television channel.

The centre also operates a large postgraduate research and teaching programme, managing a postgraduate certificate course in natural hazards for insurers and a masters/diploma course in geophysical hazards. Six doctorate students currently work at the centre, researching topics in volcanic risk, seismic risk, extreme weather prediction and disaster management. BenfieldHRC also organizes thematic workshops on aspects of hazard and risk science. Recent workshops have focused on European windstorms, new issues in seismic risk and the European floods of 2002. <www.benfieldhrc.org>

World Institute for Disaster Risk Management

A collaborative effort between Switzerland and the United States also contributes to extending hazards and disaster research networked capabilities in an international context. The World Institute for Disaster Risk Management (DRM) was formed by the Board of the Swiss Federal Institutes of Technology (ETH) joining its interests developed through its own national experience with those complementary capabilities of the Virginia Polytechnic Institute and State University in the United States.

Established in 1999, in Alexandria Virginia, and Zurich, Switzerland, this joint effort was

constituted as a research and dissemination network, also working in support of the ProVention Consortium goals. This global initiative that is also supported in part by Swiss Reinsurance marshals resources for collaborative activities in applied research and professional practice to reduce disaster risks in vulnerable communities throughout the world.

DRM works with a wide range of international organizations and institutions whose common objective is disaster risk reduction for public safety and sustainable development. The Swiss Natural Hazards Competence Centre (CENAT) coordinates DRM's contacts with the Swiss research community. DRM also maintains relationships with other international research institutions, including:

- University of Texas at Austin, United States;
- Wharton School, Risk Management and Decision Processes Center, University of Pennsylvania, United States;
- The Global Fire Monitoring Center, Max Planck Institute, Germany;
- Institute for Crisis, Disaster and Risk Management, George Washington University, United States. George Washington University also collaborates with Virginia Tech in a Joint Center for Disaster and Risk Management;
- Kandilli Observatory and Earthquake Research Institute, Bogazici University, Turkey;
- Center for Research and Transfer of Appropriate Technology, University of Buenos Aires, Argentina;
- University of Hong Kong, China;
- Center for GIS Applications for Disaster Reduction, and the Department of Urban Engineering and Architecture, Yokohama National University, Japan; and
- National Center for Disaster Prevention (CENAPRED), Mexico.

<http://www.drmonline.net>

The System for Analysis, Research and Training

The System for Analysis, Research and Training (START) is a non-governmental, non-profit organization that works to establish and foster regional networks of collaborating scientists and institutions in developing countries. These networks conduct research on regional aspects of environmental change, assess impacts and vulnerabilities to such changes, and provide information to policy makers.

START acts to enhance the scientific capacity of developing countries to address the complex processes of environmental change and degradation through a variety of training and career development programmes. START mobilizes resources to support infrastructure and research programmes on environmental change within developing regions. The many scientists affiliated with START conduct research to reduce the uncertainties related to environmental change and sustainable development.

It is co-sponsored by the International Geosphere-Biosphere Programme, the World Climate Research Programme, and the International Human Dimensions Programmes on global environmental change. With the international START secretariat located in Washington DC, additional START regional centres promote research cooperation and provide a framework to support syntheses and assessments relevant to policy makers. The activities in different parts of the world are overseen by regional committees, composed of scientists and members of appropriate national and regional bodies.
<http://www.start.org>

The International Research Committee on Disasters

The objective of the International Research Committee on Disasters (IRCD) is to promote the scientific knowledge and understanding of the social and behavioural aspects of sudden collective crises. As an entity of the International Sociological Association, it works to develop and advance new knowledge about the human dimensions of disaster.

These situations include social phenomena associated with natural hazards and technological accidents, as well as acute environmental threats. They reflect such current issues as abrupt shortages of vital resources, terrorist attacks, inter-group conflicts, and other major risks and hazards to life, property, health and social activities.

Membership is invited from many professionals. These include anthropologists; civil defence officials and emergency managers; communication and mass media personnel; disaster and crisis planners; economists; political scientists; geographers; government officials; health and medical personnel; psychologists; social welfare workers; sociologists; essentially anyone concerned with the individual human and group aspects of disasters and mass emergencies. Active members come from more than 30 countries. There is also a similar Disaster and Social Crisis Research Network of the European Sociological Association.

While some members focus on academic research, others are involved as practitioners using the knowledge and understanding of studies to mitigate hazard impacts, to improve planning and managing responses, and to reduce recovery needs.

Membership in IRCD provides:

- a subscription to the International Journal of Mass Emergencies and Disasters <http://www.usc.edu/sppd/ijmed>;
- access to Unscheduled Events, the official newsletter of the IRCD;
- information about forthcoming IRCD-supported publications;
- information about IRCD co-sponsored or supported conferences and workshops; and
- information about specialist sessions that IRCD holds in association with the World Congress of Sociology held every four years (next planned for 2006 in South Africa).

<http://www.udel.edu/DRC/IRCD.html>

Box 4.21
Book series of the International Research Committee on Disasters

Methods of Disaster Research, edited by Robert A. Stallings. Philadelphia, PA: Xlibris, 2002.

What Is a Disaster? Perspectives on the Question, edited by E. L. Quarantelli. London and New York: Routledge, 1998 <http://www.routledge.com/default.html>.

Women and Disasters, edited by Brenda D. Phillips and Betty Hearn Morrow (2003).

Exploring the Cultural Dimensions of Disaster, edited by Gary R. Webb and E. L. Quarantelli (forthcoming).

What Is a Disaster? More Perspectives, edited by Ronald W. Perry and E. L. Quarantelli. Philadelphia, PA: Xlibris, 2004.

The Routledge series on hazards and disasters

The *Hazards and Disasters* series published by Routledge UK since 1999 is a useful reference for hazard research and current knowledge in recent years. Initiated to mark the end of the IDNDR, the series is comprised of volumes dedicated to individual hazards that together provide a compendium of knowledge about hazards and collective experience in their management at the end of the 20th century. Each volume presents a comprehensive collection of new or recent research, covering areas of both theory and practice drawn from the experience of numerous leading international researchers in the field. Many case studies and other examples of activity are included from around the world to demonstrate the feasibility and efficacy of managing the hazards under discussion.

As of 2003, three titles of two volumes each have been issued pertaining to drought, floods and storms. Users can study the multiple aspects of a specific type of hazard in depth, surveying the consequences, related risks, and a wide variety of means that can be employed to manage the associated risks they pose. The encyclopedic review of professional experience is organized in a similar manner across the various volumes. The series allows users to follow a specific dimension of risk management, such as the relative feasibility and developed global experience related to early warning, or the variety and relative merits of regulatory and normative standards across the various hazards included in the series. <http://www-routledge.co.uk>

Strategic approaches to research for disaster reduction

One of the important means by which the ProVention Consortium focuses attention on the links between disasters, poverty and the environment is by encouraging and sponsoring research studies and related activities.

Any effective strategy to manage disaster risk must begin with an identification of hazards

and a consideration of their consequences. Risk identification provides an essential dimension by which to develop a more complete understanding of the full economic, financial, and social impacts of disasters on a society. Accordingly ProVention Consortium has supported research efforts which have studied the following subjects:

- economic and financial implications of natural disasters; assessing their effects and options for mitigation;
- methodologies and standards for damage and needs assessments;
- identifying and analysing global disaster risk "hotspots";
- improved database requirements for social and economic analysis of disaster impacts;
- disaster vulnerability and the role of the private sector related to critical infrastructure; and
- modelling the macroeconomic impacts of disasters.

Other ProVention Consortium research activities and related projects have considered how to overcome the socioeconomic, institutional and political barriers to the adoption of effective risk reduction strategies and measures in developing countries. Efforts have been made to:

- conduct an international evaluation of recovery efforts for massive natural disasters;
- study means by which community resilience may be strengthened to address natural disasters in Sub-Saharan Africa; and
- reduce vulnerability to climate variability.

To support efforts to protect development investments and advance disaster risk awareness, the ProVention Consortium has also worked to develop tools that can assist the most impoverished segments of populations to manage disaster risk factors more effectively. This has included studies and other efforts that consider such activities as:

- innovations in managing catastrophic risk that can help the poor; and
- evaluating microfinance and microinsurance opportunities for disaster risk management.

The overarching goal of all ProVention Consortium efforts is to increase access to information that can help communities reduce their vulnerability to disasters, and to connect and leverage resources that will facilitate that goal. To achieve that, particular attention is given to efforts that focus on sharing knowledge about disaster risk management, awareness raising and training. <http://www.proventionconsortium.org/projects.htm>

Box 4.22
ProVention Consortium research grants for young professionals

The ProVention Consortium's programme of applied research grants for disaster risk reduction is an outstanding initiative that encourages young researchers and professionals dedicated to reducing disaster risks in developing countries. First awarded in 2003, these competitive grants of up to US $ 5,000 were awarded to 65 young professionals working in 27 countries.

As the proposals were evaluated by an international jury on their potential to make a significant contribution to the field of disaster risk management, the winning submissions cover several unique topics and pursue innovative approaches in many different fields. They include studies or applied research regarding diverse issues, such as, the spread of forest fires due to honey-hunters in South Africa; coastal erosion vulnerability mapping in the Philippines; training youth in emergency preparedness and first aid in Bulgaria; and earthquake risk awareness among the population of Mendoza, Argentina.

Each project is conducted under the guidance of a mentor who is a professional in the field of disaster risk management and must be completed in an eight-month period. The collective results then will be disseminated widely by the ProVention Consortium during the following year. <http://www.proventionconsortium.org/projects/appliedres_winners.htm>

European research approaches

At a fundamental level, applied research is one of the necessary pillars of disaster risk management. Since the 1960s, the European Commission (EC) has promoted collaborative research by commercial interests, universities and research centres. Under the overall supervision and management of the Directorate General for Research (DG Research) its progressively expanding scope of related interests and a corresponding increase in direct budgetary allocations attest to the continuing commitment to the subject.

The programme for European Cooperation in the Field of Scientific and Technical Research

(COST) was initially launched in the 1960's to support joint European research. This was followed by the European Strategic Programme for Research and Information Technology (ESPRIT), which began in 1983. From that time on, there has been a continuous succession of five-year plan commitments, research framework programmes, with the first one launched in 1984 with an allocation equivalent to 3.75 billion euros.

The framework programmes are the means by which the EU expresses its internal policy regarding research. Their introduction have marked an important move towards creating targeted and more strategic partnerships among universities, research centres and private companies to promote more social unity in Europe's research community. Since the early 1990s, European research in disaster reduction has thrived, and is expected to continue to do so with the institutionalized development of the European Research Area (ERA).

Under this basic research framework, the EU pursues a concerted effort to face problems affecting the economy, society and citizens for which science holds the key. As sustainable development is a primary EU political objective, the conceptual approach to ERA requires interdisciplinary research, including in disaster reduction. Even though the DG Research does not conduct research itself, it does allocate funds among many professional, commercial and academic bodies to study hazard and risk subjects.

It is equally responsible for the management and supervision of specific framework programmes. Over the past two decades, in addition to many other research areas, the DG Research has enhanced collaboration and supported more than 150 EC research projects across Europe in the fields of hazard studies and disaster risk reduction.

During the fifth framework that ended in 2002, the DG Research funded more than 80 projects to the extent of about 70 million euros for research on floods, wildfires, earthquakes, volcanic eruptions, landslides, avalanches and technological hazards. General objectives for these research projects included the development of methods and technologies related to:

- environmental, social and economic impact, and risk assessment;
- risk management and disaster preparedness;
- hazard forecasting and monitoring;
- prevention, evaluation and mitigation;
- risk perception, communication and awareness;
- promotion of strategies to provide substantive content for EU policies or relevant legislation;
- problem solutions and policy issues of particular relevance to meet end-user or stakeholder-driven needs and requirements; and
- integration of electronic applications for science and related techniques.

The current sixth framework programme, running from 2002-2006, allocates 17.5 billion euros for priority areas of interest. In the priority area of sustainable development, global change and ecosystems, which is allocated 2.12 billion euros, a subject cluster is explicitly identified to encourage research about desertification and natural disasters.

Consistent with ERA intentions, such research will focus on large-scale integrated assessment of land or soil degradation and desertification; long-

Table 4.1
European Commission framework programmes

Programme	Duration	EU contribution (Euros millions)
1st Framework Programme (FP1)	1984-87	3,750
2nd Framework Programme (FP2)	1987-91	5,396
3rd Framework Programme (FP3)	1990-94	6,600
4th Framework Programme (FP4)	1994-98	13,200
5th Framework Programme (FP5)	1998-02	14,960
6th Framework Programme (FP6)	2002-06	17,500

Source: European Commission, Directorate General on Research

Box 4.23
European Commission hazards research projects 1998-2002

Floods and related hydrogeological projects including landslides, debris slides and avalanches
Much of the recent research has focused on forecasting techniques that can contribute to disaster prevention. The RIBAMOD Concerted Action project has created an informal network of European researchers and practitioners in river flood management to spread information about effective flood prevention methods. The FASTEX Project aims to predict storms four days in advance. The FRAMEWORK project provides guidelines for the integration of flood risks into town and regional planning strategies.

The sixth framework programme encourages "more integrated approaches, bringing together flood forecasting and management, climate change and variability, floodplain evolution and sustainability in the context of socio-economic growth, and strategies and technologies for natural hazards reduction and the mitigation of their consequences".

Earthquakes
The European Commission has funded more than 50 research projects in this area since 1987. Many have been related to efforts to increase prediction capabilities or to improve building safety. Research related to increased cooperation, improved information exchange and the development of para-seismic standards has received strong encouragement especially since 1996.

The VULPIP project is testing the resistance of pipelines to earthquakes. The TOSQA project aims to protect historic city centres from seismic effects. The EUROSEISTEST project studies how different types of construction react to earthquake effects, including taking account of soil behaviour.

Volcanic eruptions
Several research projects exist in different locations, including Greece, Sicily, Iceland, Canary Islands and Réunion.

Wildfires
Several pilot projects have been funded, like MEGAFIRES, to produce a map of potential areas of danger. PROMETHEUS aims to limit the damages to vegetation and sensitive aspects of the environment. MINERVE recommended methods for the prediction of adverse meteorological conditions and related threats for forests.

Sources: *Preserving the Ecosystem*: *Environmental Research*, EC Research on Floods in the framework of environmental research, European Commission, Research Directorate General, Brussels, 2002.

Preserving the Ecosystem: Environmental Research, Fight against major natural and technological hazards, European Commission, Research Directorate General, Brussels, 2002.

<http://europa.eu.int/comm/research/leaflets/disasters/en/index.html>

term forecasting of hydrogeological hazards; natural hazard monitoring, mapping and management strategies; and improved disaster preparedness and mitigation.

In addition, there are other cross-cutting priority subject areas such as science and society, governance, policy support and others which also include research about natural hazards and disaster risk factors. There is an increase in current policy interests regarding the impact of environmental issues on health and the economic conditions of societies. This includes a growing demand for methods to assess risks better and to mitigate their effects.

One current example is the continuing analysis of possible linkages between climate change and natural disasters, with efforts concentrating on the development of instruments that can better identify and gauge hazards.

Within EU research endeavours another distinct Directorate General, the Joint Research Centre (DG JRC) plays a key role in supporting policy development through applied research it has been carrying out in natural hazards. Its seven scientific institutes carry out research of direct concern to EU citizens. It provides technical knowledge both directly and through coordinating and contributing to numerous broader networks linking industry, universities and national institutes. The DG JRC concentrates on issues of natural and technological hazards and supports efforts that particularly contribute to developing a European framework for forecasting, assessing, managing and reducing risks in the EC.

With regard to DG JRC projects specifically, in the sixth framework there is an integrated scientific area described as technological and natural risks. In addition, the DG JRC is playing an important role in helping to establish the ERA, too. As previously mentioned, the DG JRC continues to support institutional projects in the area of disaster risk reduction. Several groups working in the DG JRC have research programmes, or "actions" in this field dealing specifically with natural hazards and related risks. <http://www.jrc.org>

The following primary actions of DG JRC are outlined here to illustrate the range of research being undertaken to further disaster risk reduction in Europe.

- The Major Accident Hazards Bureau (MAHB) located within the DG JRC Institute for the Protection and Security of the Citizen, Technological and Economic Risk Management Unit is a special unit for targeted research and decision support for disaster risk reduction. It is dedicated to providing scientific and technical support for the actions of the European Commission in controlling major industrial hazards. <http://mahbsrv.jrc.it/>
- The Natural and Environmental Disaster Information Exchange System (NEDIES) has a primary objective to support European Commission services, governments and EU organizations in their efforts to prevent and prepare for natural and environmental disasters and to manage their consequences. The project has been launched to supply updated information about the occurrence of natural and environmental disasters and their management, as well as to supply information on past disasters and main consequences, methods and techniques relevant for the prevention of disasters, preparedness and response for civil protection services. It also provides an interdisciplinary platform for dialogue among all actors in natural and environmental disaster management, creating the possibility of a common European repository of disaster experience, with a particular focus on mitigation of disaster consequences. <http://nedies.jrc.it>
- The Natural Hazards Project is another activity sponsored by the DG JRC which demonstrates how existing European knowledge about remote sensing can be used by planners and civil protection authorities to reduce the effects of natural disasters. Activities provide scientific and technical support derived from earth observation data and other sources for the identification of risk indicators and preparation of risk maps to protect citizens from floods and forest fires. Technologies and tools are also provided to partner organizations within Europe to improve existing practices in disaster management before and after a crisis. <http://natural-hazards.aris.sai.jrc.it>
- The European Laboratory for Structural Assessment in Earthquake Engineering (ELSA) undertakes research in structural mechanics, and experimental testing assisted by model simulation in the areas of civil engineering and transport. In this respect it is a part of the project, Infrastructure Damage Prevention, Assessment and Reconstruction following a Disaster (INFRAID). <http://structural-mechanics.jrc.it>
- Global Monitoring for the Environment and Security (GMES) is another important EC initiative which provides independent information on issues affecting the world's environment and the security of citizens. It focuses primarily on the use of earth observation techniques for monitoring landscape parameters, such as vegetation cover, land use, and resource degradation or depletion. Within GMES, the DG JRC focuses on supporting research for the development of EU policy applications in three primary areas of work: providing support to international environmental agreements, assessing risks and hazards, and evaluating environmental stress.

There are other EC Directorates General which support complementary initiatives in disaster risk

Box 4.24

Additional Directorate General Joint Research Centre actions in natural and related disaster risks

- Floods and other Weather-Driven Natural Hazards, prediction and mitigation (WDNH)
- Information Support for Effective and Rapid External Aid (ISFEREA)
- Comparability of Technological Risk Assessment Methodologies (COMPASS), also addresses natural hazards that trigger technological disasters.

<http://projects.jrc.cec.eu.int/>

management, often in parallel to DG JRC projects. Some of these are linked to areas of cooperation in the domain of civil protection, such as the following:

- major project on prevention;
- environmental measures to reduce the risk of floods in the river Geul catchments;
- ecological flood and erosion management in alpine river basins;
- development of rescue actions based on dam-break flood analysis;
- analysis of the 1993/1995 floods in Western Europe; and
- prevention in the mountains for the protection of the valleys.

<http://europa.eu.int/comm/environment/>

Furthermore, throughout Europe, individual countries also address hazard issues and related research themselves through regional, national and local projects. There are transnational consortiums that undertake collaborative research projects about floods, for example in the Danube, Rhine and Elbe river basins, as well as similar joint endeavours related to wildfires.

National commitments to foster disaster research

Historically hazards research and related studies devoted more broadly to risk reduction issues have been undertaken predominantly through the motivations and specialized interests of the specific professional disciplines involved. During the past ten years there has been more encouragement from scientific and academic bodies for multi- or interdisciplinary enquiry into the causes and consequences of hazards. Similarly there has been a concurrent expansion in the consideration of the human dimensions of risk exposure and consequences, in contrast to an earlier concentration on the physical properties and behaviour of hazards or the structural aspects of physical infrastructure.

With the exception of the United States and Japan, until recently there have been few examples in which a national consensus of interests has combined to identify and seek to actually undertake a coordinated national research agenda for disaster risk reduction. However, as disasters exact an increasing toll on more societies, this broader need for commonly agreed research priorities is emerging in several countries. There are examples which illustrate the engagement of national efforts to provide focus and continuity, as well as to encourage a more institutionalized basis for the wider dissemination and more timely application of the results.

As the following examples demonstrate, such initiatives to pursue national research agendas invite a wider dialogue across professional interests and throughout the different sectors of a society.

Case: United States

In the United States, the first national assessment of natural hazard effects on the country was conducted from 1972-1974. Innovative at the time, it involved a very wide range of academic hazard researchers and practicing technical professionals. Far-seeing in its conception, it was driven by a conviction that by clearly expressing the nature of hazard risks as a national agenda, significant efforts could then be marshalled to develop more effective means of managing those risks and thereby reduce the likelihood of them leading to otherwise avoidable disasters.

The second national assessment in the US was conducted from 1997-1999. Significantly, it highlights the considerable situational diversity and the very dynamic nature of contemporary risk factors that are highly conditioned by social, economic and environmental determinants of locally-perceived vulnerability. More than 250 academic researchers and practicing professionals contributed to this effort that both updates and projects the research objectives across many academic and professional disciplines for the next 10 to 20 years. The conclusions represent a comprehensive survey of the development of disaster reduction thinking and are elaborated in *Disasters by Design: a reassessment of hazards in the United States* (Mileti, 1999).

Case: Canada

Research related to natural hazards and disasters in Canada is carried out in a number of government departments at both federal and provincial levels, by

individuals at universities, by a few private sector companies through government grants, and by the Institute for Catastrophic Loss Reduction (ICLR), which is an arm of the Insurance Council of Canada.

One example of this process comprised a workshop of international experts and national consensus conferences sponsored by Health Canada, which identified health effects of extreme weather events as a priority health issue related to climate change. In order to address this recognized gap in knowledge, Health Canada then established a partnership with the ICLR at the University of Western Ontario to explore causes of health effects of extreme weather events, and to develop health risk reduction and mitigation options.

While there is no national agenda for priority research in the field, and that which occurs is mostly uncoordinated, there is recognition by a growing number of researchers and practitioners of the need for a more integrated structure. In 1999, several interested professionals took note of the recently concluded national assessment in the United States, the closing emphasis of the IDNDR, and some recent Canadian disasters.

These included consideration of the 1996 Saguenay and 1997 Red River floods, and the particularly severe and costly 1998 ice storm. Each of these events highlighted a disturbing trend over the past years of the marked rise in number and costs of global natural disasters which had arisen from the full spectrum of natural hazards.

These individuals then initiated an effort to create a series of technical background papers on interdisciplinary topics pertinent to disaster risk reduction. This has since been followed by their synthesis into a summarizing document intended for a more general audience. The result has been a national assessment of natural hazards and disasters.

Led by the Meteorological Service of Canada, the activity was realized with the financial support of Environment Canada, the Office of Critical Infrastructure Protection and Emergency Preparedness, the Geological Survey of Canada and ICLR. It could not have been accomplished without the considerable voluntary efforts of many academic researchers and other professionals interested in the subject.

A special issue of *Natural Hazards*, An Assessment of Natural Hazards and Disasters in Canada, (Etkin, D., Haque, E. and Brooks, G., 2003, Vol. 28: vii-viii, No. 2-3) reviews this bottom-up process, driven by the interest of individuals drawn primarily from academic institutions and government agencies. Other technical papers that contributed to the study have been published by the ICLR as part of their research paper series. Through these multiple means of dissemination, such interdisciplinary papers provide a useful reference for Canadians involved in the natural hazards field, both as researchers and as practitioners, in addition to transferring Canadian experiences to the wider international community. <http://www.iclr.org>

Disaster research has typically been based primarily in the physical sciences, although one of the recommendations of the Canadian hazards assessment is the need for more to be done in the social sciences, especially in terms of vulnerability reduction. There is impetus emanating particularly from OCIPEP for a national disaster mitigation strategy to be devised, which would also feature disaster research. Such a strategy, however, remains in the development stage and will require political approval and resources if it is to proceed.

Box 4.25
International Development Research Centre, Canada

The International Development Research Centre (IDRC) is a public corporation created by the Canadian government to help communities in the developing world find solutions to social, economic and environmental problems through research. The IDRC mandate is to initiate, encourage, support and conduct research into the problems of the developing regions of the world and into the means for applying and adapting scientific, technical, and other knowledge to the economic and social advancement of those regions. IDRC funds research that is geared to alleviating poverty and promoting sustainable and equitable development.

Its support is directed to the work of scientists and researchers in developing countries. IDRC favours multidisciplinary, participatory research where researchers from different disciplines work with local people to devise solutions to local problems. Involving beneficiaries in the research process at the outset increases the likelihood that communities will use research results. <http://www.idrc.ca/en/>

Case: China

In China, priority areas of research in disaster risk reduction form an essential part of the Chinese National Disaster Reduction Plan running from 1998-2010. The coordination and management of the comprehensive national research agenda is vested within the National Academy of Sciences. There, a specially designed National Disaster Management Center has been created specifically to expedite the transfer of newly developed knowledge and experience into policy and practice by, or across, the operational ministries most immediately concerned.

These concepts are becoming more evident in selected research environments, but such a comprehensive and systematic planning approach can be encouraged in many more countries. It is more commonplace that research pertinent to disaster risk reduction remains highly fragmented and often is driven by individual areas of academic or professional enquiry.

National academies of science, engineering, health, and particularly planning, can play leading roles in motivating such considered national approaches to comprehensive and interdisciplinary research agendas. Similarly, national science foundations or similar subject- specific foundations such as those dealing with environmental issues, climate change effects, or contemporary issues in national development can provide important intellectual and financial resources to relate their respective subjects to a broader relevance of risk reduction within societies.

The following examples illustrate how some countries have sought to provide a more sustainable foundation for national research commitments to disaster reduction.

Case: Germany

In Germany, two complementary research networks have developed with the aim of using this experience to advance multidisciplinary approaches to disaster research. In 1999, the German Committee for Natural Disaster Reduction urged the creation of the Centre for Natural Risks and Development (ZENEB) to focus attention on sociological research about disasters in developing countries.

Organized as a network and based jointly in the universities of Bonn and Bayreuth, ZENEB involves people in Germany and from other countries who share an interest in the relationships between national development issues and natural hazard risks in developing countries. Within this professional network, general approaches to risk research in the context of sustainable development are examined in depth and individual investigations and case studies are conducted in developing countries.

ZENEB, working with UNDP, has developed indicators to describe the relative risks of different countries. A database of these indicators has been created so that they may be used to frame socio-economic parameters of risk to highlight areas for early attention.

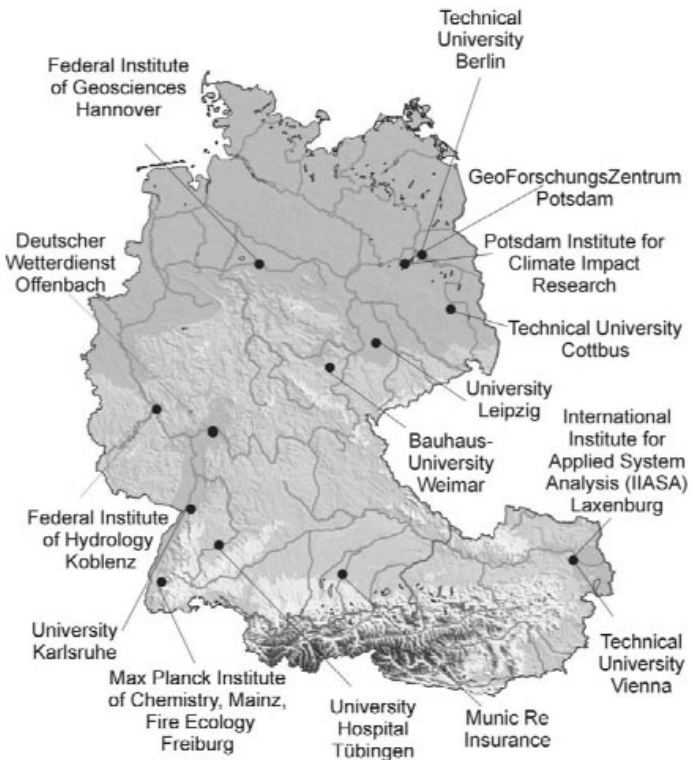
Focusing more on natural hazard knowledge, other German research institutions have formed the German Research Network for Natural Disasters (DFNK). The goal of the network is to provide the scientific fundamentals of advanced risk management associated with natural hazards and to make that knowledge more widely available.

Realistic scenarios are developed to estimate current levels of risk and to consider future potential risks by projecting changes in crucial variables such as climate, population, and land use. This information can be used for early warning, decision-making and for developing greater understanding of the issues among political authorities and the public.

The 14 partner institutions and the projects are grouped into five clusters: storm risk assessment, flood risk assessment, earthquake risk assessment, forest fire simulation, and databases and information systems. The information cluster provides data, synthesizes information and applies tools for shared information mechanisms such as clearing house functions and data warehousing that can encourage closer collaboration among the different clusters.

The city of Cologne was chosen as an initial location of concentration for combining the

Figure 4.2
Partners within the German Research Network for Natural Disasters (DFNK)



Fourteen organizations (e.g. universities, federal institutes, insurance industry) in Germany and Austria are connected within the network which is headed by the GeoForschungsZentrum Potsdam. The work is supported by users in the fields of disaster protection, politics and economics.

Source: Bruno Merz; Jana Friedrich, GeoforschungsZentrum Potsdam, 2002.

assessments of floods, earthquakes and storms. The respective clusters use extensive data sets, analytical techniques and simulation models for risk estimation so that current risks can be depicted, future risks detected, and safety recommendations made. A subsequent regional emphasis has been given to the state of Brandenburg with the city of Berlin added as an adjacent focal point. There, the forest fire simulation cluster is monitoring hazards and developing an early warning system.

Case: Switzerland

Research is an important priority for the Swiss National Platform for Natural Hazards (PLANAT) pertaining to all natural hazard sectors. It develops and helps to realize thematic focuses and research propositions. It also initiates or provides support for the transfer and exchange of knowledge and research results between national and international research projects, especially with regard to vulnerability, risk, and integrated risk management activities.

Other important areas of a national research agenda which it contributes to relate to understanding the forces of natural hazards better, as well as demonstrating the effectiveness of various structural mitigation measures. Research in the country also continues with regard to monitoring climate change and the evaluation of its relationship and effects on natural hazards.

All Swiss research institutions dealing with natural hazards and risk management are represented by CENAT, the Swiss Natural Hazards Competence Centre. CENAT was founded by the Board of the Swiss Federal Institutes of Technology (ETH) in 1996 to bring together existing institutional research capabilities in natural science, engineering and socio-economic subject areas within the ETH domain and the Swiss universities and institutes of applied science.

CENAT is hosted at the Swiss Federal Institute for Snow and Avalanche Research, in Davos, an institute of the Swiss Federal Institute for Forest, Snow and Landscape Research in Birmensdorf. It is also associated with the Pôle Grenobloise

d'Etudes et de Recherche pour la Prévention des Risques Naturels. <http://www.slf.ch> <http://www.cenat.ch/cenat.html>

The pooled resources of these institutes and other collaborating research institutions cover a wide field of hazard and risk management issues. These include the following subject areas and collaborating institutions.

For hazard assessment, physical process studies, event triggering, hazard mapping, numerical simulation, event probability studies, GIS techniques:

- Institute of Cartography, ETH, Zurich;
- Swiss Federal Institute for Snow and Avalanche Research, SLF, Davos; and
- Institute of Geography, University of Berne.

For seismic behaviour, including earthquake-resistant construction, retrofitting, building codes for infrastructure, buildings, bridges and dams:

- Institute of Structural Engineering, Earthquake Engineering and Structural Dynamics, ETH, Zurich;
- Institute for Reinforced and Pre-stressed Concrete, ETH, Lausanne;
- Institute of Geophysics, Swiss Earthquake Centre, ETH, Zurich; and
- Centre d'Etude des Risques Géologiques University of Geneva (CERG- UNIGE).

For process studies for rockfall, glaciers and permafrost, snow, avalanches, slope movements, hydrology of unstable terrain, debris flow, floods, wind, hail, geological hazard and drought:

- Institute of Geotechnical Engineering, ETH, Zurich;
- Laboratory of Hydraulics and Glaciology, ETH, Zurich;
- Institute of Rocks, Foundation and Soil Mechanics, ETH, Lausanne;
- Laboratory of Geology, ETH, Lausanne;
- Swiss Federal Institute for Forest, Snow and Landscape Research, WSL, Birmensdorf;
- Swiss Federal Institute for Snow and Avalanche Research, SLF, Davos;
- Land and Water Use Laboratory, ETH, Lausanne;
- Institute of Geography, ETH, Zurich;
- Institute of Hydraulics and Energy, Hydraulic Constructions, ETH, Lausanne;
- Institute of Geology, University of Fribourg;
- Centre d'Etude des Risques Géologiques, University of Geneva (CERG-UNIGE); and
- University of Applied Sciences, Rapperswil.

For forest, bush and wildfires, ecological impact studies, sustainability, soil erosion, risk analysis and management, forest hydrology, climate and vegetation, use of forest resources as rockfall and avalanche protection:

- Swiss Federal Institute for Forest, Snow and Landscape Research, WSL, Birmensdorf; and
- Department of Forest and Wood Science, ETH, Zurich.

Box 4.26

A selection of Russian scientific and technology innovations

The All-Russian Scientific and Research Institute on Civil Defense and Emergencies has produced the following outputs to advance disaster and risk management capabilities:

- system of monitoring and forecasting of emergencies and disasters (special award of the Russian Federation Government for science and technology, 1999);
- GIS for forecasting emergencies and developing scenarios (1st award at GIS international competition; recommended for introduction within the European systems of early-warning in natural disasters);
- mobile devices for assessment of buildings and infrastructure seismic stability (silver medal of the World Innovations Salon Brussels-Eurika-99);
- rescue devices "Ekont" and "Sprout" (gold medal of the World Innovations Salon Brussels-Eurika-99);
- monitoring and diagnostics of industrial stacks conditions without interrupting industrial process;
- robotic emergency devices;
- mobile facility for emergency supply for populations affected by disasters;
- emergency rescue facilities;
- unified system of emergency operational dispatcher control in the cities of Moscow, Kursk, Krasnoyarsk, Ufa, Izhevsk and others;
- automated emergency information-management system;
- federal system of seismic monitoring and control; and
- information system for administrations of the federation subjects in emergencies prevention and mitigation.

Source: <http://www.emercom.gov.ru>.

For socio-economic studies, public perception, political strategies and risk management:

- Institute of Economic Research, University of Lugano; and
- Institute for Economic Research, ETH, Zurich.

For climate change, modelling of variability and predictability of climate and satellite monitoring:

- Laboratory for Atmospheric Physics, ETH, Zurich;
- Institute of Geography, University of Berne; and
- Institute of Geography, University of Fribourg.

In the area of human-induced technological risks and technical processes there are other coordinating research institutions. KOVERS is analogous to CENAT in purpose, except serving as a coordinating centre for research into technical risks. Institutional relationships similarly are maintained and the potential for coordinated research explored in such areas as modelling risk scenarios and software development for assessment, evaluation, management of technical risks for process industries, storage and transportation.

In these technical subject areas, research partner relationships in Switzerland include:

- The Competence Centre for Technical Risks KOVERS ETH;
- Paul Scherrer Institute of Natural Science and Technology, ETH, Zurich;
- Swiss Federal Institute for Environmental Science and Technology EAWAG, Dübendorf;
- Centre for Security Studies, ETH, Zurich;
- Institute for Economic Research, ETH, Zurich;
- Risk Lab, ETH, Zurich; and
- University of Applied Sciences, Rapperswil.

<http://www.drmonline.net>

Case: Russia

A diversified network of 47 research, technology and education centres has been established in Russia. It is coordinated by the All-Russian Scientific and Research Institute on Civil Defense and Emergencies established under the administration of EMERCOM. Recently it has acquired the status of a federal centre for science and advanced technology. It is responsible for the development of space and land-based systems for monitoring and forecasting disasters for devising new methods and technologies in disaster risk management and information management. Work is also undertaken to create tools that can aid operational emergency assessments and the evaluation of regional risk vulnerability.

Another important initiative of Russian research and development is a project to design new tools and methods for integrated assessment of emergency risks across the different regions of the country. It is performed under a federal programme for reducing risks and mitigating consequences of natural and technological emergencies in the Russian Federation up to 2005. Dozens of research institutions are taking part in it. Its overall goal of assessing regional vulnerability to natural and technological hazards is to be pursued through several activities.

Technologies are to be developed and applied for regional mapping of territories according to major risk indicators. Regional variations in vulnerability to particular risks will then be assessed, followed by an integrated assessment of potential risks for cities and rural areas. These accomplishments will contribute to the development of computer programmes for integrated risk assessment for the regions of Russia based on GIS data and EMERCOM data banks for emergency forecasting.

Case: Romania

The Institute of Geography of the Romanian Academy has shown interest in natural and technological hazards research. In 2002, one of the main research topics was the assessment of natural and human hazards occurring in different regions of the country, especially the Vrancea seismic region. An environmental atlas is being prepared, including a series of natural and technological hazards maps of Romania.

Case: Mexico

Following the devastating 1985 earthquake in Mexico City, a decision was taken by national authorities to create an official institution which

would study and analyse technical aspects for disaster prevention. To this end, the federal government launched the national system for civil protection and the Japanese government stepped in as an important financial contributor and technical consultant in the field of disaster reduction.

Most importantly though, the National Autonomous University of Mexico (UNAM) was designated as the institutional base to provide academic input. The institution redirected its academically trained personnel to focus on research activities related to the development of disaster prevention methods. These parallel developments led to the foundation of the National Centre for Disaster Prevention (CENAPRED), in 1988.

CENAPRED was initially composed of academic staff researching issues related to disaster prevention. The institution has since been legally associated with the government, which enables it to direct influence formulation of national policies.

The close relationship with the government of Japan contributed initially to a particular focus being given to examine seismic hazards and possible ways to mitigate their effects. As CENAPRED developed its own technical and institutional capabilities, it was able to broaden its areas of interest and also to exert more influence on domestic disaster risk management responsibilities. It has since grown into a major academically-driven institution that has successfully linked applied research, civil society interests and the opportunity to contribute to official policy formulation.

CENAPRED is active in three major fields: research, capacity-building and dissemination of research results. It has become active in multiple hazards-related issues and is recognized as a valued consulting facility of the Mexican government.

Since 1996, CENAPRED has been organized around six different committees which monitor changing risk factors of the country and reflect the early warning and preparedness issues of the primary hazards that Mexico is exposed to. These are the scientific committees for the assessment of geological hazards, hydrometeorological hazards, chemical hazards, and the Popocatépetl volcano located in the immediate vicinity of Mexico City. There are also scientific committees that consider the health-related issues and social science-related aspects of hazards.
<http://www.cenapred.unam.mx/>

Case: Japan

Due to the high frequency of natural disasters and their significant impacts on the society, various organizations are engaged in disaster reduction research in Japan. Although they are administratively independent from the national budget, at the national level, both National Research Institute for Earth Science and Disaster Prevention (NIED) and the Public Works Research Institute (PWRI) are leading institutes in the field. Both are located in Tsukuba, Japan.

NIED contributes to the creation of a safe living environment through the development of efficient and dependable technology. It designs and conducts a wide range of research projects aimed to investigate the mechanisms of disaster occurrence. In response to domestic and international interests, NIED is also involved in research that studies future changes in the earth's environment and means associated with forecasting potential risks posed by these changes. Although research is conducted on various natural hazards, the study of earthquakes predominates. In this regard, the Earthquake Disaster Mitigation Research Center became a part of NIED in 2001.

PWRI conducts research and development, provides technical support and disseminates the results of studies in the field of civil engineering technology. Its main focus is on leading research and development of new materials, innovative construction methods, as well as in advanced research efforts to consider mechanisms that can further risk counter-measures in construction. In addition, UNESCO Tsukuba Center will be established at PWRI to conduct global research on flood hazards and risk mitigation.

There are also several universities in Japan which have disaster reduction research institutes. Among them, Kyoto University's Disaster Prevention Research Institute (DPRI) and Tokyo

University's Earthquake Research Institute (ERI) are two leading examples.

DPRI carries out research on a variety of problems related to the prevention and reduction of natural disasters. By employing more than 100 research staff members, nearly all aspects of natural hazards, including earthquakes, volcanic eruptions, landslides, debris flows, floods, storm surges and strong winds are investigated. In addition, human and sociological factors are also studied. Currently, there are five research divisions and five research centers.

ERI investigates earthquakes and volcanic eruptions and develops methods that can mitigate seismic risks. The institute has played a leading role in the development of modern seismology in Japan and is recognized as a leading institute for the study of earthquake prediction and volcanic eruption.

The Disaster Reduction Alliance (DRA) is an effective national research network. It was created to mobilize and integrate a wide variety of knowledge and research resources effectively. These consolidated resources prove particularly relevant when analysing the growing variety of natural and human-induced, large-scale disasters which occur around the world. The institutional members of DRA anticipate various cooperative activities such as human resource development, analytical research, mechanics of disaster response, and similar events that depend on considerable collaboration. The alliance therefore seeks to fulfill an important role as an information and knowledge hub that can contribute to improved disaster reduction worldwide.

The DRA includes the following institutional members: Asia-Pacific Network for Global Change Research, Asian Disaster Reduction Center; International Conference on the Environmental Management of Enclosed Coastal Seas Center, Japan International Cooperation Agency's Hyogo International Center, United Nations Office for the Coordination of Humanitarian Affairs in Kobe, United Nations Centre for Regional Development, Earthquake Disaster Mitigation Research Center, WHO's Centre for Health Development, Institute of Global Environmental Strategies' Kansai Research Center, Japanese Red Cross Society's Hyogo Professional Chapter, The Great Hanshin-Awaji Earthquake Memorial Disaster Reduction and Human Renovation Institute, and Hyogo Emergency Medical Center.

Case: Australia

Some examples of research drawn from Australia reflect an area of growing global interest in documenting the economic considerations or rationale for investing in disaster reduction strategies. This multidisciplinary research is overseen by the Disaster Mitigation Research Working Group of the Bureau of Transport and Regional Economics Research Programme. Chaired by the Department of Transport and Regional Services, this is a collaborative effort among the federal, state, territory and local governments. The Insurance Council of Australia and the New Zealand government also collaborate in the research programme. Some of their important studies are outlined here, with extracts of research observations, taken from programme materials.

Economic Costs of Natural Disasters in Australia was an initial effort to understand the costs of natural disasters better. By bringing together information from different sources and professional disciplines, it provided a more consistent approach to the estimation of future disaster costs. It examined the costs of natural disasters in Australia having individual costs of more than 10 million Australian dollars. It found that floods are the most costly type of disaster in Australia, on average costing the Australian community more than 300 million Australian dollars.

A lack of reliable and consistent data on the costs of natural disasters remains an impediment to more accurate assessment and resulting conclusions. The continuity of data sets and their sufficiently extended time series are important requirements for determining the true economic costs. Other important aspects include the need for more clear definitions of actions or costed activities for individual types of disasters. There is also often a lack of consistency in estimating costs because of different methodologies and approaches.

As society has changed significantly over the past decade and technology has evolved rapidly, they

have greatly changed the way people live and the production methods employed. Important issues for future disaster risk research include:

- effects of technology in the home on the prediction of potential costs; and
- extent to which a greater integration of an economy affects previous working assumptions, such as those regarding the costs of business disruption.

Benefits of Flood Mitigation in Australia "aims to build on current levels of understanding by investigating the costs avoided by Australian flood management projects". It draws on much of the available Australian information about the benefits of flood mitigation through a literature survey, consultations and case studies. It examines the benefits of flood mitigation activities by drawing on much of the available Australian information about the costs, benefits, and performance of flood mitigation works and measures.

Information highlights case studies that consider the benefits realized during floods such as through land-use planning and other non-structural measures. Social and environmental considerations are also discussed and quantified where possible. The five case studies demonstrate both the benefits of mitigation, as well as the difficulties involved in accurately measuring these benefits.

Some key conclusions of the study include the following:

- The importance of considering flood mitigation options that address the three sources of risk – existing, future, and residual and continuing – was clearly evident.
- Mitigation of existing risk by altering the way infrastructure is designed and constructed can be very cost-effective.
- Uniqueness of each location (in terms of topography, rainfall patterns, community views, affordability of measures, and rural or urban development) means that mitigation solutions must be tailored to the location in order to achieve success.
- Community awareness and preparedness together with reliable and timely flood warning systems play an important role in determining the success of mitigation. One case study found that the preparedness activities of businesses in the lead-up to a November 2000 flood saved more than 80 per cent of potential damage.
- Equity (and perceived fairness) is a powerful factor in community acceptance, and therefore in resulting policy decisions about mitigation measures.

Limitations and problems of mitigation also were noted:

- Lack and uncertainty of data available to estimate the benefits associated with mitigation limits the accuracy of case study estimates.
- Capturing and quantifying many indirect and intangible costs and benefits are inherently difficult.
- Concerns about the suitability of benefit-cost assessments – particularly in evaluating some types of non-structural mitigation measures.
- While cost-benefit assessment is a powerful economic tool for examining the economic merit of mitigation, it should not generally be the sole decision tool.

The study highlighted future research priorities:

- Further work is needed to provide broader evidence of the benefits of mitigation, including the benefits of natural disasters other than floods.
- Improved data collection and methods are required to capture indirect and intangible costs.
- Continuing improvements are necessary in the analysis of proposed mitigation projects so that public investment can be directed toward those activities producing the greatest benefits and best value for money.
- Examination of how the application of cost-benefit assessments may disadvantage certain measures or people.
- Complementary research is needed to examine the social, environmental and other aspects of flood mitigation, particularly as they may relate to the long-term economic and social impact of disasters on communities.
- Better methods are required for evaluating community awareness, education campaigns, and the effectiveness of warning systems.
- Better understanding is needed about the cost and impact on communities of less costly and more frequent disasters.

Specialized hazard and disaster risk reduction research interests

There are countless examples of institutions and other sources of reference for the many research interests involved with disaster risk reduction. In addition to the categories already referred to, a varied list indicative of research institutions and networks follows. While neither exclusive nor exhaustive to the various subjects that each entity addresses, the selection rather suggests the considerable variety and means through which disaster reduction research can be explored, often characterized by quite different subject areas.

Asia

Korea Earthquake Engineering Research Center, Seoul National University, Korea

Supported by the Ministry of Science and Technology and the Korea Science and Engineering Foundation.
<http://www.keerc.net>

Research Center for Natural Disasters, Gadja Mada University, Indonesia

Aims to attract international partners and students to Gadjah Mada University and to participate in the international tertiary education community. The university has built extensive external links with overseas partners and collaboration in educational and research institution programmes.
<http://www.gadjahmada.edu.id>

Research Centre for Urban Hazards Mitigation, Hong Kong Polytechnic University, Hong Kong, China

Proposed as an important contributor to the human ability to understand, mitigate and respond to hazards in urban areas, located within the faculty of construction and land use. The centre focuses on the effects of windstorms and earthquakes on tall buildings and long-span bridges and the effects of landslides. Its activities also include other areas related to urban hazard mitigation that are important to Hong Kong and elsewhere in China.
<http://www.cse.polyu.edu.hk/rcuhm/>>

Pacific region

Centre for Disaster Studies, James Cook University, Australia

A multidisciplinary research unit in the School of Tropical Environment Studies and Geography of James Cook University. The centre has acted as the university face to the public and professionals in the fields of emergency management and meteorology for city councils and other researchers since its establishment in 1979.
<http://www.jcu.edu.au/>

Risk Frontiers Centre for Hazard and Risk Management – Macquarie University, Australia.

Its mission is to create strategic risk management and training solutions for insurance companies and their clients through work leading research into natural perils and their consequences.
<http://www.es.mq.edu.mq.edu.au/NHRC/>

Global Coral Reef Monitoring Network, South West Pacific Node, University of the South Pacific

It aims to improve management and sustainable conservation of coral reefs by assessing the status and trends in the reefs and how people value and use the resources.
<http://www.gcrmn.org>

Natural Hazards Centre, Christchurch, New Zealand

A joint initiative of the Institute of Geological and Nuclear Sciences and the National Institute of Water and Atmospheric Research to enhance the provision of knowledge on natural hazards. The centre aims to strengthen the links between scientists, policy makers, planners and hazard practitioners by providing a focal point for science-based information on the full range of natural hazards facing New Zealand.
<http://www.naturalhazards.net.nz>

Europe

Bureau de Recherches Géologiques et Minière (BRGM), France

For the sustainable management of natural resources and the surface and sub-surface domains. <http://www.brgm.fr>

Center for Disaster Management, Bogazici University, Turkey

An interdisciplinary research centre that brings together the academic resources of the university with national and international partners to further disaster understanding and mitigation of disasters in Turkey. Creates and structures knowledge through interdisciplinary research and disseminates it to further best practices in disaster management. Conducts research and training to support risk reduction, contingency planning, rehabilitation and mental health intervention, and organizational and public awareness. <http://www.cendim.boun.edu.tr>

Swiss National Centre of Competence in Research North-South, University of Berne, Switzerland

Composed of research partnerships for mitigating syndromes of global change to complement traditional research approaches, the Centre focuses on specific core problems of non-sustainable development in developing and transition countries by considering broader approaches. It strives for a better understanding of the interactions inherent in global change between such problems and the specific patterns of these interactions, and also seeks to establish closer collaboration with the people directly affected. <http://www.nccr-north-south.unibe.ch>

The Tyndall Centre, School of Environmental Sciences, University of East Anglia, United Kingdom

Bringing together scientists, economists, engineers and social scientists, the Centre conducts interdisciplinary dialogue at national and international levels which address climate change. This involves the research community, business leaders, policy advisors, the media and the public. This approach yields new insights into how society may respond to climate change, harnessing available expertise for the benefit of the United Kingdom and communities worldwide. <http://www.tyndall.ac.uk>

North America

Center for Hazards Research, California State University, United States

Coordinates hazards-related research and educational activities by faculty and students throughout the state university system and research associates at other institutions in California. Work focuses on earthquake, flood, drought and wildfire hazards. Much of the activity has been in the application of critical social theory, media analysis, and spatial analytic methods to hazards in California, with additional attention given to the development of hazards and disaster curriculum. <http://www.csuchico.edu/geop/chr/chr.html>

Center for Hazards and Risk Research, Columbia University, United States

Advances the predictive science of natural and environmental hazards and the integration of science with hazard risk assessment and risk management. It undertakes new research programmes in disasters and risk management motivated by a clear and compelling need to reduce the catastrophic impacts on society from natural and human-induced hazards. The centre draws on the acknowledged expertise of Columbia University in earth and environmental sciences, engineering, social sciences, public policy, public health and business. It adopts a twofold focus in advancing the predictive capability for hazard and risk, and the integration of core science with techniques for hazard assessment and risk management. <http://www.ldeo.columbia.edu/CHRR/>

Consortium of Universities for Research in Earthquake Engineering, United States

A non-profit corporation formed by a consortium of schools devoted to the advancement of earthquake engineering research, education, and implementation. Its purposes include:

- identifying new ways research can solve earthquake problems;
- collecting and synthesizing information and making it easily accessible;
- establishing national and international hazard research relationships;
- performing earthquake engineering and related research;
- managing research consortiums and cooperative programmes; and
- educating experts, practitioners, students, and the public.

<http://www.curee.org/>

Hazard Reduction and Recovery Center, Texas A&M University, United States

Engages in research in hazard mitigation, disaster preparedness, response and recovery. An interdiscipinary staff includes the expertise of architects, information technology specialists, political scientists, emergency managers, planners, geographers, psychologists and sociologists. The centre is dedicated to providing access to hazards information for homeowners, emergency management professionals and the academic community. In addition to providing two graduate degree programmes, the centre provides several research and project opportunities, which provide a platform to prepare for careers in emergency management, hazard planning and disaster research. <http://hrrc.tamu.edu/>

Incorporated Research Institutions for Seismology (IRIS), United States

A consortium of more than 95 US universities and institutions that have research programmes in seismology, IRIS develops and operates the infrastructure needed for the acquisition and distribution of high quality seismic data. It serves a national focus for the development, deployment and support of modern digital seismic instrumentation and supports the research needs of earth scientists in the United States and around the world. <http://www.iris.washington.edu/>

Institute for Crisis, Disaster, and Risk Management, George Washington University, United States

Its goal is to improve the disaster, emergency and crisis management plans, actions and decisions of government, corporate, and non-profit organizations by transforming theory into practice. The objectives are to create and teach courses in crisis, disaster, and risk management; conduct research, create knowledge through its research activities; and disseminate knowledge through education programmes, professional forums, and workshops.

Faculty and staff work to facilitate exchanges of crisis management information, knowledge and best practice among all sectors engaged in both domestic and international endeavours. The institute is an interdisciplinary academic centre affiliated with the School of Engineering and Applied Science, School of Public Health and Health Services, and the Elliott School of International Affairs.
<http://www.seas.gwu.edu/~icdm/intro.html>

Institute for Hazards Mitigation Planning and Research, College of Architecture and Urban Planning, University of Washington, United States

An interdisciplinary academic institute is dedicated to exploring ways to integrate hazard mitigation principles into a wide range of crisis, disaster, and risk management opportunities. The institute is interdisciplinary in focus and structure whose capabilities are enhanced by close links with other academic and research organizations.
<http://www.caup.washington.edu/>

Research networks

Asian Pacific Network of Centres for Earthquake Engineering Research (ANCER)

A unique international non-profit, professional organization consisting of seven national centres on earthquake engineering in the Asia and Pacific regions. It has the objective to coordinate limited resources in the respective countries to develop and implement innovative engineering methods. It promotes new enabling technologies on a cooperative, centre-to-centre basis, that are optimal to design, construct, maintain, manage and renew the built environment for reduced seismic hazard.
<http://keercis.snu.ac.kr/ancer/ancer1.html>

Educational Research Network of Eastern and Southern Africa

The aim of the network is to promote collaboration and information sharing among researchers in the member countries and in the region, as well as between the research community in the region and the research communities in the North and South.
<http://web.idrc.ca/en/ev-37244-201-1-DO_TOPIC.html>

Global Applied Research Network (GARNET)

It is designed to facilitate the sharing of applied research information between researchers working throughout the world in all aspects of water and sanitation, including related technology, management, health and social factors.
<http://info.lut.ac.uk/departments/cv/wedc/garnet/grntback.html>

Indian Association of Social Science Institutions

This is a platform for bringing together academic organizations which produce knowledge and information relevant to resolving problems faced by society, through meaningful dialogues, exchange and cooperation. The association has been established primarily to facilitate and promote research and training activities, in particular, relating to major problems that can benefit from interdisciplinary perspectives. This motivates a developed interest to encourage cooperation among institutions engaged in research and training in social sciences, and especially in the areas of economic, social and technological development and change.
<http://iassi.nic.in/iassi/objective.htm>

Box 4.27
Research in disaster diplomacy

Following the publication of a special section in the Cambridge Review of International Affairs dedicated to the subject of disaster diplomacy, (vol. XIV, no. 1, Autumn-Winter 2000) a web site has been created to maintain interest and to promote vigorous discussion.
<http://www.disasterdiplomacy.org>

There are numerous case studies related to disasters and diplomacy, examining whether diplomacy promotes or impedes disaster reduction. These have been undertaken with regard to the following situations:

- Aral and Caspian seas;
- Armenia earthquake, 1988;
- Canada/United States;
- Caribbean disaster management;
- Cuba/United States;
- Ethiopia/Eritrea;
- European floods;
- Goma volcano, Democratic Republic of the Congo, 2002;
- Greece/Turkey;
- Hurricane Mitch, Central America;
- India/Pakistan;
- Iran/United States;
- Israeli humanitarian relief operations;
- Middle East seismic activity;
- North Korea;
- Peru/Ecuador;
- Southeast Asia regional haze;
- Southern Africa drought, 1991-1993;
- Southern Africa famine, 2002-2003;
- Sri Lanka floods 2003; and
- Sudan.

Other cases involve the following subjects:

- disaster victim identification;
- global seismic hazard assessment programme;
- international disease management; and
- near earth objects.

Benefits of action research

The participation of people most exposed to hazards, as well as the broader interests of the communities in which they live can trigger unexpected and practical benefits from research activities. Sometimes called action research, when stimulated by the severe consequences of a disaster it can derive multiple benefits from both the process and the documented results.

Following the devastation caused by Hurricane Mitch throughout Central America in 1998, it was initially observed that much of the damage appeared to be related to poor land use and widespread deforestation. It appeared that the damage to agricultural land was especially uneven; farms using soil and water conservation methods and other agro-ecological practices seemed to have survived better than those using conventional farming methods.

Similar observations were shared among farmers and other stakeholders involved in Farmer to Farmer, a grassroots movement promoting sustainable agriculture in Central America. In January 1999, a research team started a participatory action research project to compare the impact of Hurricane Mitch on agro-ecological and conventional farms.

The project was designed to include farmers, local community organizations and all other stakeholders as full partners in the research process from the beginning. The expectation was that by doing so, they could all be stimulated by the study and then motivated to action based on the lessons learned. In addition, the project aimed to inform decision makers and possible donor interests to influence future priorities and more progressive policies.

The NGO World Neighbors agreed to sponsor and facilitate the research, and helped obtain additional support from the Ford, Rockefeller, Summit and Inter-American foundations. Other international NGOs such as Oxfam (United Kingdom), SWISSAID (Switzerland), COOPIBO (Belgium) and Catholic Relief Services (United States) teamed up with ADESO in Nicaragua to provide further support for research teams in Nicaragua. Intercooperacion (Switzerland) and the Honduran National Network for the Promotion of Ecological Agriculture (ANAFAE) provided funding for the research in Honduras. In all, 40 local and international organizations joined the project, forming 96 local research teams to carry out fieldwork in Honduras, Nicaragua and Guatemala.

The resulting research studied comparison plots of farmland selected for their similarities in such characteristics as cropping, topography, angle of slope, location on the watershed, and intensity of the storm they experienced. The only variation between the paired plots was the extent to which one was farmed with attention to agro-ecological principles in contrast to the more conventional techniques employed on the other.

Participating farmers were interviewed about their financial, material and labour investments, the types of crops and related yields, farming practices they employed, their observations of the hurricane's impacts, and their crop losses. The farmers were the primary subjects involved in the study and took an active role themselves in the collection and analysis of data. By using their own knowledge and developing their technical abilities further in the process they went beyond being objects of study.

A total of 1,804 plots were surveyed, in 902 pairings that were located in 360 communities spanning 24 departments of the three countries. Of these, 1,738 were found to have valid data and were included in the analysis. After the data was processed for each of the three countries, the results were validated in workshops with participants at the local, regional and national levels.

The utility of this action research was demonstrated by the findings from all three countries. They showed that plots farmed with sustainable methods withstood the force of the hurricane better than the plots that were conventionally farmed.

These observations were based on an evaluation of the most vital agro-ecological indicators, such as topsoil depth, moisture content and surface erosion. The sustainable plots had 28-38 per cent more topsoil and 3-15 per cent more soil moisture than the others. Surface erosion was 2 to 3 times

greater on conventional plots than on agro-ecological ones. Overall, the ecologically managed plots suffered 58 per cent less damage than the conventionally farmed ones in Honduras, 70 per cent less in Nicaragua, and 99 per cent less in Guatemala.

Some results also varied among the three countries as well as some specific indicators applied to the different types of plots. As an example, the damage from erosion and landslides overall seems to have been equally severe on both types of plots, indicating that agro-ecological methods may not contribute to resilience in all conditions. However, as many of the gullies and landslides originated uphill or upstream from the test sites, on poorly managed, degraded or deforested slopes, the importance of adjacent conditions and neighbouring practices was underlined.

Several benefits were derived from this practical form of applied research. It was clearly demonstrated that when promoting agro-ecological systems, conservation of the entire hillside and watershed must be considered. By protecting the upper reaches of a watershed the potential damage can be reduced in the lower elevations. It is not sufficient to modify practices only at the individual farm level alone.

Steeply sloping or vulnerable lands possibly should not be cultivated at all, and may be protected better when planted as forests. Community acceptance of such observations has implications for both land use and reforestation efforts. Farmers on high-risk hillsides also would need access to better land or could benefit from incentives to manage forests instead of cultivating food crops.

These results had more impact because they were arrived at through a participatory process. Simply by their participation, more than 2,000 people and 40 institutions were affected without even taking account of the altered practices which many adopted as a result. The study became a dynamic process of learning, sharing and validating knowledge and methods.

In the course of the research process, relations were strengthened among technicians, promoters and farmers; institutional networks were broadened; women and indigenous people were engaged in the process; family and community bonds were enhanced; and local decision makers were favourably influenced.

Testimonies and opinions expressed by participants reinforced the technical findings. Even more importantly their views attest to the positive influence of action research on participating farmers, their livelihoods and communities, as well as contributing to the development objectives of supporting organizations. Further information about the action research process, including a documentary video, is available in Spanish and English from World Neighbors. <http://www.wn.org>

Future challenges and priorities

Research

Continuing research into hazards, their effects and the dynamic interactions between them and people's livelihoods as well as societies' well-being remains a crucial element of effective disaster reduction strategies. An expanded commitment to research is crucial throughout the various components of disaster reduction in such areas as education, training, advocacy, public information and policy formulation, civil administration, networked organizational relationships, information management and the expansion of more widespread communication.

While much previous study has concentrated on the nature of hazards and risks themselves, there is a growing body of interest demonstrated in both the human dimensions of risk, as well as in the operational processes involved with the institutionalization of disaster risk reduction policies and application of risk management practices. The following areas represent primary challenges and priority issues for the future.

Synthesizing multidisciplinary academic and professional interests

The expanding community of official, academic, professional and public interests being devoted to disaster risks and associated aspects of vulnerability is a welcome development, but it also results in a much wider array of accumulated study and experience. As efforts are underway to relate multiple academic and professional interests to common purposes, a growing need exists to establish and utilize numerous means of communication and dissemination more effectively.

With the vastly expanded opportunities for exchange provided by electronic communications, both the information resources as well as the benefits of research are less likely to be constrained within singular faculties or individual professional disciplines. Cross-sectoral communication becomes more important if fragmentation of knowledge or isolated perspectives are to be avoided.

Conscious and systematic efforts, best realized through established national strategies or policy agendas, are becoming essential to derive the best benefits of research. These need to be tied to a continuously expanding mosaic of discovery, analysis and experience. While the perceived benefits of applied research are well established, there is still more that can be done to hasten the utilization of academic analysis in practice as well as to translate the practical lessons on the ground into informed policy commitments.

Rather than being considered a specialist area of either the physical sciences, engineering solutions or public safety and security, research pertaining to disaster reduction needs to encompass much broader dimensions of societies' well-being in a globalized world. This entails a persistent recognition of the changing relationships between risk factors, the natural environment, sustainable development, governance and national development objectives

National commitments to disaster reduction research agendas

Given the complexity of the issues involved and the multiple interests aroused, there is a value in seeking to develop consensus around a priority research agenda. Such an approach should become a foundation element of any national strategy of disaster reduction. It could also provide both focused guidance and the basis for evaluation of accomplishment. This equally may serve to integrate multiple sectoral interests as well as to invite a more collaborative public, private and professional dialogue about risk reduction.

Such an approach can also encourage a greater economy in the use of resources in addition to providing the collective advantages of multiple perspectives through shared research commitments. As the benefits of public support to private sector research and development are well developed to advance national interests in other fields such as those crucial to agriculture production, trade, defence etc. the concepts may be applied with similar benefit to protect social assets, private livelihoods, and economic infrastructure.

Improved data availability and access

The easy availability, exchange and use of data remains a challenge, and that is likely to become compounded with the expanding range of research interests involved in disaster reduction. There is a growing need for both commonly acknowledged and highly valued research centres in respective fields of study and clearing houses or information centres. These need to be dedicated to synthesizing and disseminating the various lines of research and practical experience more widely.

Especially in the case of developing countries, there is much that can and should be done to provide wider access to research products, and even more fundamentally to enhance their own capacities to undertake and disseminate research founded on local knowledge and conditions. Efforts to support a national system to document risk factor analysis and disaster statistics can represent a particularly effective investment for future financial benefit.

Monitoring and evaluation of effectiveness

As the consequences of more frequent or more severe disasters mount, there is a pressing requirement in many countries either to justify additional expenditure for disaster risk reduction or to demonstrate the effectiveness of various forms of risk management. The provision of compelling economic analysis or broader public policy rationales that demonstrate the justifiable benefits of risk management remain important areas for future research commitments.

There is equal attention being given to the need, especially by international financial and development institutions, for the formulation and demonstrated application of methodologies that can be employed to monitor and evaluate the effectiveness of disaster risk management practices. As this involves the multiple considerations of economics, social sciences, public administration, and various technical and professional dimensions of hazards this need has remained a continuing challenge. Importantly, it has also been identified as a crucial requirement if future investments are to be made to create safer societies.

4.5 Public awareness

Increased public awareness about hazards is a vital element in any comprehensive strategy for disaster risk reduction. Public awareness campaigns can be conducted in schools, through the media and official, public, professional and commercial channels.

There is a responsibility for governments to promote public awareness of natural hazards and risk on a continuous basis. In order to create a culture of prevention, there needs to be a great degree of public participation and popular understanding.

The importance of public awareness in effective disaster risk reduction cannot be overstated and assumes different forms. These include:

- *public awareness as a primary element of risk reduction;*
- *national public awareness initiatives;*
- *special events and major activities;*
- *the role of the media; and*
- *local community experience promotes public awareness.*

Public awareness as a primary element of risk reduction

Public awareness and the creation of widespread understanding about disaster reduction have always been crucial elements in risk management strategies. The Yokohama Strategy and Plan of Action for a Safer World of 1994 noted that particular attention must be given to improving awareness in vulnerable communities. Increasing public awareness is one of the four key ISDR objectives.

Public awareness conveys knowledge about hazards and existing solutions that can reduce vulnerability to hazards. To ensure political commitment for risk reduction measures, it is essential for all stakeholders to be aware of the hazards they are likely to face.

Government authorities have a basic responsibility to inform the public about hazards and the changing conditions of risk. However, in order to sustain public awareness, other sectors of society must be involved in disseminating information.

The inclusion of risk information in education and professional training is crucial. A successful programme must include professional and civic groups and national and local authorities. The media also has a role to play. It is widely recognized that current tools and guidelines are inadequate, in part because of the limited exchange of information about global accomplishments.

Individual occasions or one-off public displays that are not relevant to daily livelihoods and social responsibilities of the public are unlikely to have an enduring effect. More strategic and ongoing approaches need to be conceived and supported.

Box 4.28
Basic principles of public awareness programmes

- They should be designed and implemented with a clear understanding of local perspectives and requirements with all materials reflecting local conditions.
- They should target all sections of society, including decision-makers, educators, professionals, members of the public and individuals living in threatened communities.
- Different types of messages, locations and delivery systems are necessary to reach the various target audiences.
- Sustained efforts are crucial to success, although single activities such as commemorative disaster reduction events and special issue campaigns can be useful if they are part of a larger, consistent programme.

At the same time, individual disaster events in neighbouring localities can provide a powerful impetus for sustained public interest. The timely and widespread circulation of lessons learned from disasters and the activities necessary to reduce risks in the future are more rapidly assimilated following a disaster event.

Having witnessed the damage to public infrastructure in California during the Loma Prieta earthquake in 1989, the authorities in Seattle, Washington in the United States used the occasion to build public awareness.

They raised the necessary support for fixing roads, bridges and other public works at a cost of more than US$ 150 million. When a magnitude 6.0 earthquake shook Seattle in 2001, there was only one fatality and the primary city infrastructure largely survived with only moderate damage.

Public discussions in the wake of disasters can also be catalysts for change. Following the major earthquakes in India in recent years, the public demanded the revision of outdated risk management programmes. The 2000 floods in

Box 4.29
Disasters increase public awareness

Experience demonstrates that there are great opportunities to mount public awareness programmes immediately following a major disaster.

The impact of the El Niño event in 1997-1998, Hurricanes Georges and Mitch (1998), followed by the losses from the earthquakes in El Salvador (2001), had such an enormous impact on public understanding that they far exceeded what any planned publicity programme could have ever accomplished in Central America.

Previously, public information typically focused on emergency preparedness and crisis response issues. Since these devastating events, the complex issues of risk have become associated with problems of poverty, social exclusion, lack of access to resources, and untenable use of land and unwise use of uncontrolled building practices.

There is now the recognition that values associated with risk reduction must be conveyed through wider public exposure and achieved by making permanent changes in educational curricula. The successful efforts to teach environmental consciousness through the formal basic education system in Costa Rica show what can be accomplished with a coherent and sustained strategy.

Box 4.30
Strategies for awareness-raising

Awareness-raising as a policy tool
In awareness campaigns, policy makers and other interested groups aim for behavioural changes based on new social norms and attitudes. However, a narrow focus on awareness-raising as a way to achieve specific goals set by politicians or researchers would be presumptuous.

Awareness as an interactive movement
Awareness-raising is an interactive movement in which different parties are engaged, each with their own roles, responsibilities and ways to make their voices heard and create social pressure. Awareness-raising is therefore inherently linked to knowledge, attitudes and behaviour.

Campaigns as means to influence and change behaviour
All awareness campaigns aim to influence behaviour and, hence, they are useful to understand how communication influences behaviour.

Traditionally, campaigns focus on providing information and knowledge to influence individual attitudes. Knowing the results of behaviour and realizing the importance of doing so might convince ones own people to change their behavioural pattern.

There are other initiatives that can influence social norms. Here the goal is less to make an individual aware of a certain problem but rather to influence the subjective norm of a larger community.

Campaigns should focus on increased understanding of the problems and their solutions. The proposed changes need to be feasible and easy to carry out. Designing the whole campaign in a participatory manner can also help stay closer to the ideas, constraints and opportunities of the target audience.

Source: Adapted from Ideas for Water Awareness Campaigns by Wouter Schaap and Franck van Steenbergen, produced in conjunction with the Global Water Partnership. <http://www.collinsassoc.ca/water/contents.htm>

Southern African resulted in political recognition of the need for regional discussion of the risks associated with recurrent natural hazards.

The challenge remains to sustain public interest in times of calm. It is the time between disasters when work in public awareness needs to be accomplished if future losses are to be avoided.

The aim of public awareness programmes should not be limited to conveying an understanding about hazards and risks to the public. It should motivate people to become involved in activities that can reduce the risks to which they are exposed.

Information needs to be consistent, with principal components repeated over a period of time. The subject must be incorporated throughout society, where people live and work, and by including it as a part of their daily personal or professional experience.

This is best achieved through encouragement and support for public information activities implemented at local levels. By drawing on earlier examples of local experience and traditional knowledge, communities can identify additional measures to promote a wider public appreciation of hazards or local capabilities to manage risks.

National public awareness initiatives

Most countries with an effective national risk management authority are committed to increasing public awareness about hazards and disaster reduction practices. They usually proceed beyond occasional commemorative events or the use of posters, public announcements or handbooks, and often have national committees made up of stakeholders from all sectors of the society.

The government of Australia sustained an excellent public awareness programme in the 1990s. Many examples of their informative manuals, posters, pamphlets, community hazard maps, and descriptions of related activities are included in a comprehensive review, the Final Report of Australia's Coordination Committee for IDNDR.

The government of South Africa consulted with community groups to learn more about local hazards and community risk issues prior to drafting a new national disaster management bill.

The National Disaster Management Office of Botswana conducted a survey and policy review late in 2001 to help in the development of a national public awareness strategy.

In the United States, both FEMA and the American Red Cross have provided extensive public information including links to many other organizations engaged in disaster reduction activities.

In Mozambique, the National Disaster Management Authority (INGC) uses disaster simulations as well as a variety of public forums to conduct awareness-raising programmes. A different location is chosen each year, usually a potentially vulnerable area near a provincial capital, and national leaders are invited to participate.

Televised panel discussions, public exhibitions, university seminars and presentations in schools are also conducted. At a more practical level and with a longer-term perspective, projects such as tree planting or the distribution of drought-resistant crops also take place. The activities are planned just before the rainy season when seasonal meteorological forecasts and updated emergency contingency plans are announced.

China has made widespread use of publications, media and other forms of publicity to raise the public consciousness about the importance of disaster reduction. In the past decade, more than 300 books have been published about the subject, and more than 20 different newspapers and periodicals have been created.

In addition, numerous international publications dealing with disaster risk issues have been translated into Chinese or adapted to Chinese conditions. In the future, the China National Committee for Natural Disaster Reduction (CNCNDR) plans to improve their public awareness programmes through greater use of broadcasting, video, and electronic means.

There are additional plans for CNCNDR to coordinate with schools to introduce new content on risk reduction in curricula, enabling youth to understand their own roles in reducing disasters.

Outreach campaigns have put the issue of disaster management on the public agenda. The China Association for Science and Technology has organized consulting services in disaster reduction for specific programmes. However, many activities have targeted urban populations. While a principal objective in most of these activities has been to influence policy makers and stakeholders at the national level, a challenge remains to instil a culture of prevention among poorer rural communities, those most likely to suffer during a disaster.

Special events and major activities

Since the early 1990s, the IDNDR and ISDR Secretariats have organized an annual world disaster reduction campaign, whose overarching goal has been to raise awareness through an interactive process, to create social pressure and change people's perceptions about reducing the risks and vulnerabilities of natural hazards.

By bringing together diverse experiences and initiatives taking place worldwide, more people learn about disaster reduction, which can ultimately lead to changed perceptions and behaviours. These can include the organization of educational community gatherings to design risk maps, school classes to explain what should be done in the event of a disaster, training opportunities for disaster reduction practitioners and the development of national disaster management policies.

The campaign builds momentum throughout the year, culminating in the International Day for Natural Disaster Reduction (the second Wednesday of October), celebrated internationally by global organizations, regional institutions and local communities, alike. Celebrations of the day bring together representatives of all facets of society, such as national governments, local emergency volunteers, school children and journalists to showcase examples of successful accomplishments in disaster reduction. The primary message is that disaster reduction can benefit communities worldwide as an essential part of sustainable development planning by avoiding the devastating set backs that natural disasters can cause.

This public awareness strategy seeks to call governments and local communities to action. It urges governments to develop and enforce building codes and to exploit scientific and technical knowledge for minimizing exposure to risk. UN agencies and their programme partners are committed to carrying out this strategy by bringing people and expertise together in the search for solutions.

In 2001, the theme was "Countering disasters, targeting vulnerability". In 2002, the theme was "Disaster reduction for sustainable mountain development", coinciding with the International Year of Mountains. In line with the International Year of Freshwater, the 2003 theme focused on water-related disasters: "Turning the tide on disasters towards sustainable development".

Case: Bolivia

Since 1998, disaster reduction has been promoted in Bolivia through two programmes. One programme has focussed on supporting the national system for civil defence; the other has emphasized measures that can prevent avoidable risks and increase public awareness about disasters.

In 2001, a new campaign called "Risk management: A new vision on disasters" was launched to further the objectives of ISDR. A workshop was organized in July 2001 by the Universidad Nacional Siglo XX de Llallagua to promote the campaign.

Another workshop was held the following month in the city of Santa Cruz on community-based disaster management, conducted within the framework of a pilot project of the Association of the Municipality of Santa Cruz.

One of the most important achievements of 2001 was the approval of a new law for improving risk reduction and disaster awareness. The law encourages the identification of risk reduction measures that can be employed in the course of implementing projects that further sustainable development.

To support this process, manuals were prepared to guide people in local communities to assess risks, formulate practical policies, and then to apply risk management measures that could be incorporated

in local development programmes. These manuals were then tested and evaluated in selected municipalities.

Case: Jamaica

A variety of local activities were conducted in Jamaica in June 2001, the country's official disaster preparedness month. A national church service was held to launch the month, broadcast live on television and radio. The following day, a press conference was held to introduce the public to the themes of disaster preparedness month. These were emphasized in public information campaigns the rest of the year.

Specific issues were also presented concerning local planning. An evacuation sign was introduced, sponsored by Medigrace Jamaica, which can be used to guide people out of the Portmore area in the event of an emergency evacuation.

The intended use of the Office of Disaster Preparedness and Emergency Management's (ODPEM) GIS was explained, and related computer technology in the National Emergency Operations Centre was highlighted.

ODPEM emphasised their initiative to include elements of popular culture in conveying disaster preparedness messages effectively to the public. This included the participation of several popular music disc jockeys and the promotion of commercial sponsorship to broadcast these messages.

One day was devoted to disaster preparedness in schools. The ministry of education called for an island-wide observance of the subject, and many schools participated in disaster related activities.

A hurricane preparedness day for businesses was also held during the month with widespread support from the business community. Several companies organized exhibitions, conducted drills and invited speakers from safety-related organizations.

A major exhibition was held in which 20 disaster-related organizations presented exhibits that displayed their products and services. ODPEM also displayed emergency supplies that people should use in the event of a hurricane.

Finally, a seminar on contingency planning directed to business organizations was held at the conclusion of the month. With the objective to raise awareness about disaster planning and preparedness, participants came from many different business sectors to learn about topics such as establishing a planning team for risk reduction and conducting vulnerability analysis.

Case: Costa Rica

On the International Day for Disaster Reduction, Costa Rica's National Risk Prevention and Emergency Response Commission (CNE) organized a community exercise in disaster preparedness. It involved an evacuation drill based on a local river flooding and resulting in mudslides affecting four communities.

A massive public awareness campaign about earthquakes was also launched. The Inter-institutional Emergency Commission of the University of Costa Rica organized a forum on the role of the media in disseminating information on disasters.

Case: Uruguay

In Uruguay, the ministry of education's Emergency and Disaster Commission organized a workshop with the support of OFDA/USAID, the National Emergency System, and the local government. The Uruguayan National Red Cross Society participated in the International Day for Disaster Reduction alongside representatives of civilian, political, and military organizations, school children and the media.

The objective was to strengthen local communities by creating awareness of social responsibility, identification of hazards, prevention and risk, especially directed at children. Workshop participants were asked to draw risk and vulnerability maps relevant to their surroundings. Another meeting was held three weeks later for the participants to share their information and experiences about the composition and presentation of their various risk maps.

Case: Colombia

In Colombia, the devastating volcanic eruption of Nevado de Ruiz in November 1985 killed more than 25,000 people and swept away entire villages. Every year, national exercises, school and media activities take place to commemorate the disaster and renew people's awareness about the risks they face. Similarly, in Peru, the Cajon de Huaylas earthquake in 1970 is commemorated every year. Special activities take place to remember the 67,000 people who died and to teach people how they can reduce risk in the future.

The United Nations Sasakawa Award for Disaster Reduction

Together with the World Health Organization Sasakawa Health Prize and the UN Environment Programme Sasakawa Environment Prize, the United Nations Sasakawa Award for Disaster Reduction is one of three prestigious prizes established in 1986 by founding Chairman of the Nippon Foundation, Mr. Ryoichi Sasakawa.

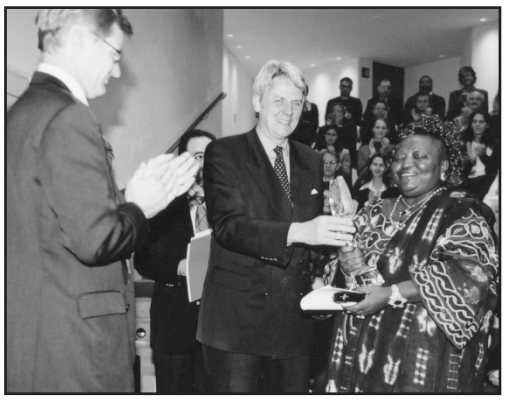
The total approximate value of the Award currently is US$ 50,000, shared between the Laureate and the recipients of Certificates of Distinction and Merit. In addition to the financial prize, the Laureate is presented with the valuable UN Sasakawa Award for Disaster Reduction crystal trophy.

Nominations for the Award are submitted to the ISDR Secretariat and agreed upon by the UN Sasakawa Jury, composed of representatives from five continents. The Award ceremony takes place on the occasion of the International Day for Natural Disaster Reduction, the second Wednesday of October.

Nominations for the UN Sasakawa Award for Disaster Reduction can be made by:

- former UN Sasakawa Award Laureates;
- representatives of institutions specializing in disaster reduction;
- UN specialized agencies;
- Resident Coordinators of the UN system; and
- Permanent Missions to the United Nations Offices in New York and Geneva.

Box 4.31
UN Sasakawa Award for Disaster Reduction Laureates



2003	Mrs. Tadzong, née Esther Anwi Mofor, Cameroon
2002	Sergueï Balassanian, Armenian Association of Seismology and Physics of the Earth's Interior (AASPEI), Armenia
2001	Global Fire Monitoring Center (GFMC), Germany
2000	Fondo Para la Reconstruccion y el Desarrollo Social del Eje Cafetero (FOREC), Colombia
1999	Prof. Mustafa Erdik, Turkey
1998	Mr. Ji Cai Rang, China, Prof. Wang Ang-Sheng, China
1997	Observatorio Sismologico del Sur-Occidente (OSSO), Colombia Dr. A.S. Arya, India
1996	Dr. Ian Davis, United Kingdom
1995	No Laureate
1994	National Emergency Commission, Costa Rica
1993	Dr. Vit Karnik, Czech Republic
1992	Geophysical Institute of the National Polytechnic School, Ecuador
1991	Mr. Franco Barberi, Italy
1990	Mr. Julio Kuroiwa, Peru
1989	Relief and Rehabilitation Commission, Ethiopia
1988	ESCAP/Typhoon Committee, Philippines
1987	Ratu Kamisese Mara, Fiji

Candidates for the UN Sasakawa Award for Disaster Reduction shall have distinguished themselves through outstanding and internationally recognized action in the following fields:

- The implementation, at international or regional level, of activities designed to strengthen people's awareness of natural disasters;
- The launching of scientific activities contributing to technological innovation facilitating disaster prediction;

- The launching of scientific or social activities contributing to the strengthening of disaster prevention and preparedness;
- The promotion of preventive activities which reduce the economic impact of disasters and contribute to sustainable development;
- Any other activities recognized as essential in promoting disaster prevention and mitigation (land-use planning, seismic risk reduction, awareness-raising, education etc.); and
- The candidate shall not be subjected to any kind of discrimination on the grounds of nationality, religion, race, sex or age.

The role of the media

"Professional newspapermen love disaster – it is their business – but don't rely on them to be very different from the rest of the community. The independent commercial media survives and thrives by reflecting the community it serves. If a community is complacent, then there is a fair chance that its journalists too will take the placid line… If people don't die in thousands, it is not a disaster, and therefore not news. The preparedness message gets only a limited airing."

Source: T. Radford, The Guardian, 1999

The media is a greatly undervalued means for increasing public awareness and providing information related to disaster reduction. Media people have the opportunity to take the lead in encouraging public information in the media. Environmental, political, education and development journalists can network within and between their respective organizations, working together on a basis of information sharing and dissemination of the information to the community.

Much more needs to be done to improve the role of the media in disaster management strategies. Current media coverage is overwhelmingly devoted to disaster events and the dramatic aftermath of damage and the provision of emergency assistance to survivors. With a few noteworthy examples, coverage about recurrent hazards or reporting about existing disaster risk management practices is much less in evidence.

A professional's viewpoint: What the media says and why

The media tends to reflect the mood of the community it serves. If there is already debate about the exposure to natural hazards or concern about disaster awareness, then journalists are likely to amplify and focus this concern.

If there is no local interest in the subject, then a local newspaper, television or radio programme is unlikely to launch and sustain the discussion. There is, however, a moment to trigger such attention and to inspire media professionals to take an intelligent interest in the wider disaster subject. This moment is in the immediate aftermath of a disaster event.

Paradoxically, such moments also underscore huge cultural gaps that exist between journalists and the engineers, scientists, health teams and administrators who want to promote wider public understanding about risk.

The media wants the story. In the first bewildering hours after a catastrophe news is not always available. Instead there is silence. Roads are cut, communications are severed, water and power supplies are interrupted and the civic authorities and hospitals that should be the sources of information are themselves part of the disaster.

At such moments, reporters telephone frantically to find university or government-based specialists who might be prepared to speculate on what might have happened. When approached urgently, by often previously unknown questioners, these experts tend to worry about reputations for scholarly accuracy, mature judgement and political soundness. They often shrink from comment, apologetically promising to offer thoughtful analysis when firm information becomes available.

This is a mistake. News people have no choice. They must report on a disaster that has just happened even if they have only the sketchiest details. If an informed and thoughtful expert is hesitant to comment based on limited information, media reporters will go in search of a less-informed and less-thoughtful commentator who will.

It is at such moments that disaster risk management professionals have a golden chance to describe the pattern of loss and destruction. They can drive home the lessons of risk awareness and known procedures that can reduce those risks. They should seize the chance to do this, in vivid, clear and chilling language.

Once television cameras get to the disaster zone, images of injured children, weeping relatives and toiling rescuers begin to flood the public. The imagery and the grim statistics of suffering dominate the news. And then who will want to hear somebody talking in academic terms about monitoring hazards or mitigating future risks? Strong media networks allow for the development of resources towards increasing public awareness about hazards. Outspoken media reporting can provoke reaction by public officials and prompt incorporation of disaster reduction in local policies and planning. The media can also be utilized as an instrument for issuing early warning and hazard alerts.

With the objective of early warning being to provide individuals and communities exposed to disaster risk with accurate information about an impending hazard – thereby allowing them to act to reduce the probability of suffering losses – the media can play a most important function at the national and local levels by assisting in the provision of clear, consistent and timely messages to communities at risk.

There are some signs of change. Public reporting of disasters has begun to include references to human actions that have contributed to the severity of an event, particularly as they may relate to the loss of life and property.

Increasingly, questions are being raised about the responsibility of public officials in either contributing to, or tolerating hazardous conditions. Media reporting was outspoken about the inadequate quality of construction and placement of many houses that were destroyed by the Turkish earthquake in Izmit, in 1999.

In 1999, reporting about the extensive losses suffered in the Venezuelan mudslides queried why the informal settlements had been constructed in such potentially hazardous conditions. Reports also questioned whether extensive deforestation had contributed the disaster.

The extraordinary floods in Algiers in 2001 were reported as having been caused, in part, by unserviceable drainage systems. So far, such inquiry happens after the consequences of an unmitigated hazard become a political or newsworthy event.

In a more far-sighted outlook, some national officials seek to relate distant events to their own more immediate conditions. The response to the ISDR questionnaire by Western Samoa noted that one of the most important issues to be addressed was local media commitment to cover major world disasters.

Journalists were encouraged to describe relief responses in both the short and long term, so that the full coverage would influence their audiences to act with greater attention to disaster preparedness.

In Mozambique, an important objective of public awareness campaigns has been to develop the media as a better source of public information about hazards. INGC has made media relations a priority in improving public awareness.

The need for more accurate reporting was a recurrent theme expressed by journalists, district administrators and other local authorities. Now, disaster management officials are working together with technical specialists and journalists to involve the media more effectively as a means to issue early warning alerts.

Since the 2000 Mozambique floods, the media has played an increasingly valuable role in disaster management. At that time it served as an important catalyst for emergency action by the international community.

In October 2001, the National Meteorological Service inaugurated a television studio equipped with professional media equipment provided through Finnish development assistance. In this way, the country was able to increase its own capacity to provide better public information about the weather and potential weather hazards.

The most important medium for social communication remains the local language radio network of Radio Mozambique. This service

broadcasts information regularly about risk reduction measures, as well as communicating alerts at the time of imminent hazards.

INGC works with WFP to conduct training seminars for journalists in order to improve the quality of reporting, and an annual prize has been proposed for the best disaster reporting.

Local community experience promotes public awareness

Some of the most effective public awareness measures take place at the local community level with the added advantage of involving a cross-section of the local population.

The Community Action Group for Floodwater in the Old Community of Rodenkirchen was founded in Cologne, Germany, after the severe flooding of the Rhine River in 1993 and 1995. This group advocates the interests of more than 4,000 residents in matters of local flood protection.

In 2001, the community action group sailed the boat Pegellatte up the Rhine from Cologne to Basel, Switzerland. The group staged events and conducted discussions in 18 towns and cities together with other community action groups and representatives of local authorities.

In 2002 the group took their floodwater campaign boat downstream from Cologne to the Rhine delta. Promoting greater awareness about flood issues is not limited to their community or country alone. The group's trips also go through parts of France, Switzerland and the Netherlands. The group cooperates closely with the German Committee for Disaster Reduction and the Rhine Emergency Floodwater Organization.

Case: South Africa

A number of public awareness projects are currently underway in South Africa covering a variety of communities at risk. Ukuvuka: Operation Firestop aims to reduce the risk from wildfires in the Cape Peninsula. The campaign was launched in the Western Cape Province in February 2000 after fires burned land along Table Mountain behind Cape Town.

Box 4.32
Tsunami in Papua New Guinea

Papua New Guinea (PNG) is highly susceptible to tsunamis because of its topographical conditions and the frequency of earthquakes and volcanic activity in the surrounding seas.

In 1998, an earthquake measuring seven on the Richter Scale occurred, with the epicentre only 30 kilometres from the coast of north-west PNG. The resulting tsunami struck coastal villages of the Aitape region almost immediately claiming more than 2,200 lives.

While tsunamis are not new to PNG, lessons learned from previous experiences were not passed on to new generations. People knew little about the imminent threat of tsunami hazards. Many residents who felt the earthquake did not seek refuge from the tsunami immediately and this contributed to the many casualties.

At the request of PNG authorities, the Asian Disaster Reduction Center (ADRC) in Kobe, Japan agreed to transfer Japanese experience to local communities in PNG. ADRC produced posters and pamphlets in English and local languages with many pictures and illustrations. They distributed them to residents and school children living in coastal areas.

The information was also used and distributed by the PNG Red Cross. The lesson to beware of tsunamis following an earthquake and to seek refuge on higher ground has since spread to more people in the country.

In 2000, an earthquake measuring eight on the Richter Scale occurred off the PNG coast. While it created a tsunami that destroyed thousands of houses, there were no deaths. ADRC continues to work in this area following its commitment to provide guidance to neighbouring countries with similar problems.

Source: ADRC, 2001.

The Ukuvuka campaign has a four-year mandate. Its goal is to transfer lessons learned about conservation and biodiversity and to pass on these lessons to other communities. The primary objective is to protect the land and vegetation by controlling alien plant species and by rehabilitating fire-damaged areas.

Elsewhere in South Africa, the Tshwane Metropolitan Council embarked on a risk reduction campaign in urban communities. The campaign targets local risks including informal settlement fires, floods, extreme weather conditions, pollution and the spread of disease and HIV/AIDS.

The Western and Eastern Cape Provinces jointly implemented an innovative I-SPY awareness campaign. This programme involved the distribution of information boxes. These small cubes had magnifying lenses placed on either end. Information about reducing community hazards could be seen by looking through the magnifying lens. As the information was depicted in pictures, the messages crossed language barriers.

Case: Nepal

Nepal is one of the most disaster prone countries in the world. As both access and communications are difficult in much of the country, information from the central government about hazards is often difficult to convey. People in remote areas are not easily provided with sufficient knowledge to reduce their immediate risks.

The government of Nepal is now training local leaders to disseminate disaster management information. In 2001, government officials, ADRC and local NGOs conducted training courses for local village chiefs, teachers, scouts and women leaders from 30 villages in ten of the most disaster-prone districts of the country.

The courses addressed the national disaster management system, knowledge about hazard-prone areas and possible countermeasures to reduce risks. Also, a radio broadcast service was utilized for the first time to disseminate disaster preparedness information.

Box 4.33
Riskland, a fun way to learn how to prevent disasters

In 2002, UNICEF and the ISDR Secretariat developed an education kit, consisting basic information related to disasters and risk reduction, along with a set of tools aimed at getting students and teachers involved in this issue in a dynamic and enjoyable manner.

The kit includes also a board game “Riskland”, which refers to disaster prevention through a number of instructive messages. The game helps understand which practices may be effective for reducing the impact of disasters and which are not appropriate and, as a result may lead to an increased vulnerability to disasters. The kit is targeted for children in Latin America and the Caribbean, between 8 and 12 years old, as a complement to any other material that schools may already have.

So far the Riskland is available in 5 languages (English, Spanish, Portuguese, Creole and Nepali), and has been widely disseminated throughout the region and beyond. Several institutions in many countries in Latin America and the Caribbean, such as El Salvador, Mexico, Honduras, Colombia, Chile, Trinidad and Tobago are adapting and reprinting the game for local use in schools and for community activities, workshops etc. <http://www.eird.org>

Box 4.34
Times of Hurricanes

With the objective of disseminating messages on disaster prevention to communities at risk in an interesting and easily understandable way, UN-ISDR, the Pan American Health Organization (PAHO) the International Organization for Migration (IOM) and CEPREDENAC joined forces to produce a radio drama series, Tiempo de Huracanes (Times of Hurricanes).

Conveying important messages on hurricanes and disaster reduction, the drama consists of four different stories which are divided into 20 chapters of 30 minutes each. These carry the listener through the issues of what could happen before, during and after a natural hazard such as a hurricane or flood. It looks at the consequences of not being prepared and how negative impacts may be reduced through preparation and awareness.

It also analyses the roles which men and women play in society and what can be done to increase community capacity to prevent negative impacts of disaster situations. In addition to the main topic of disaster management, stories also cover topics related to health, gender and migration, to mention the most important ones.

Since early 2002, the radio drama Times of Hurricanes has been widely publicized and played by radio stations throughout Central America and Mexico as well as in South America (Venezuela, Ecuador) and the Caribbean (Cuba, Dominican Republic).

Starting on 9 October 2002, in observance of the International Day for Disaster Reduction, and during the following month, Times of Hurricanes was broadcast by 46 radio stations throughout Central America, including those in Panama, Costa Rica, Nicaragua, El Salvador, Honduras and Guatemala.

The campaign was coordinated by a Costa Rican NGO called Voces Nuestras, in collaboration with the regional network of local radio stations, Centroamerica en Sintonia, and with financial support from ISDR, PAHO and IOM. In June 2003, 86 local radio stations through out the countries in Central America started the re-broadcast of the Times of Hurricanes, just at the beginning of the hurricane season.

The production has been a huge success in communities throughout the region and requests keep coming in for producing more of these kinds of radio series. In response to this, the ISDR Secretariat in collaboration with PAHO, CEPREDENAC and UNDP produced a new series “Tremors in my Heart”, on topics related to earthquakes, volcanic eruptions and landslides. Tremors in My Heart was launched in October 2003. <http://www.eird.org>

In the Spotlight: Radio Progreso, Honduras

Radio Progreso was one of the 46 radio stations that began broadcasting the radio drama on the International Day for Disaster Reduction in October 2002. Every Saturday afternoon, the residents of La Guacamaya, a small township in north-eastern Honduras gathered in community buildings, neighbour’s homes, at the football field, or anywhere where they could listen to the latest chapter of the radio drama Times of Hurricanes.

La Guacamaya is located between two creeks that were completely harmless before Hurricane Mitch struck Central America in 1998. After several days of rain, they overflowed causing landslides that destroyed over 200 of the town’s 300 homes. Luckily the mud and other debris fell relatively slowly, giving residents the time to flee. After Hurricane Mitch, residents formed groups to tackle immediate basic needs: food, shelter, and drinking water.

A similar approach has been employed in Asia where the Sri Lanka Urban Multi-Hazard Disaster Mitigation Project of the Asian Urban Disaster Mitigation Programme and the Asian Disaster Preparedness Center has produced a television drama about disaster reduction called, Of an Event Foretold.

Future challenges and priorities

Public awareness

Effective public awareness requires sustained activities in several areas. Following are some priorities for the future:

- official policies that promote the value of disaster risk reduction;
- the use of public education and professional training as primary tools;
- establishing closer partnerships between disaster managers and the media;
- gender-sensitive public awareness campaigns;
- increasing the value of public events; and
- using multiple interests to publicize risk issues.

Official policies that promote the value of disaster risk reduction

Authorities and local leaders have a responsibility to provide information and the means to ensure public security. There is considerable scope to inform and advise the public about hazards and the risks they pose.

Local communities must be involved in the dissemination process as well as being the recipients of information. Political support is equally important if sustained financial allocations are to be ensured for public awareness.

Using public education and professional training as primary tools

As there are few specialized courses currently devoted to disaster risk management issues alone, there is a challenge for education authorities as well as professional training institutions to develop these programmes. There are efforts being made to introduce more risk issues into the training of professionals such as engineers, meteorologists, urban planners and physical scientists.

There are many additional areas of instruction such as environmental management, public administration, geography, and most of the social sciences which have not typically regarded risk awareness as part of the syllabus. This should change.

Learning about natural hazards must begin in school. As important institutions in most local communities, schools and educators can serve an important role in motivating students to become involved in exercises, public discussions and other activities that promote disaster reduction outside the classroom.

Establishing closer partnerships between disaster managers and the media

There is a need for more frequent and better-informed media coverage about risk reduction before a disaster occurs. However, if the community itself were to become more interested in this subject, the media would reflect this interest. Risk reduction programmes should involve media representatives, ensuring a well informed and concerned media. It is vital that disaster managers and journalists interact regularly, in particular, before a disaster occurs, in order to lay the groundwork for effective working relationships in the aftermath of a disaster.

By becoming more familiar with each other's work, disaster managers and journalists can join forces to ensure appropriate messages reach audiences, as well as allowing for effective and widespread

dissemination. Rather than employing sensational media coverage techniques showing shocking images of human emergencies in order to draw international aid, it is important for the media to report on how people actually live with risk from day to day.

Gender-sensitive public awareness campaigns

Anecdotal evidence suggests that women are typically the most affected by disasters, often due to cultural norms that constrain their access to disaster information and emergency warnings. However, it is important to note that women are not only victims but are also agents of change. By working together, women and men can identify those hazards that threaten their lives and livelihoods and commit to building safer communities.

In many cases women are in the valuable position within communities for advocacy, initiating and promoting grassroots disaster reduction initiatives. If women are neglected as a target audience, they are unable to participate in minimizing risks associated with daily activities. For example, if women are excluded from the issuance of a warning of an imminent cyclone, they are unable to make preparations to evacuate the area with their family members in addition to the essential assets required to survive.

Increasing the value of public events

Special commemorative events have a useful role in raising the visibility of natural hazards and reflecting on the consequences of earlier unmitigated disasters. But they are no substitute for more substantive commitments to build public awareness. It is important that additional activities be pursued on an ongoing basis, so that public interest does not fade after the special event.

Using multiple interests to publicize risk issues

One of the biggest challenges in promoting risk awareness is to remove the subject from the sense of crisis or trauma that ordinarily accompanies it. Disaster risk reduction is not an emergency service. Rather, it should be considered as one of the daily concerns of people where they live and work.

Chapter 5

A selection of disaster reduction applications

This chapter discusses different applications of disaster risk reduction, as outlined in the graphic representation presented in chapter 1. These efforts become possible once risk assessment and institutional capabilities are set in place. The selection of disaster reduction applications discussed in this chapter serves to illustrate the scope of activities and applications in the field and highlighting their strengths and weaknesses.

5.1 Environmental management

A healthy environment enhances the capacity of societies to reduce the impact of natural and human-induced disasters, a fact largely underestimated. As disasters undermine both socio-economic development and environmental management efforts, there is a compelling need to explore how environmental mismanagement changes hazard and vulnerability patterns.

Knowledge about natural resources and the use of environmental management should be promoted as a strategy for reducing risks. Environmental actions that reduce vulnerability need to be identified and applied by disaster reduction practitioners. Quantitative measurement of these actions will determine their acceptance and application in political and economic arenas.

Integrating environmental management within existing disaster reduction policy frameworks and international strategies will build a safer world. National and regional institutions can best increase societies' resilience to disasters as part of a global environmental management effort. Instilling disaster reduction thinking into environmental performance is a positive proposition.

This section will outline the following:

- *links between environmental management and disaster reduction;*
- *environmental legislation;*
- *environmental policies and planning;*
- *institutional and organizational arrangements;*
- *environmental impact assessments;*
- *reporting on the state of the environment;*
- *ecological and environmental economics; and*
- *environmental codes and standards.*

Links between environmental management and disaster reduction

The environment and disasters are inherently linked. Environmental degradation affects natural processes, alters humanity's resource base and increases vulnerability. It exacerbates the impact of natural hazards, lessens overall resilience and challenges traditional coping strategies. Furthermore, effective and economical solutions to reduce risk can be overlooked.

Practices that protect the integrity of nature and ensure a wise use of natural resources can provide solutions to reduce vulnerability from which both the environmental and disaster communities will benefit.

Although the links between disaster reduction and environmental management are recognized, little research and policy work has been undertaken on the subject. The concept of using environmental tools for disaster reduction has not yet been widely applied by practitioners.

Hurricane Mitch highlighted in dramatic fashion the indispensable role of environmental management in sustainable development and natural disaster mitigation. Environmental management tools that make a cost-effective contribution to reducing vulnerability should be identified, adapted and adopted.

Environmental management can become a cost-effective tool for disaster reduction while serving many other objectives including conservation of biodiversity, mitigation of adverse global environmental changes and poverty alleviation.

Similarly, the Ministry of Natural Resources of the Russian Federation recognizes its present

Box 5.1
An eco-museum as a tool for disaster reduction

The six towns severely affected by the 2000 eruption of Mount Usu, Japan initiated the development of an eco-museum in order to focus people's attention on the damages in agriculture, forestry, fishery and tourism. The eco-museum, to be completed in 2005, will cover the entire affected area. Its aim is to teach the population how to "live with the volcano".

The objectives of the eco-museum include:

- Stimulate tourism and industries in the region.
- Preserve artefacts and recollections of volcanic events.
- Teach history, nature and culture of the area to inhabitants and visitors.
- Introduce disaster reduction activities to inhabitants and visitors.
- Involve inhabitants in development plans.
- Promote cooperation between communities.

difficulty to integrate environmental management in natural disaster reduction policies especially in water management to reduce flood risks.

Environmental actions that reduce vulnerability are seldom promoted in disaster reduction strategies and usually appear only as a beneficial but unplanned side effect. But these activities will add to the options for disaster reduction. Widely disseminating examples of their application to relevant actors will encourage their use.

At present, environmental management tools do not systematically integrate trends in hazards occurrence and vulnerability. Similarly, disaster reduction practitioners do not systematically explore the advantages of using environmental management tools and approaches. Some benefit might be drawn from the fact that environmental tools were developed from a risk management approach. Indeed environmental and social impact assessment processes are geared towards risk identification in the design of plans and projects.

The disaster and environment communities will benefit from efforts to use similar language and approaches. Research work on disaster reduction can benefit from experience gained in integrating environmental concerns in decision-making and development planning. Once tools and policies are developed, capacities will need to be built locally to respond to environmental vulnerability and use environmental management as a means of reducing impacts. In this regard, lessons learnt in the field of women's use of environmental resources as it relates to disaster reduction need to be taken into account.

The World Conservation Union (IUCN) and the International Institute for Sustainable Development (IISD) with the support of the Stockholm Environment Institute (SEI) have launched an initiative to promote the use of environmental management to reduce the vulnerability of communities to the growing threat of climate change and climate-related disasters. It serves as an important step to translate the intuitive recognition of the protective function of natural systems into useful methods for practitioners.

There is a need to put into practice the ninth principle of the Yokohama Strategy: "environmental protection, as a component of sustainable development and consistent with poverty alleviation, is imperative in the prevention and mitigation of natural disasters".

The protective roles of particular ecosystems are known. For example, important wetland functions include water storage, storm protection, flood mitigation, shoreline stabilization and erosion control. These functions are essential for sustainable development and decrease reliance on often more expensive technical alternatives. However, such benefits from wetlands are under threat from natural disasters including storms, drought and floods which will be further exacerbated by climate change. Therefore, the relationships between

Ecosystems are interdependent networks of organisms of a naturally defined eco-zone that function as a unit. Examples include natural forests, wetlands, deserts, lakes and mountain regions. The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Thus, the application of the ecosystem approach will help to reach a balance of the three main objectives of sustainable development: conservation, sustainable use and the fair and equitable sharing of the benefits arising out of the utilization of resources.

Box 5.2

Lessons learnt from Hurricane Mitch

"So far, relatively little is being channelled to attack the root causes of vulnerability, or to contribute to the non-structural mitigation of disasters through sound environmental management, integrating regional and integrated territorial planning at a scale that goes beyond individual plots or local communities.

"For these issues to be addressed there is a need to integrate risk management into environmental policy. How do healthy ecosystems contribute to abating risk? What has been the environmental impact of land concentration, misuse of wetlands and massive deforestation?

"Finally, the long term environmental security of Central American societies will depend to a significant degree on the capacity for adaptive and cross-scale in situ management of key buffering ecosystem functions. More applied research is needed on the linkages between local forest management practices and their effects on hazard mitigation.

"There are encouraging initiatives which seek to contribute to more secure human livelihoods through empowering local communities to manage risk locally. There is a growing interest in the restoration of key forest ecosystems, geared to providing local communities with more adapted livelihoods and a secure environment. Mitigation is best applied locally, but requires adequate linkages into the policy sphere to guarantee the long-term governance of the region.

"The new quadrennial programme proposed by the IUCN, provides a key framework in which to apply these ideas to the Central American context. The post disaster context is ripe for proposing innovative approaches to disaster prevention and mitigation."

Source: P. Girot, World Conservation Union, 2001.

climate change and wetlands deserve more attention by policy makers.

Wetlands also suffer from increased demand on agricultural land associated with population growth, infrastructure development, and river flow regulations, invasion of alien species and pollution.

Adaptive capacities of ecosystems to absorb sudden shifts in climatic, geological or biological components are key features in increasing disaster resilience. In this regard, traditional societies have great adaptation capacities to cycles of environmental change.

Living with flood strategies are cost-effective, relatively easy to implement and more compatible with the environment, and can more easily be incorporated in long-term development planning at little extra cost.

Global environmental issues and disaster reduction

Climate change

Consequences: extreme weather events, changes in boundaries, structure and functioning of ecological systems (forests), food security, water availability, sea-level rise.
Solutions: reforestation, adaptation programmes, disaster preparedness, early warning.

Loss of biological diversity

Consequences: loss of natural resources and diversity, interfering with essential biological functions such as regulation of water runoff, control of soil erosion, loss of resilience to disturbances and environmental change.
Solutions: conservation and restoration (forestry, agriculture, coastal zone management).

Freshwater degradation

Consequences: water quality and scarcity, droughts, health risks, economic impact of land degradation on water resources, increase in floods associated with poor land use.
Solutions: water resources management, land-use management.

Desertification and land degradation

Consequences: improper resource use, food security, loss of ecosystem productivity.

Box 5.3
Environmental systems contribute to disaster reduction and security

Maintaining and rehabilitating resilient environmental and social systems form key building blocks for disaster reduction and security. The fire and smoke episodes of 1997-1998 in South-East Asia, the Russian Federation, the Americas and the Mediterranean helped focus attention on an increasing problem. These episodes were associated with the extreme drought caused by the El Niño event which created conditions for the escape and spread of uncontrollable wildfires.

While some fires were deliberately set to cover up illegal logging, many were intended to convert forest to other land uses. Small farmers, plantation and timber companies, government settlement schemes and subsidy policies were all responsible to some extent of the resulting losses and damages. Better knowledge and monitoring are necessary to distinguish well-balanced natural fires beneficial in maintaining land-use systems from those fires which adversely affect local communities' livelihoods and habitats. Basic structural improvements, accompanied by legislative, economic and technical improvements are needed to make physical infrastructure, natural and human systems and water management more resilient.

Solutions: early warning and drought preparedness and management, alternative livelihood programmes, sustainable land and natural resource management programmes, natural environment and development planning.

Forests play an important role in protecting against landslides, erosion, floods and avalanches. They also safeguard against drought. As shown in Switzerland, continuous care given to forests including rejuvenation, careful diversification of species and structural stability ensure an optimal protective role, and also save money from disruptions caused by natural hazards.

The Yangtze River floods in 1998 showed the consequences of the loss of healthy ecosystems. As a consequence, the Chinese government banned logging in the upper watershed and increased reforestation efforts and prohibited additional land reclamation projects.

China carries out flood prevention and water resources protection as a means to lessen the impact of landslides and floods. In southern parts of France wetlands restoration is used as a means to reduce flood risks linked to decreasing agricultural practice. Related projects involve methodological development and evaluation, taking into account complex environmental and social fluctuations. Barrier islands, reefs and mangroves contribute significantly to the mitigation of hurricane risks, storms and tidal surges.

Sound watershed management that combines the protection of parks, reforestation, sustainable forestry and agricultural practices is critical to protect downstream communities, agricultural lands and infrastructure.

Environmental services provided by integrated watershed management must be recognized when making policy and investment decisions. This becomes even more important in light of the international or interprovincial nature of river basins.

Environmental legislation

In its chapter on integrating environment and development in decision making, Agenda 21 notes, "laws and regulations suited to country-specific conditions are among the most important instruments for transforming environment and development into action". <http://www.un.org/ esa/ sustdev/documents/agenda21/english/ agenda21toc.htm>

Legislative responses to environmental problems testify to countries' appreciation of the adverse impacts of environmental degradation on socio-economic systems. Many developing countries have by now adopted legislation dealing with a broad range of issues including protection of water resources or biodiversity conservation.

Framework environmental legislation mostly deals with cross-sectoral issues. This includes establishment of environmental standards, the use of economic instruments for environmental management, environmental impact assessment procedures, public participation, education and institutional coordination.

These statutes and basic environmental laws helped overcome the organizationally fragmented and uncoordinated approach to environmental management.

The China National Wetlands Conservation Action Plan finalized in 2000 is an example of a specific environmental legislation supporting disaster reduction.

Box 5.4
Environmental laws and institutions

- Constitutions (environmental component)
- Institutions (national and sectoral)
- Environmental action plans: national or regional, local (Local Agenda 21), sectoral (biodiversity, desertification, climate), specific national goals and targets (where available)
- Legislation – including environmental acts and laws on environmental impact assessment (EIA)
- Command and control measures (standards, bans, limits, permits)
- Mechanism for monitoring and enforcing legislation
- Non-binding guidelines, voluntary codes of conduct (ISO 9000 and 14000)
- Greening operations at governmental level
- Environmental litigation and judicial interventions
- Mechanisms for tracking impact and progress (environmental performance)
- Bilateral and multilateral agreements (e.g. Mekong River Commission, Southern African Development Community protocol on shared waters, UN Convention on Biological Diversity, UN Framework Convention on Climate Change, UN Convention to Combat Desertification)
- Ratification and implementation of international agreements
- Regional environmental and sustainable development bodies and organizations (e.g. South Pacific Regional Environmental Programme, Caribbean Conservation Authority)
- Financial mechanisms
- Transboundary environment laws (e.g. concerning international waterways, UN Law of the Sea)
- Trade policies (e.g. trade agreements, World Trade Organization policies and regulations on the sustainability of resource use)

More than 65 developing countries have adopted such legislation since the 1970s. A continuing process of legal and institutional innovation shows a commitment towards sustainable development. It also provides a vehicle for disaster reduction strategies.

National environmental laws provide some direction for the implementation of environmentally sound disaster reduction planning. Ways should be explored to ensure that environmental laws and disaster reduction strategies are mutually supportive.

Disaster reduction specialists should be encouraged to anticipate environmental requirements under applicable laws and to design projects that address these requirements, coordinating closely with environmental institutions.

The objective of environmental laws also could address the requirements of disaster reduction explicitly by reinforcing the protection of those natural ecosystems that have a protective function. In this spirit, Bolivia is harmonizing its environmental act with its risk reduction and disaster response act.

The existing body of multilateral environmental agreements provides a good basis to enhance options for disaster reduction. Among these are the Ramsar Convention on Wetland Preservation, UN Framework Convention on Climate Change, UN Convention to Combat Desertification, and the UN Convention on Biological Diversity. These legal instruments are negotiated at the international level but are implemented through national policies, strategies, action plans and laws.

Existing legal instruments and ongoing work with sustainable mountain development are also pertinent to disaster reduction. For example, the alpine convention of 1989 places some emphasis on natural hazards and addresses land-use planning, soil and landscape conservation, water management, forests and farming.

Specific obligations to reduce the impacts of natural and human-induced disasters, including land-use planning, watershed management, and early warning, are foreseen in future regional mountain ecosystem agreements.

Disaster reduction goals can also be integrated into non-binding instruments

Box 5.5
The World Conservation Union in Central America

The World Conservation Union (IUCN) has worked throughout Central America to help in risk reduction and to coordinate with risk specialists in promoting project activities linked to environmental protection.

The promotion of synergies between multilateral environmental conventions has led to greater appreciation of the close relationships that exist between efforts to promote community adaptation, resilience to the natural environment and to reduce the risks of disasters.

A forum organized by the ministry of the environment in El Salvador in October 2001 was built around these concepts. It sought to achieve more common understanding and to explore opportunities by which adaptation practices could be applied in different zones of the country.

such as regional strategies for biodiversity. In this regard, the New Partnership for Africa's Development (NEPAD), an initiative to promote the socio-economic development of Africa, deserves attention. Its draft programme of action includes six priority areas: land degradation, desertification and drought, wetlands, climate change, cross-border conservation and management of natural resources.

Environmental policies and planning

As in the case of environmental legislation, environmental and disaster reduction policies need to be mutually supportive as part of the sustainable development agenda.

The critical gap between macroeconomic policy-making and environmental hazard considerations needs to be addressed. Sustainability and long-term benefits will result from integrating hazard thinking into decision-making related to environmental practices.

The characteristics of disaster reduction and environmental policies are similar. Both must meet local needs and sustainable development requirements and produce multiple benefits. Both rely on extensive participation of the public, relevant sectors and stakeholders.

Designing a national environmental action plan is a standardized process that is widely used. Some of the features of integrated environmental and disaster reduction policies include:

- assessment of environmental causes of hazards occurrence and vulnerability;
- assessment of environmental actions that can reduce vulnerability;
- assessment of the environmental consequences of disaster reduction actions;
- consideration of environmental services in decision-making processes;
- interdisciplinary approaches that will ensure the use of natural and social sciences in disaster reduction planning and decision-making;
- partnerships and regional approaches to land use and nature conservation;
- reasonable alternatives to conflicts concerning alternative uses of resources; and
- advice and information to involve actors in enhancing the quality of the environment.

Water policies such as water pricing and hydropower regulation offer examples of environmental policies with beneficial impacts on disaster reduction. They can be designed to promote the sustainable use of water and allow adjustments depending on seasonal forecasts, in order to avoid floods.

Water policies promote work to be undertaken on wetlands, floodplains and open spaces to store or to facilitate runoff. Furthermore, flood and drought risk management are increasingly looked at in the context of water resources and therefore depend on effective international water management.

Policies promoting sustainable management of fuel wood and the development of alternative sources of energy can reduce deforestation and contribute to controlling flood, avalanche and landslides.

Programmes undertaken as a result of commitments under international biodiversity, climate change and desertification conventions will also reduce vulnerability through enhanced natural resource management. In this regard, it will be important that climate change response measures in the energy sector take disaster vulnerability into account.

Box 5.6

Disaster reduction strategies – tools to adapt to climate change

The risk reduction process provides a framework for selecting the best strategies to deal with those aspects of climate change that create or increase a risk to infrastructure, operations, economies or populations. It is a decision-making tool that assists in the selection of optimal or the most cost-effective strategies, using a systematic, broadly accepted public process.

Disaster reduction offers a way to address some of the economic, social, political, technological and institutional constraints to realize the full potential of adaptation to climate change.

Reducing vulnerability to today's climate variability and hazards is an opportunity for no-regrets adaptation to climate change that addresses extreme events. Mutually beneficial and no-regrets risk reduction measures include:

- early warning systems, seasonal climate forecasts and outlooks;
- insurance and related financial means;
- building codes, designs and standards (construction on stilts, redesign of oil rigs);
- promotion of renewable energy sources as mitigation and vulnerability reduction options;
- land-use planning including relocation incentives;
- flood-resistant agricultural practices;
- water management including regional water-sharing agreements, drainage facilities, flood prevention;
- environmental management (beach nourishment, mangrove belts, wetland and watershed protection, forest and agricultural land management);
- coastal zone management; and
- disaster management precepts, upstream vulnerability reduction, information, awareness, networking, reducing uncertainty for decision-making.

The disaster reduction community should take advantage of the body of knowledge existing in the climate change adaptation community. It should also translate its policies and measures for use by that community. Recognition of the inherent links between climate change and disaster reduction will eventually benefit practitioners in both fields.

The disaster reduction and climate change policy agendas cannot remain separated. Therefore several activities, such as the side events conducted in conjunction with meetings on the climate change convention (New Delhi, October 2002 and Bonn, June 2003) have been initiated by the ISDR Secretariat, to bridge the gap between the two communities.

At the Bonn meeting, the concept of a multi-stakeholder process to assess and report on the linkages between disaster reduction and climate change was launched. The involvement of disaster reduction scientists in the next Intergovernmental Panel on Climate Change assessment in 2007 is also being promoted.

Key partners in these activities include: the Intergovernmental Panel on Climate Change; the UN Framework Convention on Climate Change; the Netherlands Red Cross Centre on Climate Change and Disaster Preparedness; the Dialogue on Climate and Water; ProVention Consortium; the IUCN/IISD/SEI project on climate change; vulnerable communities and reinsurance companies, and the World Climate Impacts Programme.

The relationships between market prices, trade policies and the environment are complex. Trade policies based on sound environmental consideration can also contribute to reducing disaster impacts.

National environmental policies can increase communities' resilience by encouraging voluntary contributions and other social contracts. Leasing land, placing it in trust, land-use covenants and tax incentives are some mechanisms that can promote natural capabilities to reduce vulnerability.

The following examples illustrate how several countries and regions in the world include natural disaster reduction in national environmental action plans.

One of the ten programmes, Haiti's national environmental action plan deals with natural disaster management. It is based on a decentralized and participatory approach to planning that includes NGOs, the private sector and bilateral and multilateral donors.

Jamaica gives very high priority to climate change and sea level rise and natural disasters in the implementation of the Small Islands Developing States (SIDS) programme of action.

The Caribbean Planning for Adaptation to Global Climate Change, funded by the Global Environment Facility and executed by the Organization of American States, is one of the most important climate change initiatives in the Caribbean.

Box 5.7
Environmental management and hazard reduction integration

Although the Dominican Republic's national environmental policy reform does not explicitly address natural hazard vulnerability, it perfectly matches hazard mitigation concerns. Its development objective is to establish the basis for improved environmental management by defining environmental policy reforms and elaborating a national environmental management programme. Primary concerns include curbing deforestation and degradation of watersheds and coastal zones.

Saint Lucia's Integrated Watershed Management Project was initiated in 1994 in response to damages resulting from floods and landslides related to tropical storm Debbie. Apart from pursuing structural rehabilitation, it also supported the formulation of a watershed management plan. This integrated project has served as the basis for more integrated and sustainable development of key watersheds and strengthened the government's capacity in environmental management and flood preparedness.

Both projects are supported by the World Bank.

It supports the development of a policy framework for integrated management and cost-effective response to the impacts of climate change, incorporating tools such as disaster contingency planning.

In 1999, FAO developed a plan of action aimed at helping SIDS meet the challenges of economic change, environmental degradation and natural disasters. The programme focuses on agricultural trade, intensification and diversification of agriculture, fisheries, sustainable management of land, water and forestry resources and strengthening national institutions.

The plan aims at improving disaster preparedness by promoting measures to reduce the impact of hurricanes and cyclones on agriculture and coastal fisheries. It also helps countries assess their national meteorological and hydrological services and support early warning systems. A review of its implementation has identified emerging needs and constraints which will be discussed at a SIDS conference planned for 2004.

The South Pacific Regional Environment Programme (SPREP) has, for many years, incorporated disaster-related activities into its programme as part of its mandate to manage the shared environment of the Pacific region.

Most activities have been part of the Regional Climate Change Work Programme which emphasizes the impact of extreme weather in the Pacific region and the relationships between climate change and natural disasters. SPREP is also implementing the Pacific Island Climate Change Assistance Programme which focuses on vulnerability assessment and adaptation.

In order to realize the full potential of the resources in the region, SPREP collaborates with other organizations to expand its role in assisting Pacific SIDS to integrate disaster management, sustainable development and sound environmental practices into national planning strategies.

Another SPREP project is the Integrated Coastal Zone Management in the Pacific Islands, which includes hazard mapping and the development of disaster reduction strategies for coastal areas.

The Sub-Regional Action Programme to Combat Desertification (SRAP) in West Africa and Chad provides a strategic and programmatic framework for integrating disaster reduction and management into poverty reduction, environmental protection and sustainable development planning in the area.

Two of the eight priority areas of SRAP focus on enhancing sustainable management of shared

Box 5.8
A project in Bangladesh serving the environment and disaster reduction

Undertaken by the Bangladesh ministry of environment and forest, the Bangladesh Coastal Greenbelt Project seeks to:

- prevent loss of life and damage to property by cyclones, storms and associated tidal surges;
- protect and improve the coastal environment through increased vegetation;
- help alleviate poverty by generating income through increased tree cover and related activities;
- increase forest resources;
- increase coastal embankment stability;
- establish industries based on forest plantation;
- increase multiple uses for land; and
- create popular awareness about sustainable forest management.

Source: Bangladesh State of the Environment Report, 2001.

Box 5.9
Watershed management for disaster vulnerability reduction

Watersheds are necessary for agricultural, environmental, and socio-economic development. The physical and biological resources of watersheds provide goods and services to human populations, including water protection, attenuation of natural disasters by regulating runoff, protection of coastal resources and fisheries, protection of the environment and protection of productive lowlands. Watershed management programmes need to build on existing environmental initiatives.

The following elements are required for successful watershed management:

- No permanent structures should be located in floodplains.
- All watercourses should have buffer strips.
- Intensive agricultural activity should not to be permitted on slopes greater than a specified percentage reflecting land capacity.
- Clear cutting of forests should be limited with forest conservation and sustainable forest management stressed.
- Institutional body should be formally established to address conflicts.
- Public participation of both men and women should be stressed in management decisions.
- Effective management plans and enforcement of environmental and zoning regulation are critical.
- Regional environmental impact assessments are needed to ensure that cumulative impacts of economic activities are sustainable.

The following elements are impediments to comprehensive watershed management:

- Inadequate economic valuation of environmental services.
- Inadequate institutional structure and appropriate land-use practices.
- Inattention to socio-economic issues contributing to poverty, a degraded environment and natural disaster vulnerability.

Several actions are needed to implement watershed management activities:

- Strengthen municipal authorities and their capacity to address land use and watershed management issues.
- Establish a national management strategy.
- Support sound land-use planning.
- Ensure public participation in watershed planning and ecosystems protection, including gender concerns.
- Support policies and market-based incentives that favour reforestation and sustainable forestry on steep upper watersheds.
- Promote participation of private sector through the climate change clean development mechanism.
- Require downstream beneficiaries to pay for watershed services.
- Support critical watershed protection and restoration of key ecological systems to mitigate disaster impacts.
- Support local NGOs to clarify land tenure issues and facilitate access to land property by rural farmers.
- Establish international watershed management frameworks.
- Pursue a research agenda incorporating economic valuation of environmental services, innovative financing, analysis of the relationship between land use and environmental management and the magnitude of losses from natural disasters.

Source: Watershed management for hurricane reconstruction and natural disaster vulnerability reduction, USAID, 1999.

water, plant and animal resources. Furthermore, SRAP provides guidelines for desertification control policies, strategies and actions at the subregional and national levels. In addition, it provides a framework for cooperation between various intergovernmental organizations, such as the West Africa Economic and Monetary Union, the Permanent Inter-State Committee for Drought Control in the Sahel and the Niger Basin Authority.

Institutional and organizational arrangements

Environmental policies require coordinated organizational structures for their successful implementation. The creation of new ministries responsible for the environment and of high level interministerial advisory councils is still relatively recent, having begun after the UN Stockholm Conference on the Human Environment in 1972.

Almost all Caribbean countries have strengthened their environmental administrative capacities and are integrating environmental considerations into physical planning.

Today, environment ministries exist in some 23 African countries and 11 Asian countries. Environmental functions are sometimes performed by other ministries such as housing, planning, construction, land use, agriculture and forestry. Coordinated organizational arrangements minimize fragmented sectoral approaches.

Environmental management requires cooperative solutions, cutting across many disciplines and sectors. These involve community groups, NGOs, the private sector, governmental institutions, the scientific community and international organizations, as does disaster management. Therefore organizational frameworks in place for environmental issues can be expanded to serve the needs of disaster risk reduction as part of sustainable development planning.

Integrating environmental considerations in other policy domains could save resources. This would require linking work in science, policy, environment and vulnerability reduction. Implementation of sustainable risk reduction measures requires appropriate macro-planning to establish the critical links between policy objectives and field performance.

Intergovernmental programmes and networks focusing on environmental and global change issues can achieve integration and links. An example exists in South Asia with the South Asia Cooperative Environment Programme based in Colombo, Sri Lanka. This intergovernmental organization promotes and supports protection, management and enhancement of the environment in the region. It was established in 1982 by the governments of South Asian countries including Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka.
<http://www.sacep.org>

The Asia-Pacific Network for Global Change Research (APN) based in Kobe, Japan is another intergovernmental network dedicated to greater collaboration in the shared interests of industrialized and developing countries in matters related to global change Its primary purposes are to foster global environmental change research in the Asia and Pacific regions, to increase the participation of developing countries in research, and to strengthen links between the science community and policy makers in matters of global change.

Box 5.10
El Salvador Ministry of Environment and risk reduction

The impact of Hurricane Mitch in 1998 and the earthquakes in El Salvador in 2001 led to an increased awareness at the El Salvador Ministry of Environment about the relationship between development, the environment and disasters.

Favourable experience of collaboration among local community associations and NGOs in the Lower Lempa Valley Risk Reduction Project provided organizational precedents for more direct involvement by the Ministry in risk and disaster matters.

Following the 2001 earthquakes, it convened a committee of national and international experts to consider the creation of a new technical agency to deal with risk management issues. The National Service for Territorial Studies (SNET) was created in 2001 as an autonomous government agency with an annual budget of about US$ 2 million.

SNET has four divisions, three of which relate to monitoring the country's geology, hydrology and meteorology. This is the first time that these disciplines have been housed in the same institution in El Salvador. The fourth division deals with integrated risk management issues and develops vulnerability and risk scenarios.

SNET breaks with the tradition of adding risk reduction issues to existing emergency disaster response or civil defence plans. By expanding on the experience of the National Institute for Territorial Studies in Nicaragua, SNET may represent a first step towards establishing a comprehensive risk management system that can serve as a model for other countries. Guatemala has recently requested a feasibility study to consider a similar approach.

Another project, financed by the Inter-American Development Bank (IADB) in the Dominican Republic, is currently considering a far greater role for the ministry of the environment which already has legal authority to act in the area of land use and disaster reduction.

APN activities are decided by an annual intergovernmental meeting, and are supported by a steering group and a scientific planning group. APN member countries include Australia, Bangladesh, Cambodia, China, Fiji, India, Indonesia, Japan, Lao People's Democratic Republic, Malaysia, Mongolia, Nepal, New Zealand, Pakistan, Philippines, Republic of Korea, Russian Federation, Sri Lanka, Thailand, United States and Viet Nam.
<http://www.apn.gr.jp/>

Multi-stakeholder processes (MSPs) are one of the recent innovations to promote dialogue to achieve sustainable development. This dialogue model was initiated in 1998 by the UN Commission on Sustainable Development and has since been adopted by other international forums.

MSPs aim to unite interested parties in communication and decision-making based on equality and accountability. They are also based on principles of transparency and participation, developing partnerships and strengthening networks.

During the preparations of the World Summit for Sustainable Development in 2002, stakeholders came together to work out their contribution to the implementation of the sustainable development agenda. Major inputs that fed into one of the ISDR background papers were drafted through multi-stakeholder electronic forums. The added value of a multi-stakeholder approach ensures an increased sense of ownership and commitment for collaborative actions plans.

Box 5.11
Viet Nam's national plan for the environment and sustainable development

The Vietnamese plan for the environment and sustainable development provides a good example of a comprehensive framework to address environmental planning and management that integrates disaster planning and mitigation. It has a wide variety of components including appropriate organizational structures, well-integrated environmental policies at the sectoral level and environmental legislation. Priority projects and programmes address improved methods of data collection and management, environmental impact assessment procedures and monitoring systems.

The mandate of the central environmental authority covers the coordination of disaster management. The plan also identifies opportunities for regional cooperation in environmental management for sustainable development that include disaster reduction, combating the effects of climate change and anticipated sea-level rise, integrated management of watersheds, catchment areas and floodplains through forest management, and soil and water conservation.

Source: Viet Nam national plan for the environment and sustainable development, 1991-2000, framework for action. <http://www.mekonginfo.org/>

Environmental impact assessments

Legislative frameworks for environmental impact assessments (EIA) already exist and require the commitment of governments, aid agencies and civil society. They also depend on carefully maintained monitoring processes.

Risk reduction considerations could be further assimilated into EIA. A more comprehensive EIA could incorporate periodic vulnerability assessments to take into account the dynamic nature of vulnerability.

An expanded EIA process could provide a basis to ensure that proposed initiatives would include considerations of both disaster reduction and environmental impacts. It is also one tool to evaluate the extent to which climate change is relevant to the sustainability of development projects.

Further, it would allow for an assessment of potential problems as well as benefits of disaster risk reduction activities. Investment in mitigation measures needs to be based on an assessment of socio-economic and environmental consequences.

Disaster reduction specialists could use the EIA model to reorient disaster impact assessments so that they become a planning tool. A post-event impact assessment is an assessment of damage that has already occurred and is therefore not part of the planning process. However, the results can feed into future planning. Further collaboration between disaster reduction practitioners and environmental managers can generate better EIA techniques for use in disaster reduction.

A well designed EIA process incorporating disaster risk can be a key to encouraging the private sector and individuals to consider what impacts their own actions have on vulnerability factors.

Box 5.12
Environmental impact assessments

An environmental impact assessment (EIA) is a policy-making tool that provides evidence and analysis of environmental impacts of activities from conception to implementation. An EIA must include a detailed risk assessment and provide alternative solutions. It needs to be thorough and well documented and should provide an opportunity for the public to participate in accordance with the law.

An EIA report usually provides a detailed and rigorous analysis on which authorities can decide whether to approve a proposal and under which terms and conditions. Once a particular project is selected, it is monitored to ensure that conditions for approval are adhered to and that the benefits from the EIA are achieved. Monitoring, implementing and auditing within the EIA process provides feedback to further improvement.

However there is still some way to go before EIA processes are fully mastered. A study carried out by the Southern Common Market in South America (MERCOSUR) on the use of EIA showed that even though all three countries concerned had adopted EIA as a preventive environmental management tool, only Brazil had developed significant experience in this area. Furthermore, every emergency and rehabilitation or reconstruction action should be subjected to environmental impact assessment and documentation. This will avoid the re-emergence of inappropriate pre-disaster conditions.

Examples of disaster reduction concerns being integrated into EIA are scarce. The Caribbean Development Bank (CDB) is asking its borrowing member countries to include disaster mitigation measures in a similar manner in its EIA procedures so as to reduce risks associated with investments in their development projects. Furthermore one activity of the recently established Disaster Mitigation Facility for the Caribbean, a partnership of CDB and the Office for Foreign Disaster Assistance/US Agency for International Development (OFDA /USAID), is the development of guidelines for natural hazard impact assessment and their integration into EIA. CDB will also modify its environmental review guidelines.

In India, the regulation of environmental clearances for port projects requires an EIA report, an environment management plan, a risk analysis study and a disaster management plan. The regulation specifies that the disaster management plan should be prepared on the basis of a risk analysis considering worst case scenarios with respect to specific cases such as oil or chemical spillage, fire, explosions, sabotage and floods. It encourages green buffer zones whenever possible.

As part of its environmental sustainability programme, partnerships to mitigate natural disasters in Viet Nam provide technical assistance for integrating environmental considerations into natural disaster mitigation plans. The relationship between natural disasters and environmental degradation is being studied and guidelines will be produced for the environmental implications of disaster mitigation projects.

Reporting on the state of the environment

As natural resources have the potential to reduce disaster risk, it is vital to have a regularly updated status of the environment, including emerging issues on management legislation and development. Some of the most relevant monitoring and reporting systems include:

- UNEP State of the Environment reports undertaken in the context of periodic Global Environmental Outlooks;
- IUCN environment profiles;
- State of the Environment reports for projects financed by the World Bank and other funding agencies;
- Organization of Economic Cooperation and Development (OECD) environmental performance reviews;
- UNCSD national reporting on implementation of Agenda 21, national assessment reports and country profiles; and
- national communications required by the conference of the parties of the international climate change, biodiversity and desertification conventions.

Reporting is a qualitative assessment tool and provides a framework for policy analysis and decision-making. Reporting facilitates the measurement of progress towards sustainable development.

Box 5.13
The Global Monitoring for the Environment and Security (GMES)

The Global Monitoring for the Environment and Security (GMES) was launched by the European Commission and a group of space agencies, including the European Space Agency for an initial period of 2001-2003.

"The GMES initiative seeks to bring together the needs of society related to the issue of environment and security with the advanced technical and operational capability offered by terrestrial and space-borne observation systems."

In compliance with the goals of the European Research Area, the aim is to deliver to users a high level of technical information about the environment. It also aims to deliver guidelines (e.g. entire risk management operational systems) in order to develop security policies, including sustainable development policies, protection from environmental threats and natural disasters in Europe.

Continuous monitoring of resources and environmental conditions, detection and assessment of changes and hazards, and means for verifying the impact of policies and practices are its three areas of focus. It is seeking to become "the focal point of attention of a range of stakeholders in various fields related to environment monitoring."

<http://gmes.jrc.it>

Efforts of countries to meet their environmental and sustainable development goals are scrutinized in order to improve their performance in environmental management and develop principles, guidelines and effective strategies to set their priorities better.

Natural disaster concerns are prevalent in these reports. Links between environmental management and flood damage are most frequently described. These reports can also provide essential baseline and vulnerability information on which to develop disaster reduction policies.

Existing reporting guidelines could easily be updated to include a requirement to systematically report on the environmental features and resources necessary to reduce disaster risks. The reporting process could also record ways in which societies mitigate risk through cultural adaptation and appraisal of natural resources.

Environmental mapping, in which community members are asked to locate relevant environmental features and resources on a self-created map of their territory, could be used for risk mapping, including social data such as access to resources by specific

Box 5.14
Bangladesh state of the environment report

The Bangladesh 2001 state of the environment report prepared under the aegis of UNEP has a well-developed and detailed section on natural disasters. The report describes in detail the disaster management bodies, their main functions and responsibilities in mitigating the impacts of natural disasters.
It includes the following information:

- general introduction on the types of disasters affecting the country;
- pressures on the environment that exacerbate natural disasters including geographical settings, physical, hydrological and environmental pressures;
- state of natural disasters: floods, cyclones, droughts, abnormal rainfall, hailstorms, lightening, tornadoes, earthquakes and erosion;
- impact of natural disasters: climate change, agriculture, salinity intrusion, fisheries, ecosystems and biodiversity; and
- present and anticipated mitigation responses.

Issue	Pressure/Cause	Impacts	Responses
Flood	Excess flow in monsoon Improper infrastructure development 92% of total catchment area across border Drainage congestion due to river bed siltation Deforestation in upper catchment area	Disruption of communication and livelihood systems Loss of agricultural production Disruption of essential services National economic loss Loss of human lives and biodiversity	Comprehensive Disaster Management Plan (CDMP) Flood Action Plan (FAP) National Water Policy Flood forecast and inundation modelling Dredging of river bed Construction of embankments with sluice gates

groups or household wealth. Community involvement in mapping provides an occasion to discuss resource management issues, particularly with women highly involved as resource users and knowledgeable about indigenous knowledge, social networks and other capacities reducing vulnerability.

The global environmental vulnerability index developed by the South Pacific Applied Geoscience Commission (SOPAC) complements state of the environment reporting. It is a research tool to understand the effects of environmental processes and vulnerabilities, as well as the linkages between environmental vulnerability and human welfare. It is a tool for monitoring sustainable development that will encourage environmental stewardship and risk reduction policies.

Ecological and environmental economics

It is essential to obtain an accurate picture of the socio-economic and ecological situation when assessing a nation's progress in achieving sustainable development. Of the three interactive spheres of sustainable development, the economic considerations remain dominant. Proving that the integration of disaster reduction with sound environmental management makes economic sense is a major challenge. So is the true valuation of the ecological balance needed to enhance the conservation of nature to reduce disaster risk.

Environmental economics utilizes the tools and mechanisms of economics to measure the value and costs of the environment in currency terms. In conventional economic frameworks, natural resources have been considered in terms of their worth for human use. Beginning in the 1970s, economic analyses to quantify socio-ecological factors began to be adapted.

Environmental economics is now moving beyond the interests of only academic research and international organizations. Decision makers worldwide have started to examine ways in which socio-ecological values and costs can be measured and incorporated in economic and political discourse.

There are numerous national models, including the older forms of National Resource Accounts,

Box 5.15
Relevant economic incentives and disincentives

- Tax incentives, subsidies and loans to compensate landowners or discourage certain land uses
- User charges, fees for downstream beneficiaries (domestic water use, agriculture, hydropower, fishery, recreation)
- Transfer of development rights to avoid undesirable development
- Easements, legal agreement to restrict type and amount of development taking place on a property
- Land purchase and property rights, usually restricted for exceptional lands (restricted land leases)
- Fines and liability system for damages caused to human settlements or environmental services
- Pricing structures to discourage unsound use of resources

National Systems for Environmental Accounting and the System for Environmental Economic Accounting.

These tools work to reduce fragmentation and overlap of activities that have often resulted in confused policies towards agriculture, tourism and environmental management. Additionally, they pose innovative opportunities to develop more robust indicators of sustainable development.

Quantifying socio-ecological considerations is a huge challenge for risk reduction and environmental management practitioners alike. It is also a challenge to get these concerns onto the political agenda.

From a practical point of view, grants, funds, loan guarantees and investment partnerships are some of the tools countries can use to promote issues that serve both environmental and disaster reduction goals. Other creative options for funding exist. Penalties used to reduce misuses of environmental resources such as in the case of wetlands destruction are also relevant. However limitations of the "polluter pays" principle have to be quickly overcome.

Money generated by trust funds for eco-services under multilateral agreements can be used in disaster reduction activities. The potential to use creative environmental debt reduction strategies can also be explored. Debt-for-nature swaps are used to protect crucial natural resources and the attributes inherently contribute to disaster reduction.

Innovative thinking to combine debt-for-disaster reduction swaps and debt-for-nature swaps could be initiated. This would help the poorest countries implement disaster reduction activities as part of their poverty alleviation strategies.

In a similar vein, other projects financed by the World Bank introduce the concept of incentive payments to realise a variety of environmental services. In Costa Rica, Colombia, Ecuador, El Salvador and Guatemala, projects have been initiated in the areas of sustainable natural resource management, watershed and forest protection, conservation of biodiversity, reduced vulnerability to floods, improved water quality and reduced sedimentation.

Environmental codes and standards

Coping with environmental and natural hazard risks will require better environmental and disaster risk management. Avoiding economic losses through improved environmental management and performance is possible with the implementation of Environmental Management Systems (EMS) following procedures such as those of the International Organization for Standardization (ISO).

The ISO develops voluntary technical standards which are believed to add value to all types of business, administration and public utility operations. ISO 14000 is a set of generic tools for developing, implementing, maintaining and evaluating environmental policies and objectives. They contribute to making the development, manufacturing and supply of products and services more efficient, safer and cleaner. Organizations establish their own policies, objectives and levels of ambition. These quality standards constitute an approach of responsible care, which combines safety and prevention of technological disasters.

If upgraded to include disaster resistance, standards for EMS could reinforce business imperatives by demonstrating the application of ISO 14000 to disaster reduction. This could be achieved by including environmental auditing, life cycle assessment, environmental labelling and environmental performance evaluation in EMS.

ISO certification also provides an important basis for communication with businesses, government, financial organizations and environmental groups. People at risk and the disaster community should be added to this list.

If the certification process provides information about the capability of an organization to achieve its stated environmental objectives, it has the potential to provide additional information on its capability to reduce vulnerability to disaster risk and achieve stated disaster reduction objectives.

Another benefit of certification is an expanded scope for marketing. In the same way that green or environmental labelling has emerged, disaster resilience labelling could also be realized. Relevant work in this area has started in Australia, for example.

Future challenges and priorities

The main areas for future priority action are:

- exploration of the links between environmental degradation and hazard and vulnerability;
- identification and description of environmental knowledge that can be applied to reduce risk; and
- economic valuation of environmental actions.

Disaster and environment practitioners could apply adapted tools resulting in a greater sense of ownership and commitment. Capacities could also be developed for the increased use and regular improvement of these tools.

To achieve this, development of a common language should be encouraged which fosters the exchange of practices among experts in disaster management, environmental management, sustainable development and economics. In this regard, innovative forms of communication should be explored.

Some adjustments in policy frameworks might be necessary to reflect this approach to disaster reduction. Close collaboration would also be beneficial among institutions working on climate change adaptation, biodiversity conservation, land degradation, wetlands management, sustainable development and poverty alleviation. Finally, the integration of risk management with environmental policy will require community participation.

5.2 Land-use planning

"Land-use planning is not a simple linear process; it is complex and subject to considerable pressure, including possible court action. The land-use planning process takes place in a political context. Developers, local government, local communities, State and Federal Governments all influence land-use outcomes. The process calls for wide community consultation while being developed, as well as continual monitoring and review throughout the life of the plan. Strategic land-use planning is therefore an iterative and evolutionary process."

Emergency Management Australia, 2002

There is a need in disaster risk management to recognize the relationships between population growth, the physical demands of human settlement, economics planning and the most appropriate use of available land.

The application of informed and consistent planning practices is crucial to minimize the potential loss of physical assets and environmental capital. These practices include the use of both tools and guiding documents. Master plans, development plans, water management plans, recreation plans, tourism plans, as well as other planning instruments such as detailed land-use or subdivision plans and zoning by-laws, are examples.

The landscape itself must be treated as a valued resource in managing risk. Failure to act on this principle is to invite disaster.

Both the opportunities and the difficulties of employing land-use and planning practices for disaster risk reduction are reviewed in this section which includes:

- *the importance and difficulty of land-use planning;*
- *a delicate balance and measured benefits; and*
- *case examples.*

The importance and difficulty of land-use planning

Land-use planning that is carefully designed and rigorously implemented is the most useful approach to managing urban or population growth and minimizing associated risks. It is also one of the most challenging to implement because of conflicting values held about land by different segments of the population.

In many societies, cultural, social or economic attributes associated with land can form the basis of some of the most contentious issues among people, particularly at local levels. Reference has already been made in the preface of this review to the economic attractions that flood plains or volcanic slopes hold for inhabitants. In other countries wetlands are drained to become industrial parks or housing estates.

Deciding how to use land is demanding enough. It is even more daunting if there are competing views about the role that land should play in reducing collective exposure to risk. Considerations invariably revolve around whose land it is, whose risk is involved most emphatically and who is to benefit. Too often, the desire for short-term gains override anticipated benefits that stretch further into the future.

For these reasons, land-use management and related regional and territorial planning, have to be considered as natural extensions of conducting hazard assessments and risk mapping. They must take account of the spatial parameters of physical vulnerability considered in accordance with the broader social, economic and environmental requirements of a society.

Such forms of planning used to be considered primarily as technical exercises but planners and local political authorities are now realizing that members of affected communities have to be widely consulted and involved throughout the process.

Account also needs to be taken of neighbouring or adjacent communities, which are not always of the same country, kinship or socio-economic standing. Actions taken by one group of people living along a river or in the upper areas of watersheds, can have a significant bearing on diminishing the fortunes or increasing the risks of others who live on the opposite shore or downstream.

Government authorities need to play a role in the judicious assessment of such relative merits but there is equally a requirement for popular involvement. The informed participation of the public is essential in the development of municipal or territorial standards and the acceptance of regulatory practices.

A failure on the part of government to implement effective land-use and planning practices is untenable. As one commentator has observed, while long a function of local governments, land-use planning regrettably has often been done with little regard for exposure to risk. Consequently, inadequate, ill-informed or non-existent land-use planning has contributed to increasing the vulnerability of communities exposed to hazards.

Box 5.16
Planning safer communities in Australia

In 2002, Emergency Management Australia (EMA) published Planning Safer Communities: land use planning for natural hazards, as part of its Australian Emergency Manuals Series. The manual consists of five main sections:

- Natural hazards and disasters;
- Managing risk;
- Strategic planning and the performance-based approach;
- The role of land-use planning; and
- Integrating risk reduction into the land-use planning process.

These guidelines have been developed to demonstrate how integrated land-use planning can be used to reduce the impact of natural hazards. The focus is on risk reduction at the interface between communities and the natural environment, and integrating risk reduction into the land-use planning process. The target groups for these guidelines are local government planners and planning practitioners, emergency managers, and people concerned with community safety.

Source: Planning Safer Communities: land use planning for natural hazards, Emergency Management Australia, 2002.

Lacking formal planning, a community adopts informal ways of planning, which may or may not be effective. However, at a large scale, formal planning is essential and often there is a gap or disconnection between the formal and informal planning systems. Landslides that destroyed a housing development in the city of Santa Tecla, El Salvador following the January 2001 earthquake, represent one such example. Most likely, there are hundreds more examples in other countries.

A delicate balance and measured benefits

Land-use management and planning practices that reduce disaster risks are part of larger risk scenarios, best considered in local community contexts.

Regulatory approaches which emphasize land-use planning to reduce future flood disasters have proved effective in some countries with advanced economies, but evaluations reveal that they too are being weakened in numerous ways. This in turn is leading to calls for refinements in regulatory strategies.

Unfortunately, regulatory approaches are much less effective in developing countries with the growth of mega-cities. Many people have inadequate housing and basic services and with a rising tide of migrants also come unmanaged, informal economies. Ironically, it is in such places where planning has the greatest chance to reduce vulnerability.

Some hazard-specific examples with regard to land-use planning follow.

Earthquakes, volcanic eruptions and avalanches

Seismic micro-zoning enables identification of earthquake-prone areas at a local scale. This can be used to maintain low levels of building density or to avoid development in such areas. Micro-zoning has proved to be particularly effective in establishing setback distances from active fault lines within which building is prohibited.

Risk arising from volcanic eruptions also can be reduced substantially by means of controlling the type of development in potentially hazardous

Box 5.17
Principles of land-use management and urban planning for risk reduction

The following principles apply to land-use management in the context of risk reduction strategies.

Land-use management plans form a shared basis for sustainable development and risk reduction strategies:
- As the physical and spatial projection of the social, economic, environmental and cultural policies of a country, land-use management includes various planning tools and management mechanisms.
- They are necessary for a productive but sustainable use of the national territory and provide for the successful regulation of the economic life of a country.

Land-use management operates at different geographical scales which require different ranges of management tools and operational mechanisms:
- At the national level, sectoral economic policies are tied into the administrative framework of provincial or territorial jurisdictions.
- At the metropolitan level, strategic plans are formulated for sustainable urban development.
- At the municipal level, municipal ordinances and regulatory plans define local land-use management practices.
- At the local or community level, plans encourage participatory management for community works and urban projects.

Land-use management involves legal, technical, and social dimensions:
- The legal and regulatory dimension includes laws, decrees, ordinances and other regulations adopted by national and local governments.
- The technical and instrumental dimension includes planning tools and instruments that regulate uses of land and strive for the best balance between private interests and the public good.
- The social and institutional dimension includes those mechanisms which include citizen participation in land-use management practices, such as consultations, public hearings, open municipal sessions and plebiscites.

Land-use management encompasses integral services and individual sectoral interests:
- Integral or dominant issues revolve around the provision of essential services or related infrastructure, such as water, energy, transportation, communication – and as now recognized, risk management.
- Individual sectoral issues include housing, health, education, agriculture, natural resources, the economy and trade.

The practice of land-use management proceeds through three stages:
- Strategic planning
- Administration and fiscal control
- Follow-up and monitoring

Successful land-use management plans will confront challenges:
- Tensions or vested interests between government and private interests, national and local interests or instruments of the state and the population can occur.
- Dynamic factors such as population growth, migration, conflicts over the use, supply or demand of services will occur.
- There will be factors specific to risk management including the changing nature of vulnerability, major fluctuations in land values, urban services and environmental services.

Successful strategic land-use management requires essential resources:
- A clear legal and regulatory framework defines the competencies of the various stakeholders and the role of each actor in the various stages of planning.
- Access to information about regulatory plans, land and property markets, public and private investment projects is crucial for ensuring effective citizen participation in decision making.
- A decentralized fiscal policy strengthens the capacity of local governments to raise revenue and to consolidate their finances in the interest of effective local administration.

Source: UN-HABITAT, 2000.`

areas. In this sense, volcanic hazard mapping provides the basis for land-use regulations as well as critical information for developing effective evacuation plans.

Some countries have well established zoning regulations for mass movement hazards such as landslides and avalanches. This is the case for Switzerland where a three colour zoning system guides the development of both public and private buildings. The Swiss code subsequently has been applied in many other parts of the world.

Box 5.18
Land use in the United States

In many counties and cities in California, United States, setback ordinances are used to enforce seismic safety. Thus, building and stability slope setbacks can be recommended where proposed developments cross known or inferred faults, as well as where active landslides or old landslide deposits have been identified.

Setbacks can also be used to impose appropriate separation of buildings from each other to reduce pounding effects. This phenomenon is most common in urban areas where structures of different heights, resulting from different constructions methods, are combined in close proximity. Another type of setback regulates the distance from buildings to sidewalks or other areas that are heavily used by pedestrians. The main purpose of such setbacks is to reduce the loss of life and injury arising from collapsing buildings during an earthquake.

Source: adapted from K. Smith, 1996.

Box 5.19
Land use in Switzerland

According to the Swiss federal law for land-use planning, cantons must identify in their master plan all areas that are threatened by natural hazards. The master plan is a basic document for land-use planning, infrastructure coordination and accident prevention that allows for early detection of conflicts between land use, development and natural hazards.

In order to guarantee a uniform means of assessment of natural hazards in Switzerland charts describing various degrees of danger are used, based on hazard maps. Two major parameters are used to classify the danger – the intensity and the probability. The estimated danger has implications for land use. A description of the magnitude of damage that could be caused by an event is based on the identification of threshold values for degrees of danger, according to possible damage to property. The danger zones can be delineated on the local plan together with areas suitable for construction or zones where additional protection is required.

Three degrees of danger are defined and are represented by the colours red, blue and yellow. They indicate the level of danger to people, animals and property. The degrees of danger are initially assigned according to their consequences for construction activity: areas where buildings are not allowed are red, indicating a high hazard; areas where building must follow safety requirements are blue, indicating a potential hazard; and areas without building restrictions are yellow.

Source: O. Lateltin and H. Raetzo, 2001.

Floods

Flood management strategies are constantly being rethought. One approach draws on experience in traditional societies that seek to adapt flood conditions. Techniques include building stilt houses as is done in Malaysia. There are also effective social measures such as mutual aid responsibilities that are a part of strong kinship relationships that often exist within local communities.

Elsewhere, other strategies are characterized by responding to flood conditions, either by means of accommodation or protection. Engineering solutions and physical or structural defences are increasingly being supplemented by the consideration of environmental strategies, such as the use of mangroves or wetlands that act as natural defences.

Modern strategies reflect a perspective of sustainability and emphasize the wiser use of flood plains and coastal flood zones. Such outlooks are motivated by the anticipation of risks: empowering local communities to make choices, promoting disaster resilience, improving local and socio-economic adaptive capacities, and encourage wider public participation.

Nations or communities successful in their approaches to reducing flood losses strike a balance between the potential consequences of flood risks and the value of other beneficial socio-economic goals. They make informed decisions based on sound information, encouraging self-help and self-reliance. Successful communities embrace traditional mitigation methods as well as new technologies that will increase resilience.

Case: Cuba

In Cuba, national land-use planning and management are truly integrated into risk reduction considerations. For over 40 years, the Institute for Physical and Spatial Planning has been the responsible body for the implementation of physical planning in the country.

Its planning system integrates all scales of political and administrative jurisdictions in addressing a wide range of land-use issues. These include the

management of natural resources, decisions about human settlements, the environment, hazards, vulnerability and risk.

The institute defines regulations and provides methodologies for risk management that include building codes and risk zoning to reduce the physical vulnerability of households and critical infrastructure, especially in flood-prone areas.

These and related tools for implementing land-use controls across the country are supported by well-integrated methodological and legal frameworks tied into the sustainable development processes of the country. In addition to the institute, the national civil defence authority and the hydrometeorological service are other key organizations in realizing these strategies.

Two main mechanisms are used to implement land-use policies. The first is a series of planning tools that include land-use schemes applied at the national, provincial and municipal level. Plans for territorial and urban planning are formulated by provincial and municipal authorities. Once approved, these become legal instruments that regulate land use for public and private landholders. They are supplemented by feasibility or location studies, or other forms of detailed studies conducted to meet specific requirements.

The second mechanism consists of regulations and management practices. These include directives for the allocation of investments and provision of guidance for building investments according to land-use criteria. The consideration of physical vulnerability and environmental impact assessments are incorporated at this stage of planning.

As in other island states, coastal areas constitute the most fragile and complex ecosystems in Cuba. Their increasing exposure to the impact of natural disasters has motivated the government to support studies on land-use management.

At the national level, schemes define guidelines for the use of coastal areas, identifying priority scenarios for which higher resolution studies would need to be conducted. A hazard map for storm surges and additional vulnerability maps have been produced.

The use of these maps allows relative levels of risk to be identified for settlements located in coastal areas. Several land-use regulations have resulted from this study, including specific recommendations for retrofitting, resettlement and urban growth regulations for 107 coastal settlements.

A comprehensive study also has been conducted in Havana province, following analysis conducted in 1998 that revealed deficiencies in land-use management. By working with the government, UNESCO contributed to this study, in which vulnerability reduction was one of the main goals.

The implementation of related activities is proceeding over time, with financial commitments from both the government and the local population. The communities have participated in different stages of the project, becoming more familiar with the issues of vulnerability and principles of disaster reduction. In order to reduce disaster risk for coastal settlements in this area, the following recommendations have been made.

Direct measures that:
- Prohibit the construction of vacation houses in existing settlements.
- Relocate the population vulnerable to disasters.
- Regulate and supervise the construction of new homes in the settlements.
- Retrofit and build homes adapted to flood conditions.
- Improve the drainage systems in and around the settlements.
- Improve potable water supplies and sanitation systems.
- Improve health and transportation services.
- Create employment opportunities.

Indirect measures that:
- Improve the natural resilience of beaches.
- Improve the water irrigation systems near the coast.
- Rehabilitate the wetlands.

The city of Havana provides an example of urban planning in a coastal zone. The city has a conspicuous breaker wall or *malecon*, stretching 7 kilometres along the sea, to reduce the impact of storm surges that periodically strike the city's coast. Inappropriate urban growth is reflected by the private houses and installations that have been built in the vicinity that is a high risk area.

A plan approved by the Administration Council of Havana in 1995 is now applied to all urban planning projects in this area. Because of the

vulnerability zoning implemented through this plan, codes and standards for construction have been renewed. They aim to improve the organizational procedures, engage more effective means of construction, and promote sound rehabilitation in the area. Basements have been rebuilt, the heights of buildings regulated, and new landscape designs for public areas adopted.

Land-use management and urban planning in Cuba are economically and technically feasible tools for disaster reduction. Initiatives in land-use management and urban planning have involved communities in the identification of local problems, in the planning process and in implementing the decisions taken about land-use management. Revised legislation on disaster reduction based on new methodologies has been applied, contributing to more effective implementation of disaster risk management activities.

The multidisciplinary and inter-institutional nature of the work has helped to establish a conceptual and more methodical basis for effective disaster risk reduction. As the responsible body for disaster mitigation and relief activities in Cuba, the Civil Defence Service has benefited greatly by a broader understanding of land-use tools and their role in disaster risk reduction. Principles regarding land-use and urban planning derived from the Cuban experience appear in Box 5.20.

Case: Nicaragua

In Nicaragua during 2001-2002, more than 20 municipalities were provided with tools for risk management, with a special emphasis on land-use planning. These included the preparation of hazard maps, land-use zoning proposals and municipal disaster reduction plans. They also identified specific measures to reduce the risk of communities, considered particularly vulnerable by both local and national authorities.

National professionals who received special training developed these tools by working in a participatory manner. The project was developed in Nicaragua with the support of the Swiss Agency for Development and Cooperation (SDC).

Methods used to produce a municipal study were thorough, scientific and comprised multiple-hazard and multiple-risk analyses of the whole study area, taking account of local knowledge and specialized information. The core of the methodology is the elaboration of the municipal disaster reduction plan that involves the production of different risk management tools. Figure 5.1 illustrates the methodology used for such municipality studies.

Case: France

The Plan for the Prevention against Natural Risks (PPR) is the main tool in the French national disaster risk reduction strategy. It aims at controlling the use of natural and rural spaces and acknowledges a responsibility to inform citizens about the risks to which they may be exposed. Citizens are able to familiarize themselves with the importance of risks, take measures to protect their housing and join authorities in establishing relief and evacuation plans.

The primary objective of the PPR process is to analyse the risks of a particular territory in order to establish hazardous areas. Resulting plans are then able to introduce appropriate measures of urban planning and construction that take account of effective risk management practices. Zoning is one of the most common tools used once hazards have been locally situated.

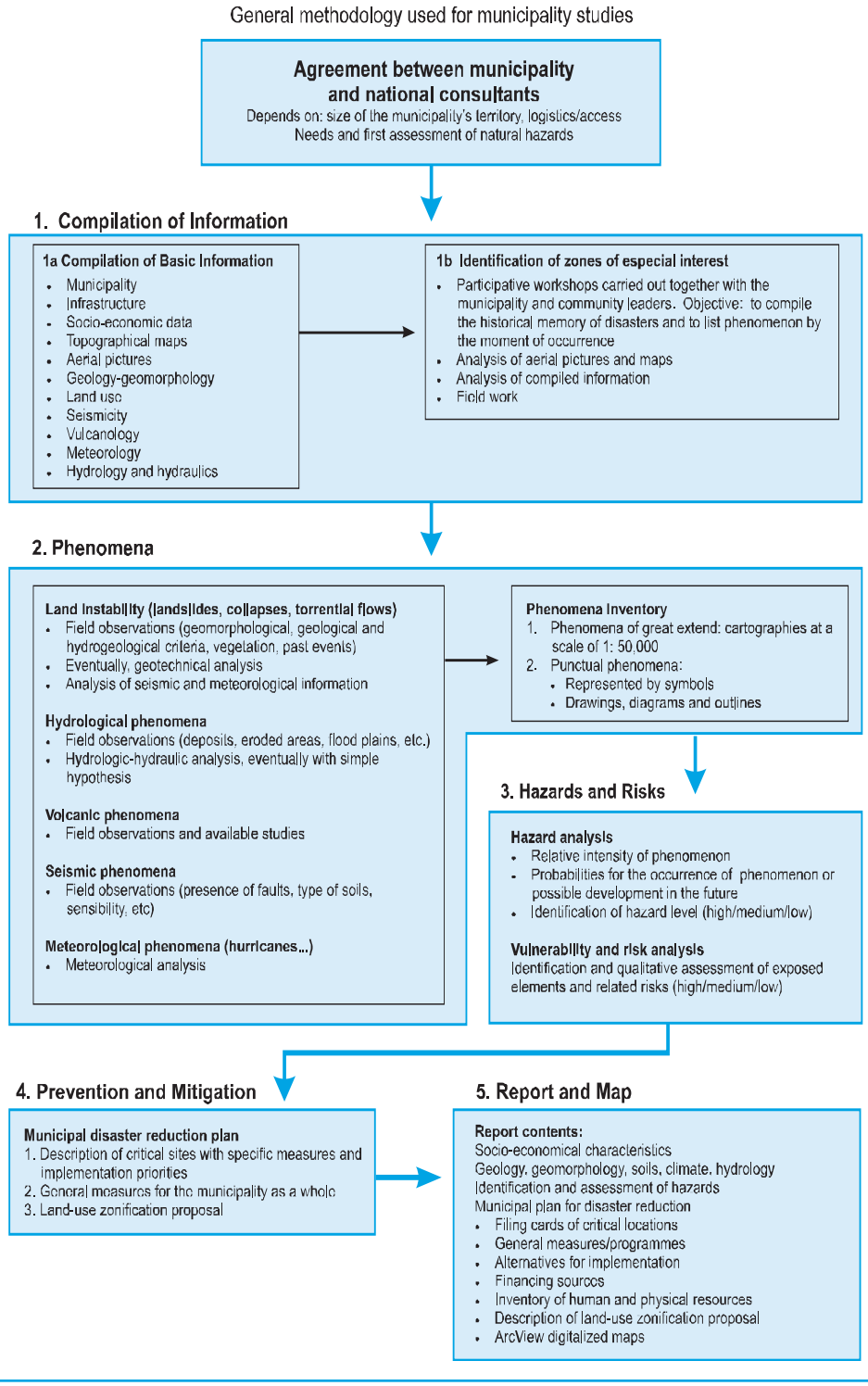
Resulting risk maps form the basis of consideration that leads to the implementation of PPR and related legislation. PPR is elaborated by state agencies and is implemented under the authority of the prefect of each department who approves it with regard to the needs of individual communities.

PPR is formulated for reference to all citizens, enterprises and instruments of the government. It is a unique procedure, which takes account of risk analysis for land-use planning. Presently, more than 2,350 communities are covered by PPR. It is anticipated that by the year 2005, at least 5,000 communities will be covered.

The Plan for the Soil Occupancy (POS) also takes due consideration of natural hazards as outlined in the French urban legal code. The PPR is then annexed to the POS of the community. It complements other instruments that highlight the potential risks in various types of land use, natural resource protection, construction activities, and the administrative management of territories.

The French Ministry of Land-Use Planning and the Environment has established a national list of communities at risk, which is updated twice a year from information supplied by prefectures. The Ministry has published these risk maps on the Internet for easy access by the inhabitants of communities, but also to underline their ready availability for use by decision makers, notaries and insurers. The database is called Corinte, for *Communes à risques naturels et technologiques*. It provides information on major risks by department, types of risk, individual risk analysis, land-use planning, departmental consolidated files and listings of prevention measures undertaken.

Figure 5.1
Land-use planning in Nicaragua



Box 5.21
The French Plan of Prevention against natural risk

A compensation scheme for natural disasters has existed in France since legislation was passed on 13 July 1982. The law of 2 February 1995 put in place the Plan of Prevention against Natural Risk (PPR), in order to inform citizens about risks in their community and how to protect themselves and their properties.

The PPR is a unique procedure taking into account natural risks in land-use planning, and abrogates all procedures issued before it. A causal link exists between the PPR and the compensation scheme. In fact, a sliding scale is introduced to vary deductibles, which normally go with the compensation of property insured, in order to encourage loss prevention measures.

For example, a state of natural disaster may be declared in a community as a result of flooding (by means of an inter-ministerial decree). In this case, a coefficient is applied to the deductible, based on the number of decrees already issued, in respect of the same natural disaster, since the creation of PPR in 1995.

If the insured person has a disagreement with the insurance company, they may call on the Central Rating Bureau (BCT), a regulatory body for certain types of compulsory insurance or cover. In cases where a PPR specifies protective measures, and if the insured person has failed to conform to the provisions of the PPR, the insurance company may refuse cover if goods or activities have been located in areas that are unsuitable according to the PPR.

Case: India

In keeping with the objectives of the *Yokohama Strategy and Plan of Action for a Safer World*, a Vulnerability Atlas of India was developed in 1997. It has proved to be an innovative tool for assessing district-wide vulnerability and risk levels of existing building stock.

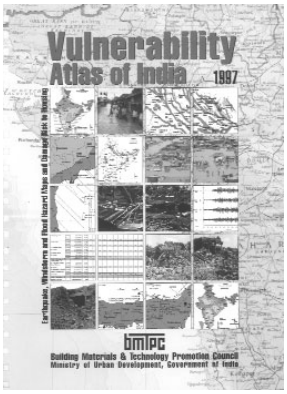
The atlas has helped state governments and local authorities to strengthen regulatory frameworks. This was achieved by amending construction by-laws, regulations, master plans and land-use planning regulations for promoting disaster resistant design and planning processes.

The documents and methodologies for vulnerability and risk assessment, along with technical guidelines for disaster resistant construction, have shown high potential for transfer, adaptation and replication. After the Gujarat earthquake in 2001 the relevance of the atlas has been highlighted and additional assessments in a more detailed scale are now being developed.

India has been successful in modifying land use by seeking to address community requirements so as to gain wider commitment in executing land-use changes. A national policy backed by local efforts is crucial to the success of these programmes.

Indian state governments are responsible for development plans, in particular those that contribute to natural hazards management, agriculture and land management. The first major initiative for preventing flood hazards in the Ganges plains was in 1960-1961 in the form of a soil conservation scheme in the catchment areas of the river valley projects as recommended by the National Flood Commission.

The National Watershed Development Project for Rainfed Areas also aimed at promoting appropriate land use and the development of farming systems on a watershed basis. A national land-use policy outline adopted by the government presents a cohesive and coordinated strategy by government agencies and others to ensure the optimal use of land. In this connection, a national land-use and conservation board and state land-use boards have been established.



The Indian experience has shown that measures to prevent disasters succeed to the extent that they focus on resource regeneration of the community living on the lands concerned. The approach needs to address both spatial and temporal dimensions of land use. Sustainability and effectiveness of interventions depend on appropriate land usage, for which peoples' participation in the planning and decision-making is a requirement.

Future challenges and priorities

Land-use planning

Land-use management and planning are practiced in many countries. There is considerable scope for the planning profession to take greater cognisance of risk factors throughout the various activities that comprise living conditions, growth prospects and environmental consequences.

As well-considered land-use planning is one of the foremost practices in this respect in both urban and regional scales, many challenging issues remain to be addressed before known methods become fully effective in reducing public exposure to risk. Competing interests or values associated with the possible uses of land almost always become an overriding issue that can be resolved only from some common understanding being reached. This most typically occurs either under law, by official instruction or through the wider acceptance of a common appreciation of relative risks.

There are additional limitations to land-use planning as a tool for risk reduction that pose future challenges. A lack of current information about hazards and potential risks within specific areas is a common limitation that must be addressed within individual localities. This is tied to the resulting undesirable consequences of a community's inability to anticipate hazard events or to undertake necessary measures to minimize their potential effects.

The often high costs and protracted nature of multidisciplinary involvement associated with the technical aspects of hazard mapping or vulnerability and risk assessment activities can be considered an impediment to establishing a systematic land-use programme. This can however, be overcome if a strategic approach is adopted which reviews plans and schedules various stages of activity over a period of time.

A more engrained and methodological approach also can counter a hesitancy to commit funds for seemingly intangible returns. A crucial challenge is to allay such uncertainties of expected benefits at a possible unspecified time in the future, in part by focusing on meaningful accomplishments that contrast with more immediate opportunities for short-term gains.

Most fundamentally though, efforts need to be exerted to minimize local political interests or community tendencies which resist a wider acceptance of the beneficial rationale for land controls. This may be associated with various related concerns such as competing economic valuations of properties or locations, weak or marginal interest in the enforcement of land-use policies, problematic licensing practices, and lax administrative procedures which invite noticeably corrupt practices in too many countries.

Ultimately a crucial priority needs to be accorded in weighing private, individual or singular uses of land against a wider concern for public values and the more broadly applicable considerations of public safety and socially determined access. The determination of how that balance is struck and where it is actually displayed in physical terms remains an obligation for public expressions of interest and concern.

5.3 Safe building construction and protection of critical facilities

Some of the earliest types of vulnerability associated with disaster risk reduction concern the physical conditions of where and how people live. Ever since people have been building structures to live and work in, and the critical elements of infrastructure systems that support the economic and social bases of all societies, there has been some attention and investment provided to protect these valued facilities.

As populations grow and expand into more inherently vulnerable locations, and as economic pressures result in even more construction and infrastructure, the necessity of risk reduction applied within the built environment becomes more pressing. However, given the magnitude of the problem, it must also be noted that positive work is being done to reduce people's exposure to risks in the built environment. This section focuses on some of these elements and accomplishments:

- *a safer built environment;*
- *structural measures for disaster-resistant construction;*
- *codes, policies and procedures;*
- *improving the resistance of non-engineered buildings;*
- *developing appropriate methodologies;*
- *protection of critical facilities;*
- *the role of engineering and technical abilities in protecting critical facilities;*
- *multiple aspects of protecting urban infrastructure and other forces at work;*
- *protection of health systems; and*
- *protection of educational facilities.*

"Earthquakes don't kill people, buildings do."
Charles Richter, inventor of the Richter Scale of earthquake magnitude measurement

A safer built environment

The skills of construction workers whether sophisticated or basic, and the professional abilities of engineers have a particularly important role to play in create and maintaining safer societies. Protecting critical facilities involves many other types of people too, including government officials at various levels of responsibility. However, successful risk management related to the built environment also includes people that are involved in planning in both urban and regional contexts, and the considered use of land and other dimensions of the natural environment. Investors and agents of development who seek to spur growth and development also need to be aware of the physical landscape, to ensure that the rush to create greater value and more physical assets does not end up increasing the exposure of the built environment to disaster risks.

The public needs to be highlighted as a primary contributor to the expectation and the realization of safer buildings and physical infrastructure. In the interest of protecting their families and property, individuals need to ensure that their homes are as safe as possible, both in where they are located and how they are built. Failing this, the potential risks multiply as populations become more concentrated in the rapid urban sprawl experienced around the world.

The mushrooming informal settlements and substandard housing are frequently located in inherently vulnerable locations. Unfortunately, this is too often tolerated for the migrant, the impoverished or transient populations.

It becomes even more critical politically and socially if governing authorities are at all attentive to reducing disaster risk factors in the built environment.

There are three distinctive contexts for introducing physical risk management measures in buildings or infrastructure:

- reconstruction or repair of buildings, particularly following the losses or damage from a major hazardous event;
- construction of new buildings in normal circumstances; and
- retrofitting existing building stock through strengthening programmes.

Each of these possible approaches also possesses different levels of opportunities that can be utilized to ensure safer conditions in the built environment – given the will and commitments to do so.

Good opportunity

Reconstruction, with the introduction of mitigation measures, is always likely to be possible, even in countries with resource limitations. It is particularly beneficial given both the evident public interest as well as the significant resources available following a disaster. This is on account of high levels of political will and public demand for enhanced safety immediately following disasters. Therefore, officials can benefit from drawing on the excellent opportunities presented by adversity to introduce mitigation measures during periods of reconstruction.

Moderate opportunity

Introducing mitigation into new construction is feasible if there are funds available to pay for the improvements and if codes are in place with adequate enforcement. However, the introduction of mitigation measures into non-engineered buildings is fraught with social, economic and cultural obstacles and remains a global challenge. It should also be noted that in most developing countries vulnerable buildings and existing infrastructure lifelines will continue to comprise more than 95 per cent of the vulnerable facilities that exist.

Box 5.22
Strategies to achieve a safer built environment

Strategies to achieve a safer built environment, need to be:

- ambitious, grasping unique post-disaster possibilities to improve building;
- focused on lifeline buildings and infrastructure;
- stimulated by a range of incentives;
- inclusive, with the attention of engineers being devoted to the creation of safe engineered, as well as non-engineered buildings; and
- inclusive, with public interest, involvement, expectations and support.

As such, the possibility of investment in retrofitting needs to be considered. If more widely shared and employed, technology provides ever more efficient and effective means of protection, especially as the cost often can be justified when compared with realistically calculated expected losses. The more vulnerable a specific locality is to a possibly severe hazardous event, the more justifiable investment in retrofitting could be.

Limited opportunity

The introduction of retrofitting for existing buildings will always be difficult given the scale of building stock in urban areas. For example, in the United States, the average turnover in the nation's building stock is only 1 to 2 per cent per year. Thus there is a vast potential cost associated with implementation in terms of securing the necessary finance and the cost of social and economic disruption.

Structural measures for disaster-resistant construction

The design and construction of hazard-resistant structures are some of the most cost-effective means of reducing risks. Urban planners, architects, engineers, construction contractors and building inspectors are all responsible to ensure that planning and construction are technically sound and account for potential hazards.

The engineering standards of buildings, lifelines and housing are determined through research and technical decisions. But they must be applied by building professionals. It is they who must

determine how effective a particular engineering solution will be in respect to stress or hazard.

However, much less attention is given to the important roles of investors, local political authorities and community leaders to fulfil their own professional and civic responsibilities. Together they have important roles to play in assuring building compliance implied by their investment, enforcement of legislation or adherence to local standards. Codes are only as good as the extent to which they are employed and enforced.

It is worth emphasizing the wide diversity of causes identified in this preceding example. They embrace technical elements, economic realities, and conditions of public administration, education, legislation, public awareness, as well as criminality and other social factors. As none of these features is limited to any single, individual country or location, to counter such patterns of vulnerability broad, well-integrated risk reduction strategies are required to meet the distinctive requirements of any economic and socio-cultural environment.

The state of Florida was regarded as having one of the most rigorous building codes in the United States until Hurricane Andrew stripped away pretences of compliance. Similar realizations often occur after disasters, whether they happen in Japan, Turkey, Egypt, Taiwan, India, United States, Mexico, Algeria, Iran or elsewhere.

Fortunately, there are dedicated institutional efforts of collaboration that are working to promote a wider understanding and more effective application of various measures that can make communities safer. Two examples follow.

"The reality that somewhere between 75 and 90 percent of all earthquake fatalities result from building failures, highlights the importance of implementing mitigation measures specifically associated with building design and construction."

Professor Ian Davis, United Kingdom

Box 5.23
Vulnerable building stock

Following the earthquakes in Turkey in 1999, earthquake specialists from Istanbul's Bogazici University summarized the reasons why Turkish building stock proved to be so vulnerable:

- Rampant code violations led to disastrous results.
- The system was conducive to poor construction.
- High inflation meant very limited mortgage and insurance, an impediment to large-scale development, resulting in limited industrialization of residential construction.
- High rate of industrialization and urbanization led to a need for inexpensive housing.
- There was very little professional qualification of engineers.
- There was ineffective control and supervision of design and construction.
- Corruption was common.
- There were regulations with limited enforcement and no accountability.
- Ignorance and indifference were widespread.
- Government was a free insurer of earthquake risk.

Source: M. Erdik and M. Aydinoglu, 2000

Earthquake Engineering Research Institute and International Association of Earthquake Engineering

In an effort to address some of these and similar issues, the Earthquake Engineering Research Institute (EERI) in Oakland, California, United States is conducting a joint project with the International Association of Earthquake Engineering (IAEE) in Tokyo, Japan. Together they are building an Internet-based encyclopedia of housing construction currently used in seismically active areas of the world.

The endeavour links more than 160 volunteer engineers and architects from 45 countries, enabling them to consolidate and share data, as well as to access tools that can reduce the vulnerability of housing in earthquakes. The goal is to create a professional resource that is useful not only for design and construction professionals but also for housing authorities, community planners and other

agencies concerned with hazard reduction and sustainable development.

Initial efforts of the project are devoted to compiling relevant information about all aspects of housing construction in seismic areas. These include architectural features, structural details, strengths and deficiencies under seismic loads, performance of materials in previous earthquakes, local construction practices, and common building materials used. Data is also compiled about the availability and use of insurance.

An important feature of the database is that it accommodates information about construction features ranging from the basic aspects of non-engineered rural housing through sophisticated engineering practices employed in urban high-rise construction.

As the information is on the Internet, users can search the database using various criteria. In addition to basic country profiles, information can be retrieved on the basis of urban or rural construction practices, seismic hazards, building functions, type of building materials or structural systems employed. The information also gives ratings of seismic vulnerability and describes community economic levels.

It is possible to compare the strengths and weaknesses of various construction techniques that have been used in different countries. Likewise, comparisons can be made of building materials, as well as indicating each country's experience with the performance of different types of construction.

The encyclopedia will also include country-specific information, including background information about seismic hazards; codes and building standards; the size, relative densities and rate of change in urban and rural housing; general weather patterns; and information about housing losses in past earthquakes. Users are able to generate graphs, tables, photos and drawings, and freely download any of the information provided. <http://www.eeri.org/>

Multi-disciplinary Center for Earthquake Engineering Research

Similar goals, but with different focus are being pursued by the Multi-disciplinary Center for Earthquake Engineering Research (MCEER) at the State University of New York at Buffalo, United States. The center strives to enhance the seismic resilience of communities by providing improved engineering and management tools for critical infrastructure systems. This relates to water supply, electrical utilities, hospitals and health facilities, and transportation systems.

MCEER works toward its goal by conducting integrated research, outreach and education activities in partnership with the users of the centre's products. MCEER unites a group of leading researchers from numerous disciplines and institutions throughout the United States to integrate their knowledge into the fields of earthquake engineering and socio-economic studies. The result is a systematic programme of basic and applied research that produces solutions and strategies to reduce the structural and socio-economic impacts of earthquakes.
<http://mceer.buffalo.edu/>

Codes, policies and procedures

The enforcement of standards to protect public safety is a responsibility of government. Codes should apply to new construction as well as for retrofitting existing structures. Surprisingly, given the large number of towns and cities within reach of volcanic eruptions, few efforts have been made to develop building codes which increase the resilience of buildings to ashfall, the most widespread of all volcanic hazards. Some other circumstances are less easily observed.

Development of standards is easy but implementation often proves to be more difficult. Land use, planning and construction standards are most often decided and enforced at the local level. It requires both prudent decisions to be taken and the expression of public confidence in the perceived value of their application and affordability. The use of mechanisms and tools for enforcing existing building codes and zoning by-laws must be central to creating a culture of prevention among officials and within the local communities.

Box 5.24
"We didn't know"

In October 2002, a moderate earthquake of a magnitude of 5.4 on the Richter Scale occurred in Molise, Italy. The only building which collapsed was the village school, killing 26 children and three adults. While the school had been built in 1953, it had been recently renovated. The resulting emotion swept across Italy, and was followed by public anger that led to the opening of a criminal investigation. Central authorities, local officials and building contractors were all accused of corruption and not adhering to building codes and regulations. In defence, it was claimed that although the region was classified as a zone of seismic risk, nobody had been so informed and such information did not appear on risk maps. Some of the local officials also were accused of not complying with the obligations of the seismic-resistance law adopted in Italy in 1982.

Case: South Africa

For some years, South Africa has enforced legislation pertaining to building codes and construction within vulnerable areas. Recently the Council for Scientific and Industrial Research (CSIR) published the *Red Book*, which stipulates guidelines for the planning and design of human settlements.

The planning and management of informal settlements are now matters of considerable interest for government. Also, greater attention is being given to tertiary educational qualifications to deal with these issues. The establishment of sustainable built environments is an important factor that will contribute to the development of South Africa and address the needs of its growing population.

Governments can set examples by insisting on the adherence to codes and by-laws in all public buildings. Similarly, government authorities can be required to build earthquake-resistant offices in seismic zones and locate other facilities in accordance with the best land-use practices to set a public example. In all countries around the world, places of public assembly and schools should be built to life safety standards.

Case: Bangladesh

Another example demonstrates how easily government practice can be employed to encourage positive change. After analysing successful survival techniques in small outlying villages during a devastating cyclone in 1990, the government of Bangladesh instituted a simple but straightforward policy modification. The ministry of public works issued an instruction that all new official government buildings in outlying locales subject to the hazardous forces of a cyclone would be built of properly engineered concrete construction and would consist of two stories. Experience demonstrated that with these two technical requirements, local government buildings could serve as viable places of temporary public refuge from storms and flood.

Experience from around the world demonstrates that there is a need to establish a system of planning controls and building by-laws that are:

- realistic, given economic, environmental or technological constraints;
- relevant to current building practice and technology;
- updated regularly in light of developments in knowledge;
- understood fully and accepted by professional interest groups;
- enforced, to avoid the legislative system being ignored or falling into disrepute;
- adhered to, with laws and controls based more on a system of incentives rather than on punishment; and
- integrated fully in a legal system that takes account of potential conflicts between the different levels of administration and government.

"The Federated States of Micronesia has passed building code laws and regulations but has not fully implemented the codes due to difficulties in meeting the financial requirements called for in the building code laws."

Micronesia response to ISDR questionnaire, 2001.

"One of the most important issues to be addressed in Zimbabwe is the enforcement of laws and regulations that relate to building by-laws and the conservation of natural resources such as stream bank cultivation, deforestation etc., causing the siltation of rivers and dams."

Zimbabwe response to ISDR questionnaire, 2001.

"One of the most important issues to be addressed in India is the strict implementation of laws including building codes."

India response to ISDR questionnaire, 2001.

"Building codes and other regulations are in existence, however the issue is enforcement. The matter is under discussion at various forums within Bangladesh, and the government is actively considering this issue."

Bangladesh response to ISDR questionnaire, 2001.

"The Cook Islands Building Control Unit has been stepped up to improve compliance with building codes and enforcement procedures by the introduction of experienced personnel drawn from commercial building construction."

Cook Islands response to ISDR questionnaire, 2001.

Box 5.25
Different perspectives of hazard resistant building codes (only slightly exaggerated)

A **seismologist** usually criticizes the stipulations of existing building codes that were prepared several years before because there is later evidence, which suggests redefinition of the earthquake hazard.

Engineers want to incorporate their recent research findings and press for stricter building codes. They are less concerned with stronger buildings themselves than with the adoption of their professional endeavours.

An **investor or owner of a building** does not want to spend the additional 2-5 per cent of the building cost to provide additional hazard risk protection for an extreme event that "probably will not happen, anyway".

Contractors cannot be bothered with extraneous regulations and troublesome building inspectors, especially if their demands are going to reduce the profit margin of the construction.

The **government** has not been able to implement even the existing building code because of the lack of suitable implementation mechanisms, including building inspectors.

Decision makers are afraid that the implementation of building codes may result in cost increases. They do not press implementation of building codes even for public construction. Public administrators are preoccupied with other pressing or important matters.

Politicians do not risk diminishing their popularity, as thje enforcement of codes is considered to be an unpopular and restrictive process of control. Besides, there are other important aspects of the construction industry to attend to, like contracts.

The **community** does not understand the process and is confused, especially after a disaster.

The **media** recognizes a controversial topic when it sees one, particularly if people have been killed as a result.

None of the primary stakeholders seems to be discussing the problem in any common forum.

So, more vulnerable buildings continue to be built…

What is required to break this cycle?

Courtesy of the Asian Disaster Preparedness Center (ADPC)

Improving the resistance of non-engineered buildings

It remains something of a paradox that the failures of non-engineered buildings that kill most people in earthquakes attract the least attention from the engineering profession. At least two explanations for the neglect have been offered. One leading earthquake engineer explained that while the failure of non-engineered building construction was certainly a major problem, it should not be regarded as a problem for engineers. He believed that by definition, "a non-engineered building is outside the engineer's scope or mandate".

The obvious follow-up question of such a perception about whose responsibility it is then to devise ways to create safer vernacular buildings to protect their occupants from earthquakes, remains unanswered. Too often, there is little consideration other than possibly a vague suggestion that this issue is probably "the province of local builders". Some recent examples tend to suggest that this has now become an unacceptable response.

Comments from another experienced earthquake engineer, this time in Japan, indicated a similar withdrawal from the subject. The engineer deeply regretted the serious problem associated with the poor

performance of non-engineered buildings to earthquakes in Japan, and he acknowledged that at a global level the matter certainly needed the attention of his profession. However, he believed that there was regrettably no money regularly allocated to fund the necessary research or to pursue the implementation of known and improved structural measures for such low-cost structures. This represents a rather unfortunate, not too say limited viewpoint of no money on the table, no action on the ground – especially if the objects are low-cost.

Fortunately there are notable, yet isolated exceptions to the more limited perspectives or negative approaches. These include important work in Peru focusing particularly on adobe structures. Similar work related to vernacular housing has been carried out in Colombia, China and Bangladesh. Noteworthy centres for research and development in this area of vernacular building protection are the Central Building Research Institute, and the Department for Earthquake Engineering at the University of Roorkee in the State of Uttar Pradesh, India.

Pioneering work in the strengthening of non-engineered construction earned the Roorkee University Emeritus Professor A.S. Arya India's highest civilian honour in 2001 for his lifetime achievements in the field. The World Bank-supported programme to retrofit village housing in the Indian state of Maharashtra following the 1993 Latur earthquake is another example of a programme that emphasized basic means of providing low-cost protection for vernacular housing.

Case: St Lucia

Throughout the Eastern Caribbean, most families live and many also work in individual houses. These dwellings represent substantial assets for those families who own their own homes, particularly for low-income home owners. With few other resources available to rebuild or repair houses affected by hazards, the damage or loss of a home can render a family unemployed and in financial peril, in addition to being homeless.

In such a hazard-prone and environmentally sensitive region, it is essential to take full account of these factors in the siting and construction details of homes to ensure the safety of the structure and its occupants. It is equally important to minimize the impact and use of the building on the surrounding environment. While property insurance can limit the financial impact of hazard-related damage, low-income residents rarely have sufficient resources to avail of such insurance.

In Saint Lucia, the National Research and Development Foundation (NRDF) offers a hurricane-resistant home improvement programme (HRHIP) for low-income earners. This programme trains local builders in safer construction and offers small loans to families wishing to upgrade the safety of their homes. In 1996, NRDF established the HRHIP with support from the USAID/OAS Caribbean Disaster Mitigation Project, and has operated it continuously since then.

The HRHIP assists low-income homeowners in retrofitting their homes to make them more resistant to the effects of tropical storms. The programme provides training in safer building techniques for builders and artisans who construct lower income housing. It has also developed minimum building standards for both homeowners and builders. Assistance is provided for estimating building material quantity and assuring quality control.

Between 1996 and 2002, NRDF disbursed 345 loans under this housing programme, with an average loan size of approximately US$ 4,100. Two thirds of these loans were for extensions to existing structures or to construct new buildings. The remainder, were used for repairs and renovations, purchases or the relocation of

The problem

"The occupants of houses of rubble stone masonry for example are many thousand times more likely to be killed in an earthquake, given the same severe ground shaking, than the occupants of a reinforced concrete structure designed and built to modern code standards. A major problem for earthquake protection is how to reduce the often extreme earthquake vulnerability of such dwellings."

Source: Coburn and Spence, 2002

A solution

"The replacement of existing dwellings with 'earthquake-resistant houses' is neither feasible nor, perhaps, desirable. It has been found more realistic to think, rather, in terms of low-cost upgrading of traditional structures, with the aim of limiting damage caused by normal earthquakes and giving their occupants a good chance of escape in the once-in-a-lifetime event of a large earthquake."

Source: Coburn and Spence, 2002

homes. While these loans are considered risky by traditional financial institutions because of the borrower's limited income or lack of collateral, repayment rates have been strong in the NRDF housing loan programme.

By making homes stronger, these properties become a more acceptable risk to property insurers so low-income homeowners who have strengthened their homes through the HRHIP can obtain property insurance. Working through a local insurance broker, NRDF has established a group insurance programme that is able to spread the risk over all the participants in the HRHIP programme. In addition to providing coverage for damages, group insurance programmes promote safer house construction by requiring the use of hurricane-resistant retrofit measures as a prerequisite for participation in the insurance scheme.

During 2003, the NRDF safer housing programme was reviewed and strengthened by refining loan procedures and enhancing its quality control mechanisms. It further developed its outreach efforts by producing two guidance documents, *Guidelines for the Implementation of a Safer Housing and Retrofit Program for Low-income Earners* and *Minimum Building Standards and Environmental Siting Guidelines*. The minimum building standards update earlier requirements and include a new section about environmentally sensitive siting criteria for island housing. The programme review and resulting improvements also reflected a joint effort of the supporting organizations that included the OAS, the World Bank and the government of Brazil. Additional information is available at <http://www.oas.org/cdmp/hrhip/>.

Developing appropriate methodologies

There are a number of initiatives and professional coalitions that have been developed to encourage greater national and technical capacities to protect critical infrastructure. Because of the strong engineering components involved, much of the motivation has come from seismic engineering specialists. One such example is the RADIUS methodology developed during IDNDR to assess urban seismic risk and currently being expanded through the Safer Cities MINNADE project led by ISDR. The examples below illustrate other initiatives that relate to different conditions experienced in various locations.

World Seismic Safety Initiative

The World Seismic Safety Initiative (WSSI) was formed in 1992 as an informal initiative of members of the International Institute of Earthquake Engineering. It later became an IDNDR demonstration project. It is a model example of dedicated professionals working together with minimal organizational structure to stimulate seismic risk reduction programmes in developing countries in Asia, the Pacific and Africa. WSSI has four goals:

- Disseminate state-of-the-art earthquake engineering information globally.
- Incorporate experience and apply research findings through standards and codes.
- Advance engineering research by concentrating on problem-focused needs.
- Motivate governments and financial institutions to establish policies that anticipate and prepare for probable future earthquakes.

During its initial activities in Asia and the Pacific, WSSI emphasized better public awareness and government attention for earthquake safety. It sought to develop information networks that could serve as catalysts for action in earthquake awareness, education and risk management.

WSSI has focused on well-defined and modest regional projects in support of local emerging technical institutions. These have included very productive associations with Nepal's National Society of Earthquake Technology (NSET) and Uganda's Seismic Safety Association, among others.

Additionally, WSSI supported regional and national initiatives in the transfer and sharing of technology; extending the application of professional engineering practices related to risk reduction; and increasing public knowledge for the improvement of structural response to earthquakes.

WSSI was also instrumental in the establishment of the Earthquakes and Megacities Initiative

(EMI) and worked together with the International Association of Seismology and Physics of the Earth's Interior (IASPEI) to prepare a global hazard map. On a global basis it also contributed to the development of the Global Disaster Information Network (GLO-DISNET). <http://www.geic.or.jp/glodisnet/dis/network/partner>

Earthquakes and Megacities Initiative

The Earthquakes and Megacities Initiative (EMI) was created following the First Earthquakes and Megacities Workshop conducted in Seeheim, Germany in 1997. EMI's scientific agenda promotes multidisciplinary research to evaluate the effects of earthquakes on large urban areas and to develop technologies and methods for the mitigation of those effects.

Within its programme, EMI promotes the establishment of comprehensive city-wide disaster management systems. It encourages the development of tools for disaster risk assessment and management. This includes information technology that enables megacities to understand their risks and then to take actions to reduce their exposure to hazards. Spreading knowledge about hazards, urban vulnerability and associated risks builds institutional strength, increases accountability and triggers new initiatives.

In addition to supporting scientific research, EMI focuses on projects expected to accelerate earthquake preparedness, mitigation and recovery. Projects encourage knowledge sharing among scientists, practitioners and end-users. Activities are aimed primarily at building and sustaining professional and technical capacities in the mega-cities of developing countries.

EMI has focused its capacity-building action plan on three main projects. The Cluster Cities Project (CCP) aims to create a network of large metropolises exposed to the threat of earthquakes so that they can share their experiences and coordinate their activities. The main objective is to enable them to increase their capacities for disaster preparedness, response and recovery. EMI facilitates exchanges within the network and coordinates joint activities for participants.

The other two projects are the Regional Centers Project, an extension of the CCP, and the Training and Education Program which involves knowledge sharing across professional interest groups to build local and regional capacities.

In 2001, EMI held three regional workshops in connection with the CCP. At the Third Americas Cluster Project Workshop in Ecuador, three areas of cooperation were identified: community-based vulnerability reduction; population needs and health care delivery in disasters; and promoting a culture of prevention.

The Oceania Cluster Cities Meeting took place in the form of a China-New Zealand workshop devoted to urban development and disaster mitigation. It resulted in a cooperation agreement between the cities of Tianjin and Wellington.

The Euro-Mediterranean Cluster Cities Meeting was part of the 2001 Med-Safe Network meeting held in Naples. An ad hoc coordination group was put in place to develop a framework for further Euro-Mediterranean cooperation involving EMI cities and partners in the region.

In 2002, three more workshops were held by the Americas, Oceania and Euro-Mediterranean clusters. In October 2002, the Third International EMI Workshop was hosted by the China Seismological Bureau in Shanghai. Significantly, it served as a starting point to launch a new programme. This new Cross-Cutting Capacity Development Program is conceived as a long-term multidisciplinary programme that establishes a framework for the EMI capacity-building agenda. It is to be implemented in partnership with EMI Cluster Cities Partners, mainly city partners in Asia, working through selected institutions sharing EMI's disaster reduction agenda.

The programme focuses on four activities: the development of toolkits to deal with disaster scenarios; support for the creation of disaster scenarios in selected rural areas and urban systems; promotion of disaster-resilient building designs and land-use planning; and capacity-building in raising awareness and increasing community involvement.

EMI is also participating in the development of an interdisciplinary research programme on hazard

reduction and response in metropolitan regions. The initiative was planned by the University Center for International Studies at the University of Pittsburgh in the United States. This programme works closely with the Americas Cluster Cities Project and was launched at its workshop in Mexico City in 2002. <http://www.megacities.physik.uni-karlsruhe.de>

While not directly related to EMI, the Megacities 2000 Foundation was established in December 1994, in the Netherlands. This followed a request by UNESCO to the International Academy of Architecture (IAA). The foundation collects and disseminates information on the development of megacities. The foundation has an active Internet site, organizes lectures and produces publications to further this aim. <http://www.megacities.nl>

GeoHazards International

GeoHazards International (GHI) is a non-profit organization based in California, United States, dedicated to improving earthquake safety in developing countries. Working together with UNCRD, GHI has pioneered a method to assess and reduce earthquake risk in urban areas. The Global Earthquake Safety Initiative (GESI) has been applied in 21 urban areas around the world and plans are under way for further expanded use of the methodology in India.

Following the major earthquake in Gujarat, India in 2001, GHI worked in cooperation with the Indian NGO, Sustainable Environment and Ecological Development Society (SEEDS) and the Gujarat State Disaster Management Authority. Together, they assessed earthquake risk and evaluated risk management options for three cities.

GHI has also signed an agreement with the Regional Emergency Office of the Ministry of the Interior in Antofagasta, Chile and the Center of Scientific Investigation and Higher Education, in Ensenada, Mexico to strengthen collaboration in those seismic-prone areas.

As a measure of the organization's innovative applications and dedication, GHI's founder and director, Dr. Brian Tucker was awarded a prestigious John D. and Catherine T. MacArthur Foundation Grant in 2002. This recognized his work through GHI in designing low-cost methods to minimize structural failure and human injury from natural disasters in the developing world. It will allow further work on the development and application of a global earthquake risk index designed to estimate risk and to motivate risk-reduction measures. <http://www.geohaz.org>

Case: Greece

Like several other European countries, Greece manages emergency and preparedness plans under the framework of civil protection responsibilities. A new law on civil protection was passed in 2002 taking account of experiences from recent disasters in the country. The law increases the responsibilities of municipalities in disaster management; emphasizes the role of volunteers in civil protection; and promotes the integration of scientific and technical knowledge pertaining to hazards and the risks they pose to the population.

Nevertheless, there are some specific national prevention measures, mainly directed towards earthquake risk. The Greek Seismic Design Code was originally enacted in 1959 and updated several times. A later seismic design code was established in 1995 and revised in 1999. Still more recent, the Greek earthquake design code and the reinforced concrete code both date from 2000 and complete the main legal instruments for earthquake prevention. The application of these codes is mandatory for all new construction.

A national effort for land-use and urban planning was undertaken under a law dating from 1983. According to the planning standards that were set, disaster protection and specifically earthquake safety were considered as a requirement. Nevertheless, the degree of implementation of the plans was lower than expected in some areas, mainly due to the pressures of rapid urbanization.

Despite these legislated instruments, important lessons were learned from the severe earthquake that occurred in 1999. Striking heavily populated areas in Athens and the Attica region, it killed 143 people, injured 750 and made hundreds of thousands of people homeless. It was also the most expensive earthquake in Greece, with losses estimated at 3 per cent of the country's GNP.

Although the Athenian buildings performed relatively well in the earthquake, other consequences demonstrated that more effort needs to be placed in land-use and urban planning with respect to providing a greater degree of seismic safety. The earthquake also confirmed that seismic safety is very dependent on the overall design of the buildings. Thus, requirements in respect to seismic safety should be included in the general building code as well as the code for the design of other forms of infrastructure.

A project to establish criteria and effective procedures for conducting vulnerability assessments of public buildings and bridges was in progress when the earthquake occurred. The earthquake only confirmed the need for seismic retrofitting of buildings. The reconstruction of the damaged buildings was done according to a new reinforcement code, with modern repair techniques such as the use of fibreglass introduced for the first time by the ministry of environment, planning and public works. Instructions about the repair of buildings were also published and training seminars were conducted for engineers.

Subsequently, additional vulnerability assessments are being accomplished. Initially, rapid macroscopic inspections of existing critical buildings, those designed for public use, or which represent high density of occupancy in all of the Greek prefectures. A database is being created regarding the characteristics of these 200,000 or more buildings. The next step will be to undertake an estimation of relative vulnerability and then to plan for a progressive retrofit programme.

There are, however, important choices to be made regarding the various earthquake reconstruction policies to be pursued. An earthquake opens a window of opportunity to upgrade the built environment and to advocate for greater measures of seismic safety, but there are also pressures to reconstruct buildings quickly in a rapid return to the same pre-earthquake conditions of vulnerability. What has become clear is that municipalities with previously existing plans and projects to address risk reduction are much better equipped to realize the positive opportunities following a severe hazardous event.

It became evident that more geological and geotechnical studies are required leading to seismic microzoning endeavours that can determine better use of land and urban planning. Seismic risk assessment would also be a useful tool in order to obtain a clear view of the possible effects of future earthquakes in the economically important and heavily populated area of Attica and to support decision-making about earthquake protection. Additional special measures for land-use planning and the protection of industries and businesses have been implemented, including geotechnical studies of the Attica Basin, urban planning, and a relocation scheme.

Public awareness programmes have also been utilized to inform the public and to train special groups about earthquake protection. Since an earlier earthquake in Kalamata in 1986, leaflets and posters were disseminated and information campaigns have been conducted, especially through schools.

Earthquake education provides dividends. It is commonly understood now that in many cases children reacted better than their parents during the aftershocks, thanks to the training they obtained at school. New information technologies provide additional opportunities for wider education and should be used more. As has been experienced elsewhere, in Greece too, many training and awareness initiatives were set up only after the earthquake. These include training seminars for teachers and for volunteers, the production of informative CD-ROMS for teenagers, and handbooks and web sites for wider access by the general public.

The wider use of media representatives, particularly to encourage closer working relationships with the scientific community before a crisis arises, may prevent the perpetuation of inaccurate messages during the critical stages of an emergency. Such prior relationships can also provide encouragement for more deliberate and safer reconstruction afterwards.

Protection of critical facilities

All societies need to be particularly selective in the identification and protection of their key infrastructure and service facilities. As these critical lifelines are essential to the effective functioning of a society, they should first of all be

built and maintained to life safety standards. This equally implies the importance of maintaining their protection from hazard impacts so they can remain functional at all times, and particularly at the time of crisis or severe community need.

There are at least five excellent reasons for protecting critical facilities:

- Protect as many lives as possible by emphasizing places of public assembly or refuge, such as religious buildings, theatres and sports stadiums.
- Safeguard the younger generation that is the future of all societies, and the facilities essential for their growth and development, by ensuring safe schools, colleges and other educational institutions.
- Maintain the economy and protect livelihoods, by ensuring the protection of local factories, means of transportation and communication, markets, vital crops or economically important natural resources.
- Maintain the viability and operational capabilities of facilities and key resources needed to address the population's safety and well-being at the time of crisis, such as hospitals and local health facilities, clean water systems, evacuation centres, police and fire service facilities, emergency operations centres and airports.
- Protect irreplaceable monuments of cultural heritage or collective identity, or unique environmental habitats that define a community's economic worth or social basis.

At the same time, it must be realized that no society can protect all of its people and resources from all potential harm or loss. Neither the inhabitants nor leaders of Tokyo or California command sufficient wealth to protect everything in their midst. The concept of determining acceptable losses may at first seem to be a luxury of richer communities. Quite to the contrary, it is much more important that poorer societies dependent on fewer assets be more selective in deciding which critical facilities and key resources must be protected at all costs.

This requires deliberate and prior considerations that can only be undertaken in a methodical process that involves the full participation of the people most immediately affected. It also underlines the important fact that commitments to the protection of critical facilities are only driven in part by technical knowledge or structural measures identified with construction and engineering abilities.

The role of engineering and technical abilities in protecting critical facilities

Critical facilities and infrastructure are necessary for the effective functioning of any society. It is therefore necessary to consider what has to be done to promote the application of appropriate standards within the built environment.

By way of example, Canada's Office of Critical Infrastructure Protection and Emergency Preparedness (OCIPEP) was established specifically to enhance the protection of the nation's critical infrastructure from disruption or destruction, and to act as the government's primary agency for ensuring national civil emergency preparedness. This underlined the importance of critical infrastructure as the backbone of the nation's economy.

It is important to keep in mind that the value of critical facilities and the systems they support, far exceeds the cost of their physical structures or facilities alone. Their true value is the sum of the cost of the building or physical facility, the contents and pertinent equipment, supplies and inventory, and the value of the activities or services they provide. This total value has to be considered in all calculations of relative costs incurred or investments made in protecting these assets.

Technical expertise is widely available to generate appropriate standards of the design and construction for damage-resistant structures and critical facilities. The political commitment to engage and more often the allocation of funds to implement known techniques and practices are wanting. The fact that specialist knowledge is spread across countries and individual fields of experience can also limit a wider familiarity and its more effective use.

Nonetheless, in many developing countries, people with the right training, skills and sometimes motivation are in short supply. At the same time, professional organizations may be weak, so

nationally recognized standards of professional qualification and conduct also may be lacking.

The pressures of growing population, poverty, corruption, inadequate skills and weak administration often combine to produce woefully inadequate standards of building control. There are also problems in translating knowledge into practice.

Many countries have adopted building codes requiring disaster-resistant design and construction. The problem is not so much that codes are inadequate but that often they are not enforced effectively. Their provisions and adequacy vary but where they are rigorously applied buildings are more disaster-resistant than they might otherwise be. Equally important but more expensive, is the need to retrofit exposed critical facilities and older buildings where practical.

Informal or spontaneous settlements of buildings erected by incoming or migrant segments of the population are usually constructed without permission and are not regulated by building control procedures. Public authorities are hard pressed to provide basic water and drainage services to serve new or rapidly expanding populations, much less to attend to how they house themselves.

The construction industry worldwide also has special characteristics of high competition and small profit margins, many of which militate against the achievement of high quality in the built environment. Contributing factors include the high proportion of small local firms; the often one-off or unsupervised nature of much of the work; the large financial risks in relation to the more moderate rewards; an ability to cut corners by covering up bad work; and the lack of adequate training. Where the prevailing culture of an official sense of public safety is lax or corrupt, there is a good chance that this will be reflected in the work of local contractors.

As one experienced engineer in a heavily earthquake affected country commented, "At least part of the problem stems from the fact that much of the supervision of building construction is concentrated on checking and approving designs, whereas in fact most violations occur at the construction site."

While engineering knowledge on disaster-resistant construction has to be enhanced on a national level, this process involves two distinct levels. One relates to important international partnerships and programmes that support education and additional opportunities to exchange experience. This leads to the establishment of well-regarded engineering schools and a few key players in the field. Turkey, India and a number of Latin American countries are examples for this.

These well-qualified engineers do not need any transfer of knowledge from abroad. The problems rather hinge on the professional commitment and means to disseminate this developed professional knowledge to the many ordinary practicing engineers working more routinely throughout the country. Incentives from national governments and international donor agencies can foster this process.

On the other hand, it is sufficiently evident that local people can do something to protect themselves from the possible effects of hazards if simple advice is given and means are available for it to be heeded. The extent to which this advice is provided is often limited and too often the skilled professional communities are not directly involved.

Aside from a common disregard for prevailing conditions of risk, there are many examples of improper design, poor construction and inadequate maintenance that figure again and again as major causes of building failure and unnecessary loss of life. Much of the older building stock may have been constructed before

"In Turkey, it is the national authorities that enact legal frameworks for disaster reduction. In the area of land-use planning and building code enforcement, responsibility lies with the local governments. Many deficiencies exist in both because local governments lack the necessary technical manpower for effective enforcement, and short-term populist tendencies are strong at that level. Unfortunately, university curricula in these disciplines do not make explicit reference to disaster reducing concepts and measures."

Turkey response to ISDR questionnaire, 2001.

the adoption of modern construction standards but there should be no excuse for the failure of modern buildings.

The lessons based on experience are clear. Engineering studies of disaster damage are regularly undertaken and constitute a vital element in the design process. Codes and standards in many countries are reviewed in the light of such studies and have gained much from them, particularly when they have been considered in the early stages of post-disaster activity.

Where they exist, national engineering institutions are committed to maintaining appropriate standards of professional ethics and competence among their members and to discipline those who deliberately break professional codes of conduct. By virtue of their national standing, they have contacts at senior levels of government and with international engineering organizations.

They are therefore in a strong position to promote the importance of technical integrity, learning the lessons of disasters, identifying and assessing risks and employing disaster-resistant design and construction practices. They are also in a position to work for a better-trained and more risk-conscious construction industry.

Many national institutions maintain high standards of professional competence. Yet institutional pressure on governments to improve the enforcement of building regulations is not so evident. National engineering institutions are important agents for a safer built environment and high professional integrity. Encouragement for the development of more effective national professional institutions and their increased influence in disaster risk management could become more explicit among international agencies concerned with development.

Multiple aspects of protecting urban infrastructure and other forces at work

Most cities experience natural hazards on a relatively infrequent basis. It will not be long before 50 per cent of the world's population is located in urban areas, with many people living in vast cities at risk of natural hazards. This is an inevitable development and the implications are profound.

The level of risk depends not only on the nature of the hazard and the vulnerability of elements exposed to it, but also upon the economic value of the elements at risk. As communities grow larger, are more established and become more complex, the level of risk they face also increases.

Population growth along coastal areas is exposing a greater number of people to the effects of severe weather. While these hazards may be considered moderate, the rapid growth in population, unregulated housing, investment and the increasingly complex infrastructure associated with cities are thrusting an ever-greater number of urban citizens into higher categories of risk. With cities producing 10-30 per cent of GNP, the challenge of making cities safer can no longer be regarded as merely a local concern.

Disasters are only one of the many risks faced by people living in urban environments. Naturally occurring hazards are combined with other equally pressing urban issues all compounded by poverty. These include aging or decaying infrastructure, poor housing, homelessness, hazardous industries, unaffordable and poor transport links, pollution, crime and conflict. This is also an area for gender analysis as women-headed households in informal urban settlements are often at very high risk in natural disasters.

The built environment is deteriorating at a rate that most cities cannot afford to address. One can cite the example of Mumbai, India among many other similar cases. According to the government of Maharashtra's Greater Mumbai Disaster Management Plan, Risk Assessment and Response Plan, 2.76 million buildings of the city were registered in the 1991 census. Not more than nine per cent of them were constructed with reinforced concrete, while another 31 per cent of the structures were made of brick masonry. The remaining 60 per cent of the structures were built of informal masonry or were non-engineered buildings constructed of light material widely used in slum areas. The vulnerability of these latter structures is so evident that an earthquake of intensity VII (Modified Mercalli Scale) would likely damage between a half and three quarters of them significantly.

There are other examples that illustrate a growing awareness of the need to protect essential services and infrastructure. They also indicate that the problems are not so simply identified as being strictly technical. The following cases demonstrate that while each one involves technical and specialist inputs, additional forces often complicate the realization of effective solutions.

In most instances though, major keys to success emerge as a combination of the exercise of official responsibilities and a wider measure of public participation in reducing the risks. Vital roles need to be played by public and private entities, international organizations and development agencies, to motivate joint and collaborative initiatives for mutual benefit. Neither the insistence of good and responsible governance, nor the assumption of civic responsibilities, can be discounted as essential measures of successful disaster risk reduction

Case: Algeria

In May 2003, the biggest earthquake since 1980 struck north-central Algeria, only 50 kilometres from the national capital, Algiers. With a magnitude of 6.8 on the Richter Scale, at least 2,300 people were killed, more than 10,000 injured, with more than 200,000 people left homeless. Many buildings collapsed like playing cards, and the prevailing perception of immediate emergency relief was that it was neither timely nor adequate.

Driven by a frustration of some people digging in the ground with their bare hands to rescue trapped people, some citizens quickly converted their suffering into anger against the national government, local authorities, property developers and constructions firms. When the president visited the impact zones the following day he was met by an angry and unruly crowd demanding to know how these conditions had been "allowed to happen".

The explanation is neither unique nor simple, when one considers that the origins of such a disaster lay in many layers of socio-economic vulnerability and political decisions taken or avoided. However, because the country is situated in a highly seismic area, one could foresee with certainty that a strong earthquake would hit the region, even if it were not possible to predict exactly when.

Certainly one among the many reasons for such a high impact was the widespread if erroneous belief that local standards of construction were sufficient, to provide an adequate measure of earthquake resilience for conditions known to exist. They clearly proved to be inadequate or were not rigorously applied.

There were probably other contributing factors. There was a sudden increase in demand for many new dwellings to house the rapidly growing population of workers, accompanying rapid economic liberalization and deregulation during the 1980s.

Under such conditions, one can speculate on the extent to which land allocation, land-use planning and building controls were considered or managed. However, following the devastation of the earthquake it was evident that people had clearly constructed recklessly, without the full benefit of professional responsibility or adequate safety standards in risky areas.

The additional contexts of unemployment, poverty, social inequality, economic dependence, and a difficulty to sufficiently use local knowledge further contributed to acceptance of vulnerability for potential losses. A dense background of risky practices and the absence of attention devoted to either the prevention or mitigation of risks is behind many disasters. Disclosure often comes with disaster.

While the complex issues of reducing inequalities and poverty, or promoting employment and public services have many roots, some shorter-term solutions for better prevention and mitigation are still possible. Increased public awareness of local hazards and risks is essential. Potential homeowners can then become a self-motivated group of building inspectors. If governments have responsibilities, so do citizens.

Case: Turkey

In May 2003, an earthquake in the Turkish city of Bingol destroyed 300 buildings and damaged more than 5,000 others. No damage was so

"If people showed as much interest in the earthquake safety of their apartments as they show in the type of tiles, doors and taps used, then it is more likely that building contractors would stick to the rules and regulations."

Source: Alpaslan Özerdem, 1999

"Hazard mitigation is not primarily a technical exercise: it is inherently and often intensely political because mitigation usually involves placing some cost burdens on some stakeholders, and may involve a redistribution of resources...Advocates for risk mitigation strategies must develop political as well as technical solutions."

Source: Coburn and Spence, 2002.

grievously felt as the collapse of a school dormitory, killing 84 children. A modern, engineered structure, the dormitory had only been built in 1998.

This event occurred four years after the terrible 1999 earthquake in Izmit, Turkey, which killed 20,000 people. It also relaunched the loud public debate on the prevailing standards and building codes that are applied, or not applied, as the case may be. An analysis of 12 types of debris in Bingol revealed that some of the concrete used was less than required norms and contained improper types of sand and gravel. Moreover, iron reinforcement bars were linked improperly, if not carelessly. A subsequent inquiry by the Turkish judicial system noted that the company that constructed the school dormitory had been forbidden previously to operate in the public sector because of overpricing.
<http://www.info-turk.be>

Many countries have outlying or isolated regions, not infrequently mountainous or subject to seismic activity. Reflecting the rugged physical geography, the inhabitants of such areas often lead a precarious life. By being distant from the political and economic concentration in major urban areas, these people often suffer national and global trends that concentrate wealth elsewhere, widening inequalities of class, ethnicity, beliefs or community. These forces can potentially fuel a process of underdevelopment that encourages corruption and leaves people to focus solely on their rudimentary survival.

Such a wider perspective of vulnerability that hinders the mitigation and prevention of risk is acutely conveyed in discussion in Radical Interpretations of Disaster (RADIX), an online discussion forum about public perceptions of risk and activist solutions.
<http://online.northumbria.ac.uk/geography_research/radix>

Protection of health systems

Following the 1985 earthquake in Mexico City, PAHO began work on vulnerability and disaster reduction for health facilities in Latin America and the Caribbean, with an emphasis on hospitals. This experience made it clear that it was not sufficient for medical and support staff alone to be prepared to attend to emergency situations. It was equally important for the political establishment and the public to undertake mitigation measures to reduce the vulnerability of the public health infrastructure.

During the past 15 years, a growing number of professionals and academics have worked to compile technical manuals about disaster risk management measures that should be applied in the construction, maintenance and retrofitting of health facilities. Additional work has been undertaken to conduct vulnerability studies and to retrofit several hospitals to withstand earthquakes.

Disaster events that occurred during the El Niño phenomenon in 1997-1998, showed an increased need to consider the impacts of water-related disasters on health sector facilities. In addition, the impact of disasters on infrastructure demonstrates considerable environmental and health consequences, in particular given the vulnerability of domestic water supplies and the physical infrastructure necessary for sanitation.

Health risks related to the disruption of water distribution and sewage systems in the aftermath of disasters, and particularly during floods, contribute greatly to mortality rates. There is growing appreciation of the importance of ensuring proper maintenance and protection of systems for industrial water and wastes, so that they do not result in toxic or chemical pollution of water resources.

Box 5.26
Vulnerability studies and mitigation measures in the health sector

In order to ensure that technical knowledge is passed to other countries, the Pan-American Health Organization (PAHO) promotes an exchange of ideas between professionals and governments in order to advance the idea of preventing avoidable losses in the health sector from natural hazards.

Despite technical advances that have been available to support health sector initiatives against natural hazards, many have not been implemented in health facilities. This has been due to lack of planning, insufficient resources or a simple lack of interest on the part of government authorities or potential financial supporters. Unfortunately, many of these projects have failed more from a lack of interest to do things responsibly than from a lack of resources.

This topic has provoked considerable interest in Latin America and the Caribbean. An attempt has been made to move the agenda of disaster reduction forward by the publication and distribution of relevant information by PAHO and other institutions. This is being realised most effectively through the joint participation of the academic, private and health sectors.

Many hospitals have taken steps to reinforce their facilities in light of the risks of disasters. In order to develop this approach further, there is a continuing need to promote and organize studies about vulnerability in the built environment, particularly facilities essential to public health.

Source: PAHO, 2002.

PAHO has promoted this topic since the early 1990s. Nevertheless, vulnerability reduction in water and sanitation has a long way to go. So far, emphasis has been on meeting the immediate needs of the population without encouraging a wider analysis and application of disaster prevention initiatives.

This is partly due to the many institutions involved with water and sanitation and the absence of leadership at national or local levels. It is also partially a result of the geographical extent of these services and the complexity of the technical solutions involved.

Advances have been made in the development of technical manuals to reduce the vulnerability of water treatment facilities against natural disasters based on the experiences of individual countries. However, technical publications that fully list criteria for building or protecting critical facilities from damage by natural disasters have not yet been developed.

Peru has established legal guidelines for the health sector to encourage the inclusion of disaster reduction activities in its action plans. However, there has been very little elaboration on the technical skills to carry out these guidelines. It is vital that academic institutions and professional organizations assume the responsibility to promote technical knowledge.

The result of these initiatives has been to familiarize organizations such as the Pan-American Engineering Association for Public Health and Environment (AIDIS) with prevention issues. In the same way, there have been advances in promoting risk reduction in various sectors such as the management of water facilities. The wider professional involvement has further enabled these topics to be included in legislative measures related to disaster and risk management issues.

With the exception of Costa Rica and Ecuador, there are few countries in Latin America that can demonstrate the implementation of specific projects to reduce the vulnerability of facilities to natural hazards. For instance, water purification facilities and related systems generally remain exposed to different types of hazards, even though many of them supposedly have been upgraded and despite the widespread recognition that clean drinking water is a top priority in any disaster response activities.

Protection of educational facilities

Schools represent a particularly forceful example of a civic obligation to protect a common good. They are universally recognized in communities around the world for their inherent social value, a location for public assembly and often protection. They regularly serve as a symbol of local identity and many times define a community's worth, as well as representing its future. They embody the highly regarded social values of education and provide the basis for growth,

understanding and experience between generations within a sense of community. This further underlines the importance of schools being built and maintained to what should be the highest standards of protection.

For many reasons in most countries, this is often not the case. Even in times of greatest need, when schools are used as emergency shelters during a crisis or for temporary accommodation following a severe disaster, the primary educational function of schools can be compromised seriously for long periods of time. Policies regarding public safety issues and the continuity of educational functions requiring the use of school buildings during and after a natural hazard event should be carefully considered, discussed and adopted by the community.

The need for such multi-stakeholder deliberation was aired and leadership displayed in an international seminar on Disaster Management and the Protection of Educational Facilities, organized by the OECD in conjunction with the Greek ministry of education and the national school building organization, in November 2001.

There are other examples which demonstrate commitments by which communities, technical specialists and educational authorities are seeking to place the importance of protecting schools, their community functions, and most importantly the children which they nurture at the heart of local disaster reduction programmes.

The OAS School Protection Programme: EDUPLANhemisférico

A comprehensive inter-American strategy was launched in 1993 to reduce the education sector's vulnerability to natural hazards by an initiative of the Unit for Sustainable Development and Environment of the Organization of American States (USDE/OAS), working with PAHO and ISDR. Known as EDUPLANhemisférico, the programme seeks to engage public and private institutions, national and international agencies, NGOs and private individuals to encourage member states to adopt an action plan for reducing the vulnerability of the education sector to natural disasters through a variety of international forums.

EDUPLANhemisférico works through eight technical secretariats with the cooperation of a variety of institutions in the Americas, including universities and development centres of school infrastructure. Together, they serve as implementing focal points located in Argentina, Costa Rica, Peru, Trinidad and Tobago, the United States and Venezuela. They conduct activities at a number of local, national and regional locations with their work divided into three areas: academic improvement, citizen participation, and physical infrastructure protection.

There is a commitment to improve the curriculum with the addition of more elements pertaining to understanding vulnerability and risk reduction in primary, secondary and higher education. This is done to encourage individuals and various professional interests to work more closely together for disaster reduction.

Regardless of international efforts to design and implement acceptable standards for building and retrofitting schools, EDUPLANhemisférico recognizes the values and needs for energetic local participation to reduce the vulnerability of school buildings to natural hazards.

EDUPLANhemisférico sees the enforcement of internationally accepted standards as a complementary but not essential component of disaster reduction of school infrastructure. The primary enforcement of standards should take place through societal mechanisms at the most local level of a society and in the most direct means possible.

Local enforcement means the participatory review and action regardless of any other technical or governmental requirements, and it is preferable to provincial or national levels of oversight. International enforcement is not recommended because local participation should demand accountability from the more immediate owners and operators of the vulnerable school infrastructure.

In this respect EDUPLANhemisférico works to accomplish more local participation and accountability in addressing all forms of vulnerability in the education sector until each successive administrative level of responsibility has

no choice but to become more accountable itself. An internationally accepted standard ultimately must be that there is no loss of life from school facilities impacted by natural hazard events and that the buildings continue to function through times of disaster.

The declaration of the ministries of education during the meeting in Punta del Este, Uruguay, in September 2001, failed to include the issue of reducing the vulnerability of school buildings to natural hazards in the sectoral agenda. Accordingly, EDUPLANhemisférico will continue working to make this issue part of the ministries of education agenda.

In Latin America there are at least three other programmes that reflect concerted efforts to increase the resilience of school buildings against damage from natural hazards.

Seismic vulnerability analysis of school buildings, Santa Fe de Bogotá, Colombia

This programme of the education secretariat in the capital district was developed by Projects and Designs Ltd. in April 2000. Most of the school buildings were built before the standard of the Colombian code for seismic resistant buildings was in force. As a result, most of the buildings in Colombia, including many schools, were designed and built without any seismic-resistant criteria. The analysis developed a methodology to be used in all phases of the project, and the staff in the education ministry was trained to obtain information for the primary evaluation of seismic vulnerability. The primary evaluations were conducted in all schools, determining the seismic vulnerability of each. Priorities among individual schools were then assigned according to available budgets. In some cases more detailed vulnerability analyses and structural retrofitting studies were conducted.

Vulnerability evaluation and retrofitting of schools, Quito, Ecuador

This evaluation exercise was developed by the National Politechnic School and conducted in three typical structural systems used for schools in Quito. These included structures employing unreinforced masonry or adobe construction; two to five storey reinforced concrete buildings generally using frame and slab floors; and those with steel frames and unreinforced masonry infill walls generally found among more lightweight structures.

The study noted that there were no previous records about the extent or types of earthquake damage to schools. However, information gathered more recently shows the following common weaknesses:

- Short columns are a common architectural design in most of the reinforced concrete buildings and cause severe damage in an earthquake.
- Inadequate design features in construction joints can result in damage to adjacent buildings during earthquakes.
- Infilled walls of the light steel structures tend to fail due to inadequate connections with the steel frames.
- Lightweight roofs collapse because of the absence of tensile reinforcement.
- Adobe construction and unreinforced masonry are very vulnerable because of the absence of connecting beams and the presence of heavy roofing tiles.

The lack of appropriate maintenance was also identified as increasing the vulnerability of the structures. Experienced engineers visited each building, performed a short evaluation, and then recommended procedures to classify them according to the degree of vulnerability observed. Subsequently, a group of schools was evaluated in more detail using mathematical models.

The government of Ecuador has recently approved revised seismic provisions for structures based on regional standards, but there are no effective mechanisms in place to ensure the enforcement of these regulations. Under the new code, schools are classified as critical facilities, so it is expected that they will be engineered to a higher standard.

Retrofitting rural schools, Venezuela

This activity was developed by Fundación de Edificaciones y Dotaciones Educativas in 1998, to strengthen the most commonly used structures in

rural areas. The lightweight structures have steel frames and unreinforced masonry with infilled walls, of one storey with a sheet metal roof. The fragility of the building components shows rapid deterioration. The objective of the retrofitting plan was to repair and improve the existing buildings so that they would be more durable, secure and comfortable.

First, the structure was reinforced. A thin concrete slab reinforced by a net of expanded metal was substituted for the metal roof, and a thermo-resistant cover was added. Then, the exterior walls, doors, and windows were modified to improve illumination, ventilation, and the security of the building. For each building, a cost-benefit analysis was considered to verify the advisability of either retrofitting or replacing the building.

A pilot project was implemented in a preschool building, and the methods employed solved the problems observed in most of the buildings evaluated. It was observed at first that the initial cost appeared high in comparison to an unmodified structure. However, the obvious benefits of the improvements in the quality of education that could be offered in a comfortable, secure, hygienic, and more aesthetic school convinced people that the expenditure was a good investment.

Future challenges and priorities

As essential components of any successful disaster risk reduction strategy, safe building construction practices and the protection of critical facilities present both important opportunities, but also areas for additional attention. In reflecting on the experience conveyed in this chapter, the following issues represent important challenges for the future.

Safe construction is rooted in risk assessment

The fundamental starting point for the effective engagement of engineering and construction measures for disaster risk management must proceed from a sustained and on-going commitment to risk assessments. Attention in this respect initially must take account of the intended physical locations of housing, facilities and infrastructure, guided by consideration of appropriate land use and related planning processes. The suitability and quality of construction as related to risk factors are inextricably linked to the judicious evaluation of physical aspects of vulnerability.

Need for a wide coalition of interdependent interests

Experience that demonstrates the value of structural measures in creating a safer built environment is grounded in the mutual recognition of many different interests. The constituency associated with the physical aspects of disaster risk management needs to include a growing coalition of investors, developers, planners, architects, engineers, builders and government officials. Educators in each of these professional disciplines, but especially in the fields of building trades, engineering and public administration are equally important. They are crucial for consolidating the knowledge and experience of the past and passing that knowledge along with professional skills to future generations. There is a need to bring the full range of technical, social and political considerations to bear on each of these responsibilities, with a fuller appreciation of their mutual inter-dependence if significant levels of physical resilience and protection are to be realized.

Responsibility starts at home

The most essential responsibility for a safe building environment must rest with the public and individuals in fulfilling their roles as owners, users and inhabitants of structures. It is only with their understanding and involvement that collective behaviour can be encouraged that leads to providing greater resilience within any community. Translation of such individual self interest into more persuasive advocacy rests upon the systematic efforts to spread information about hazards and associated risks. This builds a basis for institutional strength, increases accountability and can also trigger new initiatives.

A need for determining acceptable levels of risk

Even while the foundation of effective risk management in the built environment is tied to risk assessment, it is important to ensure that there is a related commitment to evaluating levels of acceptable risk. There is a need for institutional capabilities and also public dialogue to establish priorities of what structures, facilities or lifeline systems must be protected at all costs. Such priorities need to proceed beyond the identification of key facilities and systems and have to be carried through to the determination of priority applications of chosen technical procedures or processes. There is a need for technical analysis and understanding, but success will depend ultimately on the extent of negotiated agreement that takes account of economic, political, and social tradeoffs of what the society or community cannot afford to lose.

With regard to infrastructure and related lifeline services, it is particularly critical that a long-term perspective be adopted in consideration of collective well-being. This suggests that a particular relevance be given to protect the health and educational systems that underpin the social vitality of a community at least as much as the economic and natural resources that determine the viability of a population. For both of these reasons, it is important that the value of infrastructure be seen in terms of the service functions they provide in the context of sustainable development.

Continuing challenges in enforcement of safe practice

In all countries there are many continuing challenges to ensure the adherence and implementation of safe building standards and land-use regulations that contribute to a safer built environment. While continuous efforts to improve existing building codes are always desirable, and authorities are encouraged to devise them where none exist, the real and pressing need is to find means to apply and enforce those that have already been designed. It is widely accepted that incentives are more conducive to realizing normative standards in ones own self interest than the threat of punishment for the failure to do so, which seldom seems to be pursued with the vigour that should be expected.

As discussed, the reasons for non-compliance are many but official and commercial corruption, intentional oversight, and concentration on short-term advantages all contribute to a careless attitude towards public safety. Only continuous concerted public and private efforts to create a stronger sense of dedication to risk reduction can overcome these other more selfish attitudes. The goal needs to be one of creating sufficient critical mass in public expectations and political responsibilities through good governance to make risk reduction an accepted public value.

Professional training and applied knowledge

The construction and engineering professions, along with the commercial interests and educational institutions which sustain them, have special responsibilities in the teaching and promotion of values that contribute to successful disaster risk management in practice. It is they who must work with greater effort to instill professional integrity within their own ranks, but also to advocate for more sustained policies in the public interests for a safer built environment. Such an approach may seem to fly in the face of expected traditional relationships between business, academia and government. Nonetheless, it forms the basis of public-private collaboration that is increasingly being identified as the only viable, and economical, way to achieve safer construction and public infrastructure.

5.4 Financial and economic tools

Financing disaster risk reduction has become a critically important issue in view of the increasing need for investment in disaster mitigation and preparedness at national and local levels. The mounting costs of disasters, the huge losses that have to be covered by insurance companies, and the fiscal pressure on governments in undertaking post-disaster recovery and reconstruction have called for sustainable financing arrangements to address disaster risks. While many governments have sought external assistance and credit for reconstruction, communities and households continue to need access to more resources for protecting their income and consumption.

Insurance is a well-established mechanism for risk transfer, but less than one fourth of all losses resulting from natural disasters around the world are insured. The distribution of natural disaster insurance is heavily in favour of developed countries. The United States, United Kingdom and Japan amount to about 55 per cent of the total coverage.

By contrast, Asia, with many developing countries, and which represented half of all the damages caused by natural catastrophes and two thirds of all the casualties from catastrophic events in the last years, accounted for only 8 per cent of the insurance coverage for catastrophes purchased in the world market. This lack of insurance coverage and more limited social safety nets in countries imply a high level of vulnerability, which is only exacerbated by risks of natural disasters.

Reducing vulnerability requires investment in preparedness and risk reduction and access to financial resources. These resources are provided through official development assistance, multilateral development banks, governments' budgetary resources, and market- and community-based institutions. Utilization of these resources depends upon the availability of facilities and instruments, and necessary institutional support.

This section presents a brief survey of different sources of funding, as they strongly influence the development of specific financial instruments and services. It further discusses how specific financial instruments and services help governments, communities and households in managing disaster risks, focusing on:

- *international assistance;*
- *national financing for disaster risk reduction; and*
- *market based instruments for risk reduction.*

International assistance

Official development assistance

An important source of funding for disaster reduction is the official development assistance from member countries of the Organization for Economic Co-operation and Development (OECD). It is often difficult to determine the precise amount of assistance provided for reducing disasters impacts as official assistance data for natural disasters often incorporates data on complex emergencies, such as conflict also affecting the area in question. Funding for disaster risk reduction historically has tended to come from humanitarian assistance, which typically responds to emergency assistance and relief needs at the time of a disaster or crisis situation. Recent developments have encouraged it to become embedded in development projects, particularly as risks assessments and disaster risk reduction are taken into account.

According to the UN Office of the Coordination of Humanitarian Affairs (OCHA) the total donor contribution for all kinds of humanitarian

"Development and relief workers are seeking ways to use available relief funds to meet the emergency needs of disaster victims and, at the same time, support fundamental change towards long-term development. These two motivations—an urgent need to deal with the causes of disasters rather than only with the symptoms, and the necessity of getting the best possible short-term and long-term outcomes from aid funds—are forcing policy makers to take a harder look at the tools that are available for effective planning and programming. One such tool, which can contribute significantly to addressing root causes and which can support effective, efficient, and equitable long-term development, is gender analysis."

Source: Mary Anderson, 1994.

assistance was US$ 4.2 billion and US$ 4.5 billion in 2001 and 2002, respectively. Out of this assistance to support emergency and disaster response activities, natural disasters accounted for a small percentage: US$ 331 million in 2001 and US$ 238 million in 2002. The yearly breakdown of official assistance for natural disaster response is given below.

Table 5.1
Official development assistance in response to natural disasters

Year	Contribution for natural disasters (US$ millions)
1992	257.44
1993	77.66
1994	113.47
1995	104.67
1996	84.14
1997	302.69
1998	1,151.87
1999	296.41
2000*	
2001	331.51
2002	238.27

* Data for the year 2000 unavailable.
Source: OCHA <http://www.reliefweb.int/arfts/>.

The incorporation of risk reduction measures in development portfolios and projects is less obvious, but nevertheless is being increasingly recognized. No consolidated statistics are yet developed to show the trend.

Development banks promoting investment in disaster reduction

The World Bank and multilateral development banks such as the Inter-American, Asian, and Caribbean development banks have emerged as primary sources of funding for recovery and reconstruction following a major disaster. For example, after the Bhuj earthquake in India in 2001, the World Bank provided US$ 400 million by restructuring existing loans.

Many governments in the developing world find themselves fiscally constrained to reallocate their own resources for emergency needs following a large-scale disaster and turn to international financial institutions for immediate assistance. However, investment data on disaster mitigation are rare as only a small number of countries have approached multilateral development banks to ask them to finance disaster mitigation programmes.

These institutions, are also in a stronger situation to support sustainable disaster risk reduction strategies through their large-scale lending. In recent years, they have come to recognize the strategic importance of projects for implementing disaster risk reduction as part of their portfolios.

The World Bank

The World Bank has supported reconstruction projects across all regions in 56 countries.

Table 5.2
World Bank approved natural disaster reconstruction projects (1980-2000)

Region	Number of disaster projects	Percentage of all active projects
Africa	19	21
East Asia	13	58
East Europe/ Central Asia	9	44
Latin America	36	36
Middle East/ North Africa	9	22
South Asia	16	19
Total	102	33

Source: Gilbert and Kreimer, 1999.

In addition to reconstruction, the World Bank has also invested in disaster mitigation projects as well, albeit indirectly. Most of the mitigation projects seek to achieve a number of objectives

Box 5.27
Lack of ownership a reason for low-priority risk reduction

Tearfund is a British relief and development NGO. During 2003, it completed a research project that assessed nine institutional donors' policies and practices on natural disaster risk reduction.

The research identified that a key obstacle preventing greater integration of risk reduction into development interventions is a lack of ownership of the subject by development departments. Neither relief nor development sectors within donor agencies fully identify risk reduction as an area of their specific responsibility. Consequently, the issue falls between relief and development processes. Consequently, a lack of ownership results due to:

- The relief-development cultural divide: development specialists often do not perceive disasters as their remit, but rather an unfortunate detour on the developmental path.
- The unreliable assumption of development professionals that poverty reduction development work, by its very nature, reduces the risk of disaster. Hence the entire development community already addresses the problem.
- The broad range of disciplines involved in preventing disasters. This only adds to the confusion regarding whose responsibility it actually is.

There are several strategies to improve and integrate ownership:

- Engage development staff through risk reduction training initiatives, workshops, seminars and presentations.
- Use practical tools such as checklists to assist development professionals consider a project in light of the disaster risks it faces, and the ways in which it can withstand and help mitigate these risks. Any checklists should be developed with the as broad participation as possible. In this way they will view it as a useful aid to incorporating the risk dimension and not as more unnecessary rules.
- Establish a monitoring process to ensure checklists are used and to evaluate the impact of policy on the practice of the organization.

Tearfund's research joined the findings of UN/ISDR, the development banks, the International Red Cross and Red Crescent Movement and others in highlighting the need for more concrete evidence of the cost effectiveness of risk reduction.

It is vital that development sectors are convinced that investing in disaster preventive action is worthwhile. Considering the current weak economic rationale for risk reduction, development specialists and, more crucially, economists (including those working on poverty reduction strategy papers in developing countries) need to be convinced that risk reduction pays.

Source: *Natural Disaster Risk Reduction: The Policy and Practice of Selected Institutional Donors*, Tearfund, 2003.

other than natural disaster mitigation such as those involving the construction of dams or water resource management. Very few countries have approached the World Bank to finance a disaster mitigation programme exclusively.

Latin America and the Caribbean

While expanded economic and financial investment in disaster reduction is proceeding at different paces reflecting different levels of commitment throughout the world, Latin American and Caribbean countries have taken the lead.

The relationships between disaster vulnerability reduction and economic development have been encouraged by influential regional institutions. These include the UN Economic Commission for Latin America and the Caribbean (ECLAC), the Central American Bank for Economic Integration (CABEI), the Caribbean Development Bank (CDB), the Andean Development Corporation (CAF), the Inter-American Development Bank (IADB) and the World Bank's Disaster Management Facility (DMF). These organizations have recognized the value of disaster mitigation measures in reducing and alleviating serious economic disruptions and thus in determining a country's path towards economic growth.

IADB is a very active lending institution in the field of disaster reduction with well-defined policies and activities. Since 1990, the IADB has lent more than US$ 2 billion in the region to help countries undertake disaster-related programmes.

One third of the loans have been directed to prevention and mitigation investments, often as

components in sustainable development projects. The main part of the financing following disasters has concentrated on rebuilding physical infrastructure. This has included water, sewage, electricity and road systems (65 per cent of all reconstruction loans). The re-establishment of social services including health, education and housing amounts to 25 per cent of the loans. Additional credit lines and support for productive activities such as micro enterprises account for another 10 per cent.

Over two thirds of IADB loans related to post-disaster funding represent new monies extended to the affected countries. Less than one third of the reconstruction resources came from modifications of loans already approved under implementation. There is a special accelerated disbursement mechanism for emergency situations for amounts up to US$ 20 million per project. Eight such programmes have been approved since 1999. IADB strategies to incorporate disaster reduction in development are outlined in *Facing the Challenge of Natural Disasters in Latin America and the Caribbean: An IADB Action Plan*, published in 2000.

In March 2001, IADB approved a new financial mechanism, the Sector Facility for the Prevention of Natural Disasters, to support pilot programmes in disaster prevention and risk management. The facility provides reimbursable resources of up to US$ 5 million per project for activities that strengthen disaster prevention and risk management systems.

It covers many areas, including policy and institutional development, adaptation of innovative financial instruments, early warning systems and mitigation investments. A number of countries in the region are seeking financial resources through this facility.

The Bank has been funding a Regional Disaster Policy Dialogue among the borrowing member countries since 2001. It also has established special programmes to improve the availability and use of risk information in the region with ECLAC, and to elaborate disaster indicators with the help of the National University of Colombia and in coordination with UNDP. A set of criteria and checklists to manage risk within the project cycle for loans is under development.

CDB has adopted strategic and operational guidelines for assessing natural disaster management programmes. These initiatives seek to assist member countries in developing disaster management capabilities while ensuring that disaster management principles are integrated into CDB operations. OFDA/USAID and CDB member states made it possible for CDB to launch the Caribbean Disaster Emergency Relief Fund, a disaster management facility set up to provide greater assistance for disaster mitigation and preparedness.

ECLAC has reviewed its socio-economic damage assessment methodology to promote investment in risk reduction as part of rehabilitation and reconstruction following disasters. The review is carried out in collaboration with several other UN agencies, the World Bank and IADB. A new manual includes additional components on environmental assessment and gender focus.

Asia

The World Bank and the Asian Development Bank (ADB) have, between them, provided financial support of up to US$ 2 billion to numerous projects for disaster recovery and reconstruction in Asia. These projects relate to emergency financial assistance, earthquake reconstruction, flood recovery and restoration, and cyclone reconstruction, among others.

Operating in a region very much beset by natural disaster, ADB is keenly aware of the risks associated with development and its investments. Nonetheless, a review in 2000 indicated that the bank's experience with quantitative risk analysis was limited to a handful of applications aimed at estimating the development project risk of certain facilities such as a port, power projects or a rural productivity scheme.

ADB is beginning to place greater emphasis on early warning, prevention, preparedness and mitigation. This bodes well for future support for increased use of disaster risk analysis and estimation procedures aimed at making risk and vulnerability assessments a standard part of country strategies and programmes under its new Emergency Assistance Policy. With the

establishment of a new Regional and Sustainable Development Department, ADB is poised to expand its support to risk reduction activities.

However, there are limitations of this emerging practice in risk analysis:

- They express standard application of risk in project analysis and not analysis of the risk of natural hazards.
- The cases adopt quantitative risk determination through estimates of probability; there is little evidence of the use of multi-stakeholder processes.

There are a large number of post-disaster recovery and reconstruction programmes in Bangladesh, Cambodia, China, India, the Islamic Republic of Iran and other countries in the region. ADB has also supported a number of technical assistance projects for capacity-building in many countries. In India, ADB initiated a programme which goes beyond its traditional role of extending reconstruction loans after disasters to support long-term risk management.

A technical assistance programme was supported by ADB and implemented by the Asian Disaster Preparedness Center (ADPC) in two Indian states, Uttar Pradesh and Uttaranchal. The project was launched in the wake of the 1999 Chamoli earthquake and focused on advising the two state governments on existing institutional arrangements for disaster management. It also provided training workshops on earthquake engineering and the use of local building centres to promote earthquake-resistant buildings. <http://www.adpc.net/technical/ADBproject.html>

Africa

The African Development Bank (AfDB) has provided emergency assistance to member countries since 1979 specifically directed at repairing infrastructure and public utilities damaged by both natural disasters and complex emergencies. According to available statistics, about 33 per cent of all natural disasters in the world, 16 per cent of disaster-caused deaths and 5 per cent of all persons totally affected by natural disasters in the year 2002, occurred in Africa. Hence, disaster impacts have been one of the major obstacles on the path of poverty reduction and development in Africa.

AfDB has focused its development interventions on poverty reduction, but has recently taken steps to broaden its support for disaster management. It has instituted a disaster management financing mechanism emphasizing proactive commitments to mitigate disaster risk and is financing projects to improve disaster preparedness. It sought to provide a more coherent response to disasters by adopting policy guidelines in December 1998 for short-term relief operations and long-term reconstruction and rehabilitation projects. A special relief fund has also been established to provide grants to countries subjected to natural and technological disasters, as well as complex emergencies.

Currently, AfDB and UN/ISDR are jointly carrying out an initiative to break the vicious circle of poverty and disaster vulnerability by mitigating the impact of disasters to sustain development gains. There are four objectives:

- provide a better understanding of the economic impact of disasters, and of the importance of disaster risk management in development planning and activities;
- promote disaster-resilient development activities through integration of disaster risk assessment into development undertakings;
- provide a tool which will guide the steps of disaster risk assessment prior to formulation of development projects; and
- reverse past risky unsustainable development by analysing the disaster risk exposure of development undertakings, so that scarce economic investment, especially from the poor, can be used in an efficient manner.

The ongoing initiative between AfDB and UN/ISDR will result in an initial report and disaster risk assessment guidelines.

The World Bank and disaster reduction

The World Bank has invested US$ 7.5 million in 102 natural disaster reconstruction operations since 1980, but has now, along with other borrowers, begun to be more attentive of the need

to mitigate the effects of natural disasters before they strike. There is a growing trend of bank approval of mitigation projects with 55 approved in the 1990s against only 40 in the 1980s. However, a review of the bank's disaster-related projects since 1980 found that in most projects, the full loan amount was not dedicated to mitigation and prevention measures.

Four countries alone – Bangladesh, Brazil, China and India – accounted for 40 per cent of the World Bank's mitigation portfolio. Moreover, it is a concern that half of the top client countries for reconstruction projects do not appear among the main borrowers for these mitigation projects. There is scope for greater bank mitigation assistance to these countries that may help reduce demand for reconstruction.

The World Bank has provided more than US$ 14 million to both Honduras and Nicaragua in support of projects to improve municipal capabilities in risk management. Activities will focus on improving land-use and planning procedures based on hazard analysis and strengthening national risk and disaster management systems. The scheme works through umbrella municipal organizations, national disaster organizations and scientific and technical institutions such as the Nicaraguan Institute of Territorial Studies.

The World Bank is continuing to commit resources to the Organization of Eastern Caribbean States (OECS), mainly through subregional programmes which offer risk reduction loans to five countries to support capacity-building, institutional strengthening, community preparedness and greater protection for key infrastructure. The number of bank-financed OECS projects has almost tripled since 1997 and commitments have doubled to US$ 71.2 million. <http://www.oecs.org/>

International Monetary Fund balance of payment support

Since 1962, the International Monetary Fund (IMF) has provided emergency assistance to member countries afflicted by natural disasters. IMF loans are intended to maintain balance of payments position, enabling countries to offset resulting shortfalls in export earnings or from increased imports for recovery and reconstruction.

The IMF uses quick disbursal loans, and does not involve adherence to performance criteria. Assistance is usually limited to 25 per cent of the member's quota in the IMF, although amounts up to 50 per cent have been provided in certain circumstances. The loan is advance at a standard rate of charge, and repayment is required within 3 to 5 years. <http://www.imf.org/external/np/exr/facts/conflict.htm>

To date, 24 countries have received financial assistance related to natural disasters on 26 different occasions. Countries that have received IMF assistance for natural disasters since 1998 are shown in the following table.

Table 5.3
IMF Emergency assistance related to natural disasters (1998-2003)

Country	Year	Event	Amount (US$ million)	Per cent of quota
Bangladesh	1998	Floods	138.2	25
Dominican Republic	1998	Hurricane	55.9	25
Haiti	1998	Hurricane	21.0	25
Honduras	1998	Hurricane	65.6	50
Saint Kitts and Nevis	1998	Hurricane	2.3	25
Turkey	1999	Earthquake	501.0	37.5
Malawi	2002	Food shortage	23.0	25
Grenada	2003	Hurricane	4.0	25

Source: International Monetary Fund, 2003.

National financing for disaster risk reduction

Official development assistance and multilateral lending for reconstruction and rehabilitation have followed major disasters, yet these resources are generally insufficient to meet reconstruction needs. In addition, as governments also require resources to deal with small and medium disasters, they have to depend upon domestic resources for financing disaster risk management.

Domestic financing for disaster risk management has been slow to develop owing to both

Box 5.28
European Union Solidarity Fund for national recovery

A regional disaster reduction fund, the European Solidarity Fund, capitalized to 1 billion Euros annually, was established following the floods that occurred in central Europe during the summer of 2002. The fund will provide assistance to a member state or a country affected by a major disaster.

This is defined as having damages estimated as greater than 3 billion Euros or more than 0.6 per cent of a country's gross national income. However, exceptions can be made in case of extraordinary regional disasters resulting in damage inferior to this threshold and for remote and isolated regions.

Assistance from the fund can be used for:

- restoration to working order of infrastructure and plant in the fields of energy, water and waste water, telecommunications, transport, health and education;
- provision of accommodation and funding for rescue services to meet the needs of the population concerned;
- securing preventive infrastructure and measures for immediate protection of cultural heritage; and
- cleaning disaster-stricken areas, including natural zones.

Assistance from the fund takes the form of a single comprehensive grant, with no necessary co-financing, complementing the public efforts of the beneficiary state. The fund has released 444 million Euros to Germany; 134 million Euros to Austria; 129 million Euros to the Czech Republic; and 21 million Euros to France.

Source: <http://www.ibeurope.com/Database/Factsheets/> and <http://europa.eu.int/abc/doc/off/bull/en/200209/p104030.htm>.

institutional and informational weaknesses in addressing disaster risks. Though national budgets make provisions for disasters, it is generally for relief and emergency response activities.

Prevention and mitigation have not yet become integral to public finance, nor have institutional channels for mitigation investments yet been developed. A number of special funds now being set up in many countries for financing disaster risk reduction are discussed below.

Calamity funds

The objective of calamity funds is to provide resources to meet emergency needs immediately following a disaster. By using resources accumulated before a disaster occurs, these funds offset government expenditures at the municipal, local, national and even regional levels during a crisis. A number of countries, such as Colombia, India, Philippines and Fiji have set up contingent calamity funds.

Reconstruction, mitigation and vulnerability reduction funds

Another set of funds addresses more long-term objectives. The funding, legal structure and operating principles of these funds derive from their intended objectives. Like calamity funds, safeguards against misuse, autonomy of operations, and sustainability are critical issues for the effective use of these funds.

In Germany, a special disaster relief and reconstruction fund, *Sonderfonds Aufbauhilfe*, was set up after the Elbe floods of 2002. It is a large fund, with 7.1 billion Euros of tax revenues regulated by a special flood solidarity law, the *Fluthilfesolidaritätsgesetz*.

In 1996, the government of Mexico established a Fund for Natural Disasters (FONDEN) composed of three separate funds. The infrastructure fund provides for the repair of uninsured infrastructure. The agriculture fund provides immediate assistance to restore the productivity of low-income farmers. The assistance fund provides relief to low-income victims of disasters. FONDEN has, however, not been capitalized sufficiently to cover all of its obligations. The World Bank provided US$ 404 million in 2002 to recapitalize FONDEN and to support wide-ranging activities related to disaster management.

In Latin America and the Caribbean there are other municipal development and environmental funds that can allocate resources for the prevention and mitigation of catastrophe events in addition to their normal activities.

In Andhra Pradesh, India, a Vulnerability Reduction Fund, financially supported by the World Bank, was created as part of a cyclone reconstruction project. The objective of the fund was to provide matching funds to districts for encouraging communities to undertake hazard reduction activities at the local level.

Social funds

Social funds have become important instruments for social protection in many parts of the developing world, particularly in Latin America and Sub-Saharan Africa. Such funds are generally used to make investments in social infrastructure, particularly in health, education, water supply and sanitation. They have recently begun to be used additionally in disaster risk management and to respond to specific emergencies such as Hurricane Mitch in Central America and drought in Zambia.

These funds are guided by their specific objectives. They may not be sufficiently broad to cover a large number of risk reduction measures, and their viability is also dependent on public sector resources. Further, most of these funds cover a particular segment of the society. These examples represent an increasingly strong advocacy of market-based mechanisms of risk management as a response to inadequacies of public policies for risk management.

Public works programmes

Public works programmes are not specifically financial instruments, but are nonetheless useful means to provide employment to poor households affected by a crisis or disaster. Typically, such programmes focus on infrastructure projects and target poor households. Providing households with income following a crisis helps them avoid costly and damaging strategies such as having to sell their belongings or go hungry.

One of the best-known examples of a large-scale public works programme to improve household conditions at the time of crisis is the Maharashtra Employment Guarantee Scheme. Launched during the severe drought of 1970-1973 in India, the scheme expanded rapidly to assist some 500,000 workers monthly.

Argentina set up Trabajar II Programme in the 1990s to cope with sharply rising unemployment, which reached 18 per cent in 1996-1997 and was concentrated among poor people.

Although public works programmes are often expensive to support, their cost-effectiveness needs to be compared with alternative transfer programmes. Public works programmes have been

Box 5.29
Social funds and post Hurricane Mitch reconstruction

In both Honduras and Nicaragua, social funds played a key role in helping communities cope and rebuild after Hurricane Mitch, in October 1998. The Honduran Social Investment Fund (SIF) was decentralized to the most heavily damaged areas in order to work closely with communities and municipalities to assess immediate needs for shelter, water, sanitation systems, road access and bridge rehabilitation.

Special authority and procedures granted to the SIF regional offices enabled SIF emergency response teams to act on location, enhancing their capacity for rapid, effective project placement. Within 100 days, 2,100 projects were executed, with a total value of US $40 million, and another 2,500 projects were identified or appraised with a total value of US$ 57 million.

In Nicaragua too, SIF teams were quickly decentralized, setting up offices in four regions. A 72-person task force of architects and engineers was deployed to the affected areas. There, they worked to settle the homeless, to provide water and sanitation systems, to open rural roads and rehabilitate bridges. The SIF technical team guided local government units in contracting community firms, hiring 200 local architects and engineers to locate sites to settle the homeless, installing water supply and sanitation systems in the settlement camps, and tackling extensive infrastructure rehabilitation. Within three months, about 1,300 projects were executed with a total value of US$ 12 million.

more effectively used with droughts or famine, while their suitability for other crises such as floods and earthquakes remains to be tested.

Market-based instruments of risk management

Insurance is the most widespread existing risk transfer mechanisms offered by private sector companies. Other market-based mechanisms such as catastrophe bonds and weather derivates have emerged more recently and can be classified as alternative risk transfer mechanisms. Microfinance institutions have also provided a range of financial services which offer promise for reducing risks, particularly for poor households.

Insurance

Major economic shocks such as the one experienced during the Asian financial crisis can weaken existing social safety nets in developing countries. Many developing countries have inadequately funded or limited unemployment benefits, pension schemes, or old age and disability benefits.

In the industrialized world, insurance is a standard practice of transferring risk from one entity or individual to a collective. Insurance is also evident in other countries too, but the lack of insurance for catastrophic risks is in sharp contrast to the use of insurance for other risks.

Insured losses caused by major disasters and mishaps in different regions provide a good idea about the extent of insurance coverage. In 2002, 39 per cent of insured disaster losses were in Europe, caused largely by flooding and storms. A further 39 per cent of insured losses were registered in the United States, most being caused by storms. By contrast, only about 4 per cent of insured losses were incurred in Asia, where Swiss Reinsurance registered more than half of the victims of all catastrophes recorded.

Rich countries also transfer their catastrophic risk from the national insurance systems into worldwide risk-sharing pools. These pools are managed by international reinsurance companies and backed by substantial capital resources. In poor countries, much of the catastrophic risk remains to be borne within the country.

In poor countries, the coverage of catastrophic risk insurance is limited by conditions of both demand and supply. On the demand side, the major obstacle is that governments tend to bail out uninsured parties in the aftermath of a disaster for legal and political reasons, while on the supply side the risk pool is often too small to make insurance viable. Premiums for property insurance are most often unaffordable for households.

Catastrophic risk insurance has become expensive even in richer countries because of several very costly disasters. In a number of countries, notably France, Spain and New Zealand, insurance for catastrophic risks is subsidized by public sector-owned insurance companies.

Table 5.4
Insured losses for different continents and regions

Region/Country	Number of catastrophes	Per cent of all catastrophes	Fatalities	Per cent of all fatalities	Insured loss in US$ millions	Per cent of total insured losses
Europe	40	11.6	1,063	4.5	5,221	38.5
Americas	69	20.1	1,388	5.8	6,338	46.8
United States	30	8.7	140	0.6	5,194	38.3
Asia	154	44.8	14,057	59.1	647	4.8
Africa	65	18.9	6,638	27.9	151	1.1
Oceania	4	1.2	75	0.3	66	0.5
Oceans / Space	12	3.5	574	2.4	1,131	8.3
World total	344	100.0	23,795	100.0	13,553	100.0

Source: SwissRe, Sigma, No. 2/2003.

In the United States, the National Flood Insurance Policy is the largest example of public-funded insurance. In 1991, California set up an insurance pool, which was replaced with California Earthquake Authority (CEA) in 1996. Some 70 per cent of the market for earthquake insurance participates in the CEA. Hawaii created a voluntary homeowner's catastrophe fund in 1993. Florida's 1994 catastrophe fund is a reinsurance fund that reimburses insurance companies when disaster-related losses exceed certain levels. <http://www.raanet.org/policyupdate/natdisaster_state.html>

These new trends in disaster insurance show that catastrophic risk insurance offered by the private sector may only be a partial or limited solution for many of the poorest countries of the world. A more comprehensive approach to insurance is required, which combines both public and private sector resources so that risks my be shared by a very large pool of insurers.

The Turkish Catastrophe Insurance Pool set up after the Maramara earthquake of 1999, supported by the government of Turkey, the World Bank and the private sector reinsurance company Milli Re is a very good example of public-private partnership in providing catastrophic risk transfer and financing facility. <http://www1.worldbank.org/finance/assets/images/tcip_release.pdf>

Alternative risk transfer mechanisms: catastrophe bonds and weather derivatives

Conditions for reinsurance of catastrophic risk exposure tightened following the large insurance losses in the United States following Hurricane Andrew in 1992 and the Northridge, California earthquake in 1994. Insurance companies sought to secure their insurance risk in the global capital market, and began to explore the possibilities offered by alternative risk transfer mechanisms to shift catastrophic risks.

Such a strategy relies upon the tremendous potential of capital markets in absorbing risk. Because global capital markets are so vast – publicly-traded stocks and bonds have a total value of more than US$ 50 trillion – they offer a promising means of funding protection for even the largest potential catastrophes.

Several new risk transfer mechanisms were introduced in the early 1990s to manage catastrophic loss exposures. The Bermuda Commodities Exchange introduced futures and options contracts based on the Guy Carpenter Catastrophe Index. The Chicago Board of Trade opened trading in quarterly futures and options contact based on reported catastrophe losses. The Catastrophic Risk Exchange was established in early 1996 as an Internet-based business-to-business exchange for all types of insurance contracts and related risk management products.

Catastrophe bonds (CAT bonds) were first issued in 1996 and have since gained in importance. They are capital market instruments in which investors receive a premium to compensate for the risk they are taking, and their capital in return if no catastrophe occurs. The yield on these instruments varies depending on the nature of disaster and the severity associated with it. If a catastrophe does occur investors lose the entire principal and the funds are transferred to the insured.

Weather derivatives are another risk transfer instrument that is derived from one or more independently measurable weather parameters. Despite the support of global financial markets, these instruments have not been very successful. A general consensus is emerging in favour of governments playing a central role in furnishing coverage for uninsurable risk. However, there is no agreement as to what the precise role of the government should be and to what extent involvement is required.

Microfinance

Microfinance services are targeted at poor households, who are excluded from the formal banking sector. They started in Bangladesh with the Grameen Bank and expanded to a number of countries with different institutional models. The programme component initially consisted of credit, but subsequently came to include savings and insurance as well. Though microfinance is strongly linked to poverty alleviation efforts for more than a decade, its potential for helping households in crisis or disaster situations has been recognized only recently, in particular after the devastating Bangladesh floods in 1998.

Natural disasters hit women particularly hard. Microcredit programmes, targeted largely to women, can be seriously affected by the impact of a disaster. In India, the Fodder Security System for the women of Banaskantha in Gujarat puts people at the centre of its strategy. It moves away from simple relief measures and provides long-term development solutions for strengthening a community's capacity to prepare for the onset of the disaster and mitigating the effects of drought.

Women who have the responsibility for fodder security and for maintaining the family during drought have benefited from the system in several ways. Fodder provides them food security and increases their opportunities for earning income. Reduction in migration has reduced the pressure of their responsibilities as men begin to remain in the village throughout the dry season.

At a more strategic level, women are participating in the public sphere alongside men in the decision-making processes related to the scheme.

Microfinance institutions can provide both financial and institutional support to their client households by assisting them in reducing their vulnerability to disasters. Financially, they help households by giving them opportunities for income-diversification by source and season. Multiple income earning opportunities and building assets through microfinance help poor households to cope with disasters better.

Microfinance institutions can also provide savings or loan products to encourage clients to move to safer areas and to invest in more durable housing. Some microfinance programmes have begun experimenting with insurance products for

"Misery and hard life are written in my life. They have made me old before my time, but I have not lost hope. Then came the drought of 1985. Both my husband and I started going to work on the relief sites—digging earth. There was drought for four successive years and we dug earth for four years —there was no other way. All my hair fell out and I went bald.

But now I have guaranteed work. I am a member of SEWA and our village group leader. I earn 600 to 700 rupees every month. From my year's savings, I have now bought a buffalo, so that gives me extra income. I am the sole breadwinner; my whole family lives on my income. I also assist the other village women to do high-quality embroidery so that they also get regular work and income. Now, all the men in the village also respect me. They call me a sahib and salute me. The sarpanch (village leader) also consults me when there is a crisis and asks me to present the issue to SEWA."

Source: Profile of Bhachiben Bhurabhai, 45, leader of artisans in Vauva village, quoted in Disaster Mitigation Institute information sheet on women and drought.

Box 5.30
Provision of microinsurance by SEWA, India

Women's high level of self-organization at the local level enables partnerships between women's groups and private or public organizations engaged in risk reduction and disaster response. In India, the Self-Employed Women's Association (SEWA), a trade union registered since 1972 to represent low-income women workers in India's vast informal sector, is a case in point. To protect its membership against risks such as unemployment, poverty, natural disasters, and sickness, SEWA offers its members a variety of microinsurance packages.

Under a basic scheme, members can secure insurance against hospitalization to US$ 43, house and asset insurance to US$ 110, and accidental death insurance for US$ 870. The cost of this package, which also offers benefits against natural death and the accidental death of one's husband, is a fixed deposit of US$ 22 and an annual premium of US$ 1.85. More expensive schemes offer additional protection against natural death, hospitalization and loss of house and assets. Over ten years, 2,000 women have received more than US$ 327,400 in compensation.

In the aftermath of the Gujarat earthquake in 2001, SEWA was instrumental in ensuring that relief supplies reached women equitably, as they maintained lists of member households in some of the worst-affected areas. They immediately conducted village-level needs assessments working closely with surviving family members and with the local Disaster Mitigation Institute.

Recognizing women's urgent need for income following the Gujarat earthquake, SEWA not only helped direct and deliver emergency food, clothing, and water but also provided craft kits to women artisans eager to begin work again even while housed in tents. Within two weeks of the earthquake, SEWA's insurance team had surveyed over 2,500 insured members' claims of damage and losses. Working closely with the local associations in the three worst affected districts, the insurance team carefully documented losses, mainly the destruction of houses.

SEWA's extensive social networks and knowledge of informal leaders, living conditions, and women's livelihood concerns makes them valuable partners in risk reduction. It is also well-positioned to assist women directly but to advocate for their full involvement in participatory and community-based reconstruction emphasizing risk reduction.

Source: <http://www.adb.org/>.

disaster response, in some cases turning to the re-insurance market to spread aggregate risks.

Institutionally, micronfinance endeavours help through their physical proximity, regular contacts, and trust-based relationship with clients. A group- or community-based approach that extends through a wide network of branches in remote areas is conducive to the dissemination of disaster-related information and community preparedness. Related services can also assist in preparing essential medicines, storing food and arranging health-related services.

Many microfinance disaster-related services have not been replicated yet. They require sustained efforts through the design of appropriate microfinance products and services. Investment in these products and services will be mutually beneficial to the well-being of client households and to the strength and solvency of microfinance initiatives.

Future challenges and priorities

The discussion suggests several financial services and instruments exist for disaster risk reduction although each has its respective strengths and limitations. None of the services or instruments can be applied in isolation and a combination of services and approaches will be a more feasible strategy for disaster risk reduction.

In all countries there is a now converging trend of public and private sector resources sharing the financial burden of disaster risk reduction. There are additional challenges which merit further attention.

Forging public-private partnerships will produce new financial instruments and increase the size of the risk pool. It will also give a wider choice to households, communities, and businesses for managing their disaster risks. This also encourages the insurance sector to explore how insurance incentives can support disaster risk reduction measures.

UN agencies and development banks can come together to promote many innovative financial instruments and mechanisms in disaster preparedness, mitigation, recovery and reconstruction. This must include continued encouragement for international development banks and development agencies to require risk assessments and management for new infrastructure development projects.

Development of more specific financial tools for risk management aimed at the very poor is necessary. Insurance schemes need to be complemented by other low-cost risk-sharing mechanisms in poorer communities, such as kinship networks, microfinance and public works programmes to increase coping capacities.

Further systematic documentation and research is needed to quantify the benefits of risk reduction and hazard mitigation. The ProVention Consortium addressed this need by launching a study in 2003 aimed at developing methodologies and guidelines for assessing the net benefits of disaster reduction.

Regional policy dialogue should be supported to facilitate the exchange of experience in areas such as governmental strategies for financing catastrophe losses. This could include losses to government-owned assets, obligations to reimburse losses due to natural disasters, and new financial policy alternatives.

A related area which requires greater understanding is the contrasting influences of the potentially detrimental effects of commercial deregulation and economic privitization, and the beneficial effects associated with trade opportunities and economic competitiveness.

5.5 Early warning systems

The ultimate goal of hazard forecasting and early warning systems is to protect lives and property. They therefore constitute one of the key elements of any disaster reduction strategy.

To serve people effectively, systems must be integrated and link all actors in the early warning chain including the scientific and technical community, public authorities and local communities. Accurate, timely, reliable and comprehensible communications are essential. Effective early warning procedures should be part of the national institutional and legislative framework for disaster management. They equally need to have redundancy built into the system.

Early warning must be complemented by professional services, training and capacity-building activities and the allocation of resources to enable timely actions to be taken to avert loss.

This section will start with the current status of early warning thinking. It will then examine the three key prerequisites on which to build effective early warning systems:

- *political responsibility to promote integrated early warning strategies;*
- *human dimensions of early warning; and*
- *international and regional support.*

It will also describe the following components of the early warning chain:

- *technical identification and monitoring of hazards;*
- *communications requirements; and*
- *response to warnings.*

Current status of early warning thinking

Early warning has always been considered a cornerstone of disaster reduction. One goal of the IDNDR was that all countries should, by the year 2000, have ready access to global, regional, national and local warning systems and broad dissemination of warnings.

During the past decade, many activities promoted the benefits and feasibility of early warning, and identified major strengths and weaknesses of related capacities around the world. These included the 1994 *Yokohama Strategy and Plan of Action for a Safer World*, the declaration of the 1998 Potsdam International Early Warning Conference, the Early Warning Programme Action Plan for the Future presented at the IDNDR Programme Forum in 1999 and the recent outcomes of the Second International Conference on Early Warning in 2003.

Specific concerns were also addressed relating to climate phenomena such as El Niño (1998 Guayaquil International Seminar) and to small island developing states (SIDS) (1994 Barbados Global Conference).

Efforts to integrate early warning as an essential component in disaster reduction have always been encouraged by the UN General Assembly. The crucial importance of early warning was again validated by the ISDR Inter-Agency Task Force which identified early warning as a priority area for its work and created a Working Group on early warning from 2000-2003.

Advances in science and technology during the last decade have improved the potential of early warning to reduce human loss. Good estimates of the timing and location of landfall for tropical cyclones now can be made 48 hours ahead. In one decade, warning lead-time of tornadoes has

doubled. Drought warnings are now issued several months in advance.

The development of new information technologies and the rapid spread of global communications have considerably increased the availability of information and early warnings about natural hazards and disasters. These technological advances now enable better monitoring and forecasting of extreme weather conditions.

Significant improvements in global observation systems have also enhanced the early detection of medium-term climatic conditions such as El Niño events, and will contribute to warnings of long-term hazards associated with environmental change. Sophisticated early warning systems will only be effective with the free and unrestricted exchange of meteorological data.

Early warning systems also must be comprehensible and accessible to all users. They must deliver clear and concise messages tailored to respective social and cultural contexts. The ability to deliver vital information to the public at risk has not always been successful. In many cases, local mechanisms for communicating risk and interpreting warnings remain very weak. Sophistication of technical information may be of little use if it is not linked to the local situation's capacities, resources and traditions.

Moreover, detailed information about the adverse impacts of hazards on people and infrastructure, and their vulnerability – necessary for informed decision-making – is often missing. Even where procedures do exist, communities often do not respond appropriately to warnings because of lack of community engagement and lack of planning, training, resources or viable response options. In many documented cases, the perceived threat of looting following evacuations is considered greater than property loss caused by disaster. In the absence of information about what actions to take, warnings can create panic or indifference.

Box 5.31
Elements in the early warning chain

The main elements of the early warning chain are:

- Detecting and forecasting impending extreme events to formulate warnings on the basis of scientific knowledge and monitoring, consideration of factors that affect disaster severity and frequency;
- Disseminating warning information, augmented by information of the possible impacts on people and infrastructure (i.e. vulnerability assessment), to the political authorities for further communication to the threatened population, including appropriate recommendations for urgent actions; and
- Responding to warnings, by the population at risk and local authorities, based on a proper understanding of the information, and subsequent implementation of protective measures.

Early warning is now widely acknowledged as being much more than a scientific or technological issue related to hazard monitoring, forecasting and telecommunications and climatology, volcanology and seismology. Satellite coverage and state of the art surveillance techniques are now well developed. As stated by Sorensen (2000), "better local management and decision-making about the warning process are more critical than promoting more advanced technologies, although both would help".

The dissemination of, and response to, warnings are still areas where knowledge is at an early stage. For example, in 1997, research in the United Kingdom indicated that the performance of its flood warning systems was generally poor. This was seen as primarily due to weak links in the chain that connects forecasts with the public at risk. The study found that only about fifty per cent of warnings were received by intended recipients.

In some places, inhabitants became aware of flood risks through unofficial or informal flood detection and warning processes, with the official warnings being received well after the informal alert. Sometimes warnings were received even after the flood had occurred. People were found to be dissatisfied with poorly targeted systems that did not reach down to those at risk. Unsuitable institutional arrangements were cited as part of the dissemination problem. Areas of concern were the weaknesses in:

- monitoring and evaluating hazard onset situations;
- learning from experience to improve future policies and operational practices;
- the effectiveness of internal communications systems;
- communicating with potential victims and advising them of appropriate actions;

- providing adequate levels of pre-hazard training; and
- mobilizing resources for response activities.

The example of the March 2001 floods in the town of Grafton, New South Wales, Australia illustrates problems associated with the response element of the warning chain. The potential threat was so serious that it was decided to evacuate all 12,000 residents from the flood hazard zone. However, fewer than ten per cent of the residents left the city during the nine-hour evacuation period. A research project was undertaken to enquire into why so many people remained in the danger area.

An examination of recent reviews of flood warning systems in North America and Europe also points to an overall negative assessment of warning performance. However it also shows that substantial progress is being made in many local areas and countries, as well as in steady improvement in the reliability of forecast and communications hardware.

As illustrated by the Mount Pinatubo example, the success of early warning systems depends greatly on human aspects related to public understanding, communication and confidence. The conscious shift of many national meteorological services away from a predominantly science-centred approach to a more user-oriented philosophy is a welcome step toward improving the overall effectiveness of early warning systems.

The basic principles for effective early warning, which are partly the result of several years of work undertaken by the IDNDR Early Warning Programme, are reproduced throughout this section and provide a clear and comprehensive basis for the early warning process. The challenge in coming years is to translate the accepted principles into action and practical procedures that systematically protect people from avoidable harm and loss.

Box 5.32
Principles and responsibilities for effective early warning

The objective of early warning is to empower individuals and communities threatened by hazards to act in sufficient time and in an appropriate manner so as to reduce the possibility of personal injury, loss of life and damage to property or the environment.

Risk assessment provides the starting point for an effective warning system. It identifies potential threats from hazards and establishes the degree of local exposure or vulnerability to hazardous conditions. This knowledge is essential for policy decisions that translate warning information into effective preventive action.

The responsibility for effective early warning spans from local to international levels, each level having essential but partially overlapping functions:

- Vulnerable populations need to be aware of the hazards and the related effects to which they are exposed and be able to take specific actions to minimize the threat of loss or damage.
- Local communities need to have sufficient familiarity with the hazards to which they are exposed. Community leaders must understand the advisory information received, to be able to advise, instruct or engage the population in a manner that increases their safety or reduces the possible loss of resources on which the community depends.
- National governments need to exercise sovereign responsibility to prepare and issue hazard warnings for their national territory in a timely and effective manner. They should ensure that warnings and related protective guidance are directed to those populations determined to be most vulnerable to the hazard risk. The provision of support to local communities to develop knowledge and response capabilities is an essential function to translate early warning knowledge into risk reduction practices.
- Regional institutions need to provide specialized knowledge and advice in support of national efforts to develop or sustain operational capabilities, especially for countries that share a common geographical environment. Regional organizations are crucial to linking international capabilities to the particular needs of individual countries and in facilitating effective early warning practices among adjacent countries.
- International bodies need to provide the means for the exchange of data and knowledge as a basis for the efficient transfer of advisory information as well as the technical, material and organizational support for the development and operational capabilities of national institutions officially designated as responsible for early warning practice.

Box 5.33
Mount Pinatubo, an early warning success story

Early warnings of the 1991 eruptions of the Mount Pinatubo volcano in the Philippines were a notable success. The number of deaths compared to the number of people at risk was small despite the magnitude and violence of the eruption. This was due to a number of factors including:

- timely identification of the hazard and delineation of vulnerable areas;
- successful application of modern monitoring and surveillance techniques;
- accurate prediction of the destructive phases;
- timely issuance and dissemination of easily understood warnings;
- prompt action by key civil defence officials and disaster response workers; and
- timely evacuation of the majority of inhabitants at risk.

The experience highlighted the value of international cooperation based on mutual respect, sustained intensive public education, active involvement of selected scientists as spokespersons for awareness and dissemination purposes, open and speedy communication lines between specialists and civil defence officials, good relationship between scientists and the media.

Source: Punongbayan and Newhall, 1996 and 1998.

Political responsibility to promote integrated early warning strategies

The first prerequisite for an effective early warning system is the recognition of the benefits of early warning in protecting societies. With this recognition, the necessary political engagement and the will to promote early warning as a policy instrument for disaster risk management will evolve. However, political will alone is not sufficient; governments also need to develop and support legislation, administration, contingency planning, operational procedures, including inter-ministerial and inter-agency mechanisms.

Governments must establish and maintain collaborative frameworks essential for the functioning of credible and accountable warning systems. An important aspect in this regard is the necessity to overcome difficulties associated with the inherent uncertainty of hazards and predictions, and to build the understanding and support needed for the implementation of government decisions at times of crisis.

This requires mobilizing the necessary political, human, technical, material and financial resources, including support of community groups best equipped to reach highly vulnerable groups, such as women's organizations, community operated radio stations, and rural support networks.

An understanding of the main indicators of the effectiveness of early warning can be useful in guiding governments to implement appropriate and relevant systems. Such measures of effectiveness may include the following:

- forecast timing and accuracy;
- assessment of each stage of the warning process against specific targets such as proportion of audience reached and time taken to reach them;
- quality of warning system design and operation;
- public understanding of warnings;
- human and economic losses avoided;
- knowledge and implementation of timely and appropriate actions; and
- public satisfaction with the warning service.

The following are examples of successful national early warning systems in use.

Case: Mauritius

The specifications of the Mauritius cyclone warning dissemination system, including roles and responsibilities, are set out in the 1995 natural disasters scheme issued by the office of the Prime Minister. The Central Cyclone Committee, a well-administered and communication-oriented central body, provides leadership to ensure the effectiveness of the warning system. A high degree of legitimization is accorded by the endorsement of the scheme at the highest level of political authority. Furthermore the meteorological office is part of the Prime Minister's office, which provides added authority to the warnings issued by the Director of Meteorological Services.

"The commitment of policy makers is essential for achieving an effective early warning system. By accepting political responsibility to promote integrated early warning strategies, governments take a crucial step towards protecting the interests of communities against a possible disaster.

Effective early warning procedures should be part of national institutional and legislative frameworks, complemented by professional services, training and capacity building activities and the strategic allocation of resources.

The first early warning conference in Potsdam five years ago emphasised the importance of early warning for disaster reduction in the 21st Century. The Second International Conference on Early Warning provided a chance to enhance the early warning dialogue, by bringing together policy makers and practitioners to further integrate activities related to the early warning process.

As a key element of any disaster reduction strategy, early warning will bring us closer to the achievement of the Millennium Development Goals."

Jan Egeland
Under-Secretary-General
for Humanitarian Affairs
& Emergency Relief
Coordinator
United Nations

Box 5.34
Hurricane Michelle, a disaster preparedness success story

In Cuba, the national hurricane preparedness plan and early warning system is practiced and tested every year before the start of the hurricane season. The system is activated at the first information notice by the military authorities and civil defence, involving all actors from official authorities to companies and cooperatives. Planned measures are then activated according to different levels of warning, including an informative phase, a cyclone alert, a hurricane alarm and a concluding rehabilitation phase, if required.

Hurricane Michelle formed in the Gulf of Honduras on 2 November 2001, reached Cuba on 4-5 November with wind speeds of up to 220 kilometres per hour. This was a category four hurricane on the Saffir-Simpson Scale. Michelle was the strongest hurricane to hit Cuba in 50 years.

Upon early notice from the Institute of Meteorology the evacuation plan came into action. Twelve provincial and 150 municipal headquarters for civil defence, involving 87,000 workers were activated. More than 5,000 vehicles were deployed for evacuation.

Over 700,000 people were evacuated, of whom 270,000 were provided with temporary accommodation and basic needs for a longer time. Also, 777,000 animals were moved to safe areas. The hurricane created a major economic setback. Principal damages were to building infrastructure, agriculture and communications facilities. However, only five fatalities and 12 injuries were reported.

Case: Southern Africa

Southern African Development Community (SADC) countries have long focused attention on drought and food security for which early warning mechanisms have been developed over the last 20 years. Recent extreme weather events have encouraged a wider perspective for early warning and more comprehensive disaster preparedness activities.

Additional warning requirements need to be addressed through policies that can provide an integrated regional early warning and disaster preparedness framework, reflecting the relations between hazards, human actions, environmental consideration, management of natural resources and the climate. Toward this end, steps are being taken to develop a framework for a multisector disaster management strategy within SADC supported by UNDP and other international donor interests.

In 2000, following the devastating floods in Southern Africa, SADC governments took another step in institutionalizing early warning systems. A review of the contributions that meteorological and hydrological services provide resulted in recommendations to boost regional early warning strategies. These included the need for SADC countries to create a policy that is more focused on regional requirements for early warning and disaster preparedness. To achieve this, the formulation and progressive implementation of a structured regional approach was proposed.

It was also recommended that adequate funding be provided to national institutions to equip them with the necessary facilities and tools to maintain a satisfactory level of public service. Another recommendation was for plans that integrate early warning systems, disaster preparedness and related mitigation activities into overall national disaster management frameworks.

Case: Viet Nam

With sustained UNDP support, the Viet Nam Disaster Management Unit (DMU) has developed a nationwide information system that provides real-time information to the Central Committee for Flood and Storm Control (CCFSC), the primary government agency responsible for realizing disaster management policy.

The system provides early warning information, updates on emerging disaster situations and related information about damage or need assessments, through a computerized network linking CCFSC, DMU, the national hydrometeorological services and all of the 61 provincial committees for flood and storm control. The system is also able to draw on information supplied by the ministry responsible for agriculture and rural development.

The internet provides new opportunities to disseminate timely warnings to the public, to address emergency requirements and publicize general disaster management information. Since early 2001, the project has benefited from even more advanced technologies because of additional funding from OFDA/USAID. Expanded activities include the design of weather and natural disaster warning systems based on computer graphics for use by Viet Nam television to produce more effective public warnings.

Flood maps for all of the central provinces in Viet Nam are being created with the latest geographic information systems (GIS) technology, accompanied by training that will encourage its effective use by provincial and local authorities. A new warning system is also being designed for the areas most prone to rapid or flash flooding.

Case: India

The India Meteorological Department (IMD) has a well-established organizational arrangement for observing, detecting, tracking and forecasting cyclones in the Bay of Bengal and Arabian Sea and for issuing warnings. A special disaster warning system disseminates simple cyclone warnings in local languages through a satellite to users in isolated places.

Cyclone warning bulletins are issued to All India Radio and national television for broadcasting in different languages throughout India. IMD also issues cyclone advisories to neighbouring countries. Improvements in the forecasting and warning system are ongoing, drawing on past experiences inside and outside of the country and related technological development.

The effectiveness of cyclone forecasting and warning systems was confirmed in several cyclonic events including the super cyclone of Orissa in October 1999. The intensity of this cyclone, the region's worst of the 20th century, caused extensive loss of life and property. However, the timely warning by IMD coupled with the pre-event efforts of the administration saved many human lives.

Human dimensions of early warning

The second prerequisite for effective early warning is the strong recognition of the human dimensions of early warning mechanisms. Early warning messages must reach, be understood, believed and personalized by the public at risk, in order to be acted upon so as to reduce immediate exposure to hazards. Therefore community involvement is essential to the design of locally efficient and socially relevant early warning systems.

Informed communities will be in a better position to overcome weaknesses in transmission systems and fail to fully appreciate risks and take protective actions. Community involvement is essential to identify and satisfy the need for a variety of warning methods and products.

A continuous dialogue between users and authorities is key to clarifying needs, perceptions and priorities before disasters strike and to avoid confusion, contradiction and conflicts at times of crises. An example in this regard, is the consideration of the security of people's belongings during evacuations and responsibility for this property loss. In 2000, when the volcano near Puebla in Mexico was threatening to erupt, people were reluctant to evacuate because a few years earlier their animals had been stolen during a similar evacuation.

Sociological research is important to properly understand the human dimensions of warning generation and use, for example to examine the influence of the mode of warnings, collective interpretation of warnings and risk perception, the natural attachment of people to their home environment and personal properties, family ties or beliefs and superstitions, and existing forecasting and warning methods and coping strategies based on traditional knowledge.

Box 5.35
Principles for the application of early warning

The application of early warning at national and local levels requires attention to the following principles:

- Early warning practices need to comprise a coherent set of linked operational responsibilities established at national and local levels of public administration and authority. To be effective, the early warning systems should themselves be components of a broader programme of national hazard mitigation and vulnerability reduction.
- Within each country, the sole responsibility for the issuance of early warnings for natural and similar disasters should rest with an agency, or agencies, designated by the Government.
- The decision by authorities to act upon receipt of warning information is political in character. Authoritative decision makers should be identified and have locally recognized political responsibility for their decisions. Normally, action resulting from warnings should be based on well-established disaster management procedures of organizations at national and local level.
- In the chain of political responsibility, the initial hazard information is often technically specialized or specific to a single type of hazard authority. To be applied effectively, the warnings derived from this information need to be clearly understandable and operationally relevant to the local agencies that must act upon them.
- Early warning systems must be based upon risk analysis that includes the assessment of the occurrence of hazards, the nature of their effects and prevailing types of vulnerability, at national and local levels of responsibility.
- Locally predominant hazard types and patterns, including small-scale or localized hydrometeorological hazards related to patterns of human, economic or environmental exploitation, must be incorporated if early warning is to be relevant to risk reduction practices.
- The warning process should include demonstrated practices that can communicate warning and advisory information to vulnerable groups of people so that they may take appropriate actions to mitigate loss and damage.
- There is a continuing need to monitor and forecast changes in vulnerability patterns, particularly at local levels, including those arising from social developments such as rapid urbanization, abrupt migration, economic changes, nearby civil conflict or similar elements.
- Considerable responsibility rests at local levels for producing detailed information on risks, acting on the basis of warnings, communicating warnings to those individuals at risk and, ultimately, for facilitating appropriate community actions to prevent loss and damage. This requires detailed knowledge and experience of local factors and risks, decision-making procedures, roles and mandates of authorities, means of public communication and established coping strategies.
- Groups of people experience different types of vulnerability and have different perceptions of risk and various coping strategies. Locally appropriate warning systems need to provide a range of communication methods and to provoke multiple strategies for protection and risk reduction.
- To be sustainable, all aspects of the design and implementation of early warning systems require the substantive involvement of stakeholders at the local and national levels. This includes involvement in the production and verification of information about perceived risks, agreement on the decision-making processes involved, the formulation of standard operational protocols, and especially the selection of appropriate communication media and dissemination strategies for those at risk.

An overview of early warning systems for hydrometeorological hazards in South-East Asia in 2002 showed that communities demonstrate a high level of resilience and act from experience or respond instinctively to survive. This was confirmed by another study carried out by the ILO in India in 2002 which documents the wealth of information existing among tribal people to forecast hazards. This knowledge needs to be compiled and tested for incorporation in local early warning systems.

Communities and NGOs are crucial in operating early warning systems. They must be involved especially in disseminating messages and coping strategies, operating and maintaining warning equipment. They also have important roles in organizing training, public education and conducting regular testing to ensure reliable performance during a crisis. It is important for them to raise awareness about the responsibility people have for their own survival, not least by providing motivation and building confidence for systems in place.

Experience shows that informal and social networks in addition to community awareness and understanding of hazards contribute to more effective early warning systems.

The following examples illustrate public involvement in warning dissemination, strengthening of local capacities, the application of local experiences and public participation in the design of early warning systems.

Box 5.36
Human elements important to the early warning process

- improved understanding of warnings as a complex social process;
- improved understanding of the cognitive processes involved in communicating along the early warning chain;
- improved knowledge of local needs, perceptions and priorities;
- clear identification of those at risk and of intended warning recipients;
- knowledge of key people and resources available at the local level to tailor message contents, dissemination channels and response options;
- collection of empirical knowledge of hazards and local experience and memories, as well as local coping strategies;
- access to highly vulnerable social groups, including people in remote communities or squatter settlements, those with physical or cognitive disabilities, the sick, the elderly, widows and single heads of households, transients and tourists, the undocumented, illiterate persons and those with language barriers, and other socially marginalized groups;
- understanding of user needs and preferences in terms of education and content (what, how, where, when), as well as display and format of information;
- recognition of cultural factors in the access, understanding and reaction to warnings
- social support for public policies and decisions such as mass evacuations;
- enhanced credibility of, and trust in, warning messages; and
- feedback from warning recipients for improvement of early warning systems.

Case: Bangladesh

For the past 30 years, the Bangladesh Red Crescent Society has been working to reduce the effects of cyclones on communities. The Cyclone Preparedness Programme (CPP) disseminates warnings and assists cyclone-affected communities along 710 kilometres of the Bangladesh coastline in the Bay of Bengal.

Over 30,000 village volunteers work for CPP, equipped with hand sirens, megaphones, transistor radios, signal lights, flags, first-aid and rescue kits. They are the communications channel through which the CPP head office in Dhaka relays weather bulletins from the Bangladesh meteorological department to more than 10 million people living in areas of high cyclone risk. Local information on the progress of an approaching cyclone or the resulting effects after it has passed through an area is likewise transmitted back to the central office. The network has also proved to be an important asset for relief operations after a cyclone.

CPP has demonstrated that disaster preparedness programmes can be successful through the use of community-based management methods and basic forms of technology if both are pursued methodically and sustained over a period of time. The CPP volunteer training and public awareness programmes are central to its success.

Public awareness about the risks associated with cyclones is conveyed by the volunteers and demonstrated through drills and demonstrations. Printed materials, the use of films and videos and targeted publicity campaigns together supplement the regular use of the radio and television media to build a common understanding of basic elements of early warning and cyclone protection behaviour.

Box 5.37
Traditional knowledge

Tribal people in Rajasthan, India, rely on nature to provide early warning. They observe the movement of clouds and of animals, the changes in flora and listen to the sound of the river. Examples of reported signals for heavy rain and flooding include: when the patangga (insect) flies in the opposite direction of the river flow; unusual numbers of hende munjh (black ants) moving around with eggs; unseasonal flying of the machharanka (kingfisher); water from thatched roofs are forming bubbles; and profuse flowering of katam and siju (flowers).

Source: Coping strategies and early warning systems of tribal people in India in the face of natural disasters, ILO, 2002.

As pointed out in the study Traditional knowledge of impending hazards: Potential application in coastal Bangladesh, we cannot afford to ignore any potential low-cost strategy which might improve survival and mitigate property losses. We need to explore whether certain combinations of the best indigenous indicators and the best scientific indicators can offer a more appropriate, reliable and comprehensive warning system for vulnerable rural people. The study suggests that incorporating the knowledge of local warning indicators into locally managed warning systems would increase the resilience of poor and vulnerable people.

Box 5.38
Encouraging public participation

Elements that lead to successful public involvement in early warning systems include:

- political commitment and political articulation on early warning;
- early start in the warning design process in order to allow time for building trust;
- definition of how participation will be organized;
- provision of all necessary information to community leaders and civil society representatives;
- advertisement and wide sharing of the warning process through the mass media;
- testing of warning options, monitoring of implementation;
- communication feedback and iteration during the process; and
- institutionalization of feedback procedures and assurance of sustainability and maintenance of the system.

Source: B. Affeltranger, User-based design of socially efficient flood warnings, 2002.

Case: Central America

The RELSAT strengthening of local structures and early warning systems project was implemented in pilot zones in each of the six Central American countries between November 1998 and December 1999. The project was financed by the European Commission Humanitarian Office (ECHO). The project was part of long-term community-based disaster risk reduction cooperation between the Coordinating Centre for the Prevention of Natural Disasters in Central America (CEPREDENAC) and German Technical Cooperation (GTZ).

The purpose of the project was to establish efficient and reliable early warning systems for floods, tailored to the realities and capabilities of the selected pilot zones. However, as the main characteristics of the six zones were comparable, regional action was also possible.

The pilot zones demonstrated the experiences of local communities in applying local disaster risk management techniques, supported by national and regional structures that were competent in the area of disaster reduction. The main activities implemented during this process were:

- analysis of the risk zones;
- training of the local population in flood-fighting measures;
- selecting, training and equipping observers and analysts in the affected watersheds;
- improving communication capacities among the individuals and institutions involved; and
- developing contingency plans and implementing evacuation exercises in the pilot zones.

The project developed early warning systems that work. People living in the upper parts of the river regularly measure rainfall and water level. They transmit this information by radio to a central office in the nearest municipality where data are analysed.

The centre communicates with people in the flood-prone areas. At times of expected danger the centre can alert the population exposed to risks and can prepare for their evacuation, if necessary. In order to be effective, this system requires reliable communication and coordination. Responsibilities must be clearly assigned and commitment must be continuous.

Case: South-East Asia

Cambodia, Lao People's Democratic Republic, Thailand and Viet Nam make up the membership of the Mekong River Commission (MRC). The MRC is designing an early warning system for the Lower Mekong which is prone to flooding. The strategy is technically efficient and relevant to communities.

The ongoing project is guided by research focusing on the complex social process triggered by warnings. This needs to be understood to design both the technical and social aspects of the warning system.

MRC fully endorsed the value of the social ownership of the warning strategy when developing its Flood Mitigation and Management Plan in 2001. Participatory approaches are progressively being introduced by the MRC into the disaster risk management culture of the region.

Box 5.39
Mekong River Commission on the internet

On-line since July 2001, the Mekong River Commission web site provides a flood warning and forecasting facility. It informs in a user-friendly manner about current and forecasted hydrological conditions in the Upper, Central and Lower Mekong areas. The information is updated daily, providing updates on the flood situation and alarm levels in the Mekong basin. New features based on end-user requirements are being added.

<http://www.mrcmekong.org/info_resources/ffw/overview.htm>

Individual countries are developing a similar approach depending on institutional settings and political will. Draft action plans to implement user-based flood warning and disaster mitigation were presented to the MRC secretariat, as well as to representatives of member countries at the MRC Expert Meeting on Flood Forecasting and Early Warning Systems held in Phnom Penh, Cambodia, in early 2002.

The plans emphasized the need to understand vulnerability, risk culture, related trade-offs and the social response to floods necessary to provide useful warnings. National authorities were advised to conduct a proactive, preliminary assessment of the social relevance and expected efficiency of their flood warning strategy in order to improve it further.

A number of activities focused on community-based flood mitigation in the Mekong basin are ongoing or have been completed. New projects will capitalize on these initiatives, thereby strengthening networks, building mutual trust and further developing professional practice and expertise.

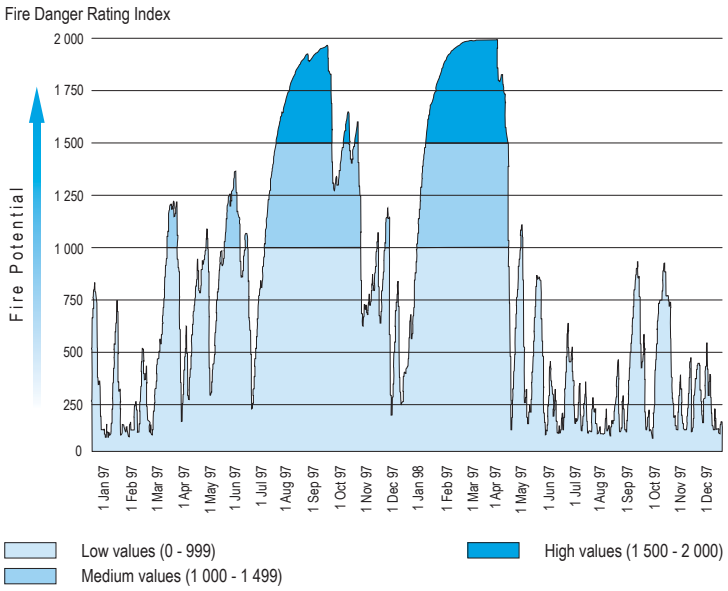
Case: Europe

The European Union *Operational Solutions for the Management of Inundation Risks in the Information Society* project and the Information Society

Box 5.40
Forest fire early warning

The Integrated Forest Fire Management (IFFM) project in Indonesia is a technical cooperation project supported by German Technical Cooperation and the Global Fire Monitoring Centre. The project relies on the involvement of local communities in fire prevention and community-based fire management preparedness. IFFM has been working with a fire danger rating (FDR) system in East Kalimantan since 1995. The FDR is based on the Keetch-Byram Drought Index (KBDI) and is part of a fire information system that manages spatial fire-related data and information in an integrated manner.

Fire Danger Rating Index (FDR),
South Coastal Zone, east Kalimantan, Indonesia, during 1997/1998 El Niño event



The graph of the KBDI readings for the 1997-1998 El Niño years show the development of drought and fire danger in the coastal zone of East Kalimantan. This drought index is easy to handle because it only requires on-site rainfall and temperature measurements. Since fire-weather patterns in the tropical rainforest region vary within short distances, it is advantageous for this system to be used by local entities such as local fire departments, forestry enterprises and communities.

Source: IFFM / GTZ / GFMC, 2001

Technologies Programme assessed the potential added value of new information and communication technologies for flood-related warning and information management. The project also studied conditions necessary for effective operation of such tools, including social ownership factors.

In 2000-2001 the European Centre on Risk Prevention (CEPR) in Niort, France, organized community-based workshops. A two-phased study was carried out to understand differences in risk perception and information demands among stakeholders, and to survey the social relevance and efficiency of existing or planned flood warning systems. UNESCO carried out a study in Hungary on flood-related information management systems and public participation at community-level in flood mitigation and control.

These examples suggest that early warning strategies should not be separated from broader development planning. Practical objectives and incentives are likely to trigger community commitment to user-based processes. Respectful understanding of existing social processes and the ability to capitalize upon them are keys to successful schemes for public participation.

Case: Australia

The fatal 1997 bushfires in the Ferny Creek area of the Dandenong Ranges near Melbourne prompted a small group of residents to express concern that they had inadequate means of knowing when to seek further information regarding fire danger. The residents lobbied all levels of government and the Country Fire Authority for the installation of sirens which could be audible throughout the area.

However residents were told that sirens were used for other purposes. A widely representative working group was set up to examine other options for an early warning system which might address residents' concerns. It also developed and implemented a community education campaign for the Ferny Creek residents on bushfire preparedness and survival. A thorough community consultation process was established, involving a public meeting, individual home visits, and the development of a residential newsletter about the project.

Between January and April 2000, three sirens were installed and tested. During the following fire season, the sirens were sounded on five occasions. Conflicting views about the value of the system seemed to relate to different priorities between community residents and emergency service organizations. The Ferny Creek trial demonstrated that the complex process of engaging the community to reduce risk through information and awareness campaigns requires social trust and commitment to building genuine partnerships.

International and regional support

The third prerequisite for effective early warning systems is the support provided by international and regional institutions. These networks provide incentives and motivation to strengthen early warning capabilities, ensure coordination of activities and promote the development and exchange of knowledge.

International support is needed both for development assistance, particularly capacity building, and for advanced technical information, such as satellite monitoring, El Niño prediction and regional food assessments.

Regional relationships and mechanisms can provide a framework to support and guide action at the national level. Regional institutions can provide motivation and advice to national institutions and can assist in fund-raising. They are key interlocutors for governmental authorities, able to amplify a collection of individual national concerns or distinctive conditions of either need or accomplishment. Regional institutions also help countries engage in international activities, and can assist groups with sometimes limited technical abilities to obtain wider exposure and to build links with collaborators.

International cooperation provides essential support in building national early warning capacities. International networking initiatives facilitate the exchange of information and experience, as well as linkages with international agendas. Specific activities such as the development of uniform standards can only take place internationally with the cooperation of as many countries as possible.

Box 5.41
Principles for early warning systems at international and regional levels

1. Technologically advanced countries can play a major role in reducing adverse effects of disasters by encouraging and supporting improved early warning practices in developing countries, in small island developing states, economies in transition and disaster-prone countries with special circumstances.
2. Disaster affected countries have a primary responsibility to identify their needs for warning and to review and audit the effectiveness of their early warning capabilities. The conduct of assessments of regional and national warning system capabilities after disaster events is particularly important.
3. Specialized regional and global centres involved in the preparation and dissemination of warnings such as the WMO Regional Specialized Meteorological Centres and Drought Monitoring Centers provide important links to national early warning systems. The application of their technical capabilities and the utility of their products should be carefully integrated with the needs of the countries being served, including any necessary clarification of responsibilities between these centres and national agencies in the same region.
4. In the interest of protecting people from the risk of natural hazards, it is essential that the formulation and presentation of warnings be based on the best available technical and scientific knowledge and free of political distortion or manipulation.
5. International bodies and regional organizations must work to maintain the timely exchange and unrestricted access of observational data and other warning information between countries, particularly when hazardous conditions affect neighbouring countries.
6. Early warning systems need to be integrated into the context of commonly accepted international standards, nomenclature, protocols and reporting procedures. Established or internationally agreed means of communication should be employed for the international and regional dissemination of any warning information to specific authorities designated in each country.
7. Collaboration and coordination is essential between scientific institutions, early warning agencies, public authorities, the private sector, the media and local community leaders to ensure that warnings are accurate, timely, meaningful and can result in appropriate action by an informed population.

Recent international poverty reduction initiatives contribute to stronger social support networks and disaster reduction activities, including the establishment and maintenance of early warning systems. Translating early warning principles and strategies into recommendations for action is still a challenge. The World Summit on Sustainable Development reiterated the contribution of early warning systems make to achieving sustainable development.

The Second International Conference on Early Warning (EWC-II) in 2003 was a timely opportunity that generated a renewed commitment and urgency for a bolder and more systematic approach to early warning (see box 5.42). Through enhanced cooperation, partnerships and concrete action effective early warning systems can become a reality.

At the regional level, the growing economic importance of climatic variability has prompted WMO and other technical institutions to expand work beyond scientific research. WMO is using available meteorological information to help establish early warning systems and to strengthen local risk reduction practices.

WMO, USAID, the US National Oceanic and Atmospheric Administration (NOAA), and the International research Institute for Climate Prediction (IRI), have assisted regional and national bodies to organize a series of Regional Climate Outlook Forums (RCOF) over the last decade. These seasonal meetings have brought together meteorologists, climate forecasters, agriculture and water managers, media representatives and disaster managers from neighbouring countries to review the available climate forecasts and to consider the potential implications in their respective countries.

Weather forecast data are discussed with respect to social and economic dimensions of public interest. This is done with a view to integrating meteorological considerations into disaster and risk management, agricultural, public health, energy and commercial interests shared by the participating countries.

An international review of RCOF was undertaken in 2000. Conclusions called for improved links among stakeholders. There is a need to build capacity in key areas including the development of improved forecast products tailored to users' needs.

According to the review, the development and use of seasonal climate forecasts will be enhanced by "more systematic organization of the roles and responsibilities of forum partners including users, researchers, and operational organizations" with partnerships "needed at all levels of the process". Stakeholders are invited to engage in a dialogue for the management of climatic impacts.

Box 5.42
Second International Conference on Early Warning, Bonn, 2003

The Second International Conference on Early Warning, held in Bonn, Germany over 16-18 October, 2003, was a signal event in the international development of early warning. The conference was promoted and developed by a working group on early warning that was set up under the ISDT Inter-Agency Task Force on Disaster Reduction.

The primary aim of the working group was to improve global coordination in early warning activities and its effective use as an instrument in disaster reduction activities. UNEP's Division of Early Warning and Assessment led this working group. Membership included CDERA, FAO, DKKV, and ADRC, GFMC, IGAD, the SADC Drought Monitoring Centres, SOPAC, UN-HABITAT, UNCCD, UNDP, UNESCO, IRI and WMO.

The group built on previous activities undertaken in the field and coordinated with the other ISDR working groups. The group sought to involve as many parties as possible from national, regional and international organizations to ensure its intersectoral and multidisciplinary dimension. Its main activities included the development of an inventory of early warning systems, formulation of criteria for indicating the efficiency of systems and the planning of the early warning conference.

The on-line inventory, which was coordinated by UNEP, the ISDR Secretariat and DKKV provides access to a database of early warning systems around the world. The compilation of the inventory has helped reveal strengths and weaknesses of existing systems. <http://database.unep.dkkv.org>

Over 400 participants convened at the Second International Conference on Early Warning (EWC-II). The conference focused specifically on political commitment and responsibilities, calling upon all national, regional and international authorities to act with resolve to implement the following recommendations which build on the four preparatory regional workshops held in 2003 in Bandung (Indonesia), Antigua (Guatemala), Nairobi (Africa) and Potsdam (Germany).

Participants recognised the progress that had been achieved in understanding the importance of early warning since the first International Conference on Early Warning held in Potsdam in 1998 and the International Decade for Natural Disaster Reduction (IDNDR, 1990-1999). However, it was noted that those guiding principles for early warning identified in 1998 are still not effectively implemented.

The participants, representing political leaders, organizations engaged in disaster risk management and humanitarian aid, the private sector, as well as the scientific community, identified the need to further strengthen capacities for early warning as a crucial element to reduce risk and vulnerability to natural and technological hazards and thus securing sustainable development.

Three main outcomes resulted from EWC-II:

- The conference statement
- A policy brief aimed at policy makers on integrating early warning into public policy
- The delineation of an international early warning programme, with sets of priorities for action.

The Conference identified five main areas of focus aimed at more coherent action at the international, regional, national and local levels:

1. Better integration of early warning into public policies is needed, particularly into development policies and programmes.
2. The improvement of technical aspects such as data collection, forecasting and information exchange.
3. The need for capacity-building and training, especially in developing countries, to strengthen early warning systems.
4. A greater focus on the human aspects of early warning, to build people-centred warning systems that address the needs of those most at risk.
5. Concrete means for sustaining the early warning dialogue, such as through a platform (organizational capacity) to promote international cooperation, to develop information and guidelines, and to promote early warning in international agendas, including the World Conference on Disaster Reduction in January 2005 (Kobe-Hyogo, Japan).

Technical identification and monitoring of hazards

The first part of the early warning process is the forecast of hazards, which relies on scientific knowledge and monitoring capabilities. When combined with vulnerability and risk information, this will allow for the formulation of warning messages.

Typically, most early warning systems have concerned single types of hazards such as storms, or floods, or volcanoes, or have followed individual organizational requirements. In the future, early warning systems are expected to become more comprehensive and to be responsive to environmental and climatic events over a longer period of time.

They will also remain active between hazard episodes, in the calm between periods of imminent threat. There will be a greater demand for uniformity of systems, including nomenclature, procedures, organizational relationships and common approaches to information management. Advances in communication facilities and information technology should make it easier to meet these needs.

As stated in the conclusions of the 1999 IDNDR Programme Forum, there is a crucial need to implement early warning systems that use interdisciplinary knowledge and sociological, political, organizational, economic and scientific information.

There are many organizations and centres throughout the world which provide early warning information and actively promote its use. A few of them are described below.

Hydrometeorological hazards

Almost three-quarters of all natural disasters are related to weather, water or climate. WMO, a specialized technical organization of the of the United Nations, plays an important role in coordinating the development of standards and procedures for the monitoring, analysis, forecasting and reporting of hydro-meteorological hazards. It works through and provides technical support to national meteorological and hydrological services (NHMS) and specialized regional meteorological centres. Without these institutions, early warning capabilities would be almost non-existent.

The following WMO programmes are particularly important in contributing to global detection, forecasting and early warning of hazards, as well as in providing procedures to minimize their adverse consequences through the application of science and technology:

- The World Weather Watch (WWW), supported by NMHS observations, enables the exchange of real-time data, forecasts, warnings and advisories for the public and the international community. This is the bedrock foundation of all weather and climate forecasts.
- The Public Weather Services programme of WWW issues a series of technical documents and guidelines to improve the performance of public services in delivering user-oriented warning products. The Guide on Public Understanding and Response to Warnings was recently issued to assist NMHS efforts in this respect, and is available on the WMO web site.
- The Tropical Cyclone Programme develops professional abilities and promotes national and regional systems to ensure effective preparedness for tropical cyclones and associated phenomena.
- The World Climate Programme's Climate Information and Prediction Services (CLIPS) project helps countries n the early warning and management of climate-related natural disasters.
- The World Weather Research Programme develops and promotes cost-effective and improved techniques for the forecast of high-impact weather such as tropical cyclones, sand and dust storms and heavy rainfall that can provoke severe flooding.
- The Hydrology and Water Resources Programme assists national hydrological services issue forecasts and assess risks of water-related hazards, with a focus on floods and droughts.
- Regional specialized meteorological centres are designated worldwide by WMO to provide weather forecasts and advisories on tropical cyclones or other risks associated with the atmosphere or having global implications. These include volcanic plumes, fire haze, or environmental emergencies.

Box 5.43
WMO technical cooperation

WMO technical cooperation projects contribute to the improvement of early warning systems in many developing countries. One recently completed project supported early warning systems for the national meteorological services of Burkina Faso, Mali and Niger.

Another project is looking into the feasibility of establishing a regional system that would produce and utilize early warning of social and economic consequences based on El Niño forecasts. This will be analysed from technical, economical, social, environmental, legal and institutional perspectives.

The success of the WMO programmes illustrates the economic and social benefits that are derived from an accurate global weather monitoring and forecasting system. Studies show that the benefits of weather forecasting do not stop at the early warning of natural hazards and related risks. However, meteorological services are still undervalued in many countries even though they are a key element in building a national disaster reduction strategy.

Observations of weather phenomena go beyond immediate forecasts determining daily human activity. Long-range studies of the atmosphere and oceans are crucial in understanding El Niño, climate change or the depletion of the ozone layer. WMO scientific analyses and warnings are instrumental in addressing these issues and in supporting multilateral environmental agreements to tackle them. <http://www.wmo.int>

Floods

The Dartmouth Flood Observatory has capacities for detection, mapping, measurement, and analysis of extreme flood events worldwide using satellite remote sensing. Products include yearly catalogues, maps, and images of river floods, from 1985 to the present and current information on flooding updated daily. The observatory provides quick access to a collection of tools and data sets such as the SeaWinds microwave scatterometer data from the NASA Quikscat satellite, which provides a unique and frequent update of surface water conditions worldwide.
<http://www.dartmouth.edu/~floods/>

Box 5.44
Glacial lake outburst floods in Nepal and the Himalayas

UNEP is contributing to the establishment of an early warning system to monitor hazards in the Hindu Kush Himalayan region, including glacial lake outburst floods (GLOF). It is undertaking this initiative through its Environment Assessment Programme for Asia and the Pacific, at the Asian Institute of Technology in Bangkok, Thailand.

Through a project implemented in collaboration with the International Centre for Integrated Mountain Development (ICIMOD), Nepal produced inventories of glaciers and glacial lakes in Bhutan and Nepal, identifying lakes that are potentially at risk of flooding.

The project also recommended establishing a system to monitor lakes at risk using remote sensing, geographic information systems and strengthening national capabilities to implement an early warning system for GLOF hazards. Training for local experts was also provided.

Following panic created by the media earlier in 1997 in the Rolwaling and Tama Koshi valleys, the government of Nepal implemented an early warning system to provide timely warning to the people. An army and two police posts were established at appropriate locations and provided with high frequency radio transceivers, one post having a back-up set. Regular radio contacts were maintained with headquarters in Kathmandu.

In addition, the posts were provided with satellite telephones. The disaster prevention cell at the home ministry received communications twice a day. In the event of a GLOF, Radio Nepal, the national broadcaster, would broadcast a warning. Radio Nepal can be received in most places along the valleys that are at risk.

The GLOF warning system can be essentially divided into two general components: the GLOF sensing system, which detects the occurrence of a GLOF and initiates the warning process, and the downstream warning system, which conveys this warning to communities at risk. These are linked by the signal transmission system. The operation of the warning system has been satisfactory.

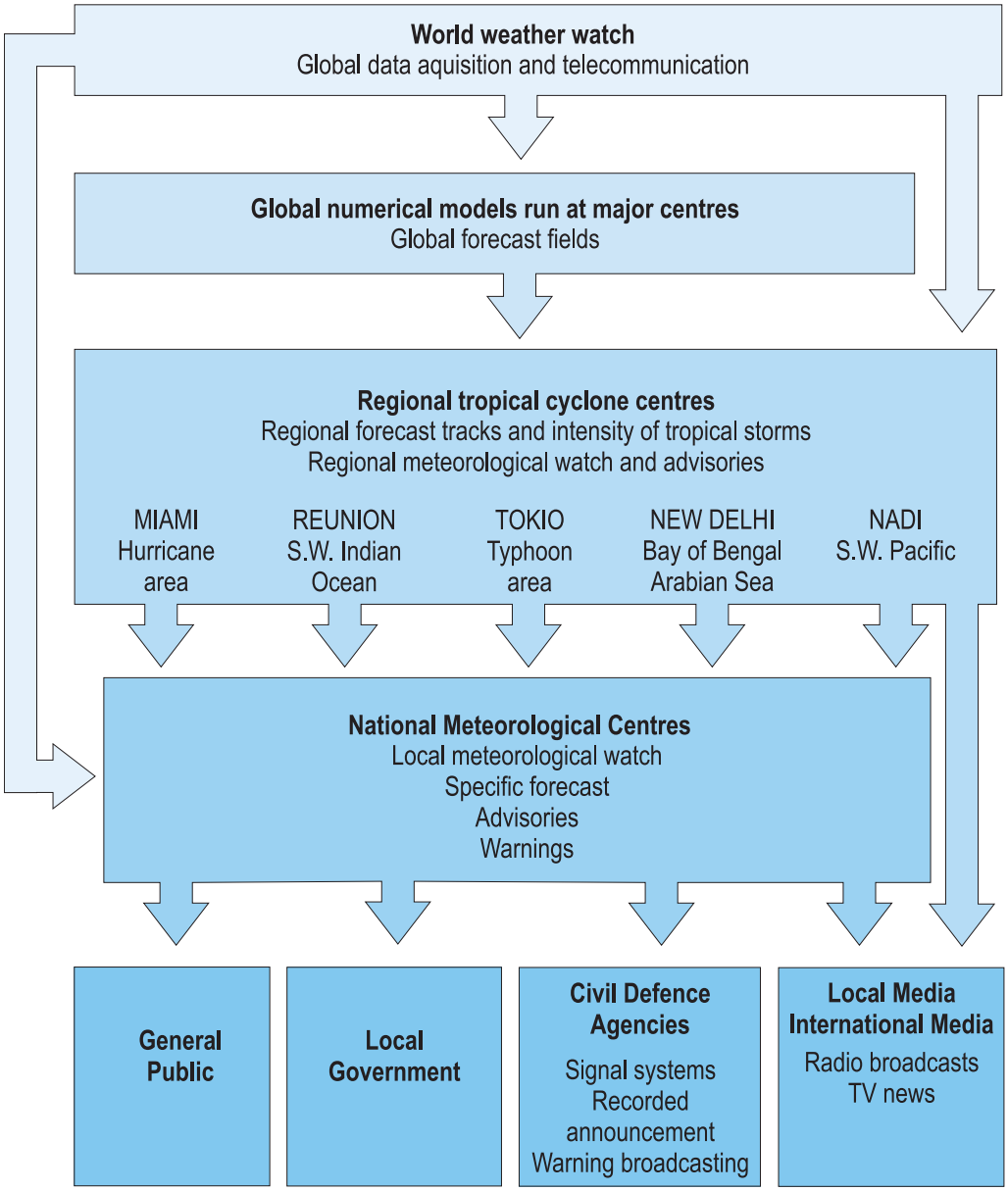
<http://www.rrcap.unep.org/issues/glof/>

(see figure 5.2)

Wildland fires

The Global Fire Monitoring Center (GFMC) in Germany provides real-time early warning information concerning wildland fires. Systems are based on both short-term and long-term

Figure 5.2
Global network of tropical cyclone monitoring, forecasting and warning systems



weather forecasts at different spatial scales with data provided by several different regional organizations. The Experimental Climate Prediction Centre generates information for the whole global.

Regional systems involved include the Association of South-east Asian Nations (ASEAN); Fire Weather Information System of Forestry, Canada; the Eurasian Experimental Fire Weather Information System; and the EU European Natural Hazards Project Forest Fire Risk. Satellite-based indices and thermal data are also used.

The area, intensity and duration of vegetation stress, fire potential and fire danger can be estimated from maps that are updated regularly. Together with real-time satellite data on active fires the GFMC information system provides a range of information tools for early warning of critical fire situations. <http://www.fire.uni-freiburg.de/>

Box 5.45
Disease early warning in southern Sudan

In 1999, Early Warning and Response Network (EWARN) was launched by WHO in collaboration with several international agencies, NGOs and local communities. The aim was to strengthen disease outbreak detection and response in southern Sudan.

The objectives of EWARN include:

- early detection, alert and prompt investigation of suspected disease outbreaks;
- establishment and strengthening of disease outbreak preparedness and rapid response;
- provision of regular feedback and technical guidance to all involved; and
- building local capacity for early detection, prompt investigation and rapid response.

Currently, EWARN partners handle alerts that would previously have called for mobilization of international teams. EWARN has improved alerting, reporting and response in the event of suspected disease outbreaks and has saved time, money and lives.

Box 5.46
Early warning of El-Niño events

Scientific research produced a breakthrough around 1970 when it was discovered that the El-Niño phenomenon, which affected ocean temperatures, fisheries and rainfall patterns along the western coast of South America, was intimately linked to the Southern Oscillation, which caused drought and changed rainfall patterns thousands of kilometres away across Asia, Australia and the Pacific islands. This understanding of the interaction between the tropical oceans and the global atmosphere quickly led to practical models of the combined phenomenon and useful forecasts of what are now called El-Niño Southern Oscillation (ENSO) events.

Forecasts of ENSO events rely on close observation of the changing temperatures of the Pacific Ocean, and are regularly produced and disseminated by international centres using complex computer models of the oceans and atmosphere. Institutes such as the International Research Institute for Climate Prediction (IRI) not only seek ways to improve the forecasts' quality, but also undertake research on how to make more effective use of forecasts, for example in managing water reservoirs in Brazil and the Philippines, and in choosing drought resistant crops in Tamil Nadu, India.

A UN-supported study of the large 1997-1998 El Niño event, one of the largest events of the century, showed that growing awareness of the El Niño has resulted in more effective responses, but that many lessons remained to be learned in how best to make use of the available forecast information – as indicated by the study's title Once burned, twice shy.

Tsunamis

The Pacific Tsunami Warning System of UNESCO's Intergovernmental Oceanographic Commission (IOC) provides tsunami warnings and information bulletins to Pacific populations. It is operated through the Pacific Tsunami Warning Centre (PTWC) with the support of national and regional tsunami warning centres. The automated tsunami alert system developed by the Pacific Disaster Center in Hawaii and replicated in other tsunami-prone countries automatically delivers official PTWC bulletins. IOC also maintains an International Tsunami Information Centre in Honolulu, which acts as a source of information for national and regional tsunami warning authorities. <http://ioc.unesco.org/itsu/>

El Niño

The International Research Centre for the El Niño Phenomenon (CIIFEN) is based in Guayaquil, Ecuador. It was created under the auspices of ISDR, WMO and the Government of Ecuador. The centre will conduct regional projects on early warning systems. Although it will have global links, the centre will focus on the Eastern Equatorial Pacific and the western countries of South America. Seasonal forecasts and El Niño/La Niña warnings and advisories will be provided and converted into user-oriented information products. These early warnings should benefit many social and economic sectors, including public health, agriculture, fisheries, water management, energy production and use. <http://www.iri.columbia.edu>

Earthquakes

A European warning system coordinated by ECHO has been implemented to respond to earthquakes. The Euro-Mediterranean Seismological Centre in Paris and its 33 networks of seismometers provide information on the location of epicentres, magnitudes and maps of the epicentre locations. <http://www.europarisks.coe.int/csem50.htm>

The UNEP Global Resource Information Database (GRID) early warning portal provides information on existing and emerging environmental problems to reduce societal vulnerability and future risks. Three different temporal and thematic approaches are used to disseminate credible scientific and relevant policy data through strategic alliances and international cooperation:

- Near-term perspectives: Operational warnings normally associated with disasters such as floods, wildfires, volcanic eruptions and earthquakes.
- Longer-term perspectives: Raising awareness about emerging environmental issues such as the impact of climate change, acknowledging that unexpected new issues are inherently unpredictable.
- New ways of looking at contemporary environmental issues: Viewing environmental issues in a more holistic and integrated manner by establishing the connections between land, air, water and biodiversity that amplify environmental problems. <http://www.grid.unep.ch/activities/earlywarning/>

Box 5.47
Early warning of environmental threats

The ingredients of a comprehensive, integrated observation system for the Earth now exists. The Global Climate Observing System (GCOS), the Global Terrestrial Observing System (GTOS) and the Global Ocean Observing System (GOOS) are known collectively as the Three Global Observing Systems (G3OS).

Under G3OS, UN agencies, the International Council of Scientific Unions (ICSU) and satellite agencies work together in providing early warning information needed for long-term global environmental changes. G3OS activities are closely linked to the UNFCCC and harmonized through the Integrated Global Observing Strategy (IGOS). Another contributor to this strategy and useful tool for information and knowledge exchange is the UN Earthwatch. It provides information on environmental concerns that needs to be integrated into the new generation of early warning strategies.

To address the environmental challenges of the 21st century, the existing Earth observation and data management infrastructure needs to be sustained and further evolved. A major international initiative in this regard was the hosting of the Earth Observation Summit by the United States in Washington D.C. in July 2003. The summit focused on the concept of creating an international, comprehensive, integrated, and sustained Earth observation system. <http://www.earthobservationsummit.gov/>

Health

With massive worldwide travel and trade, global surveillance of epidemics is essential to ensure international public health security. International efforts to contain health-related threats are coordinated by WHO.

It has established international networks for specific disease threats and has developed several electronic databases. These include FluNet, a geographical information system to monitor influenza activity, and the Global Public Health Intelligence Network (GPHIN), a web-based system developed in collaboration with Health Canada that scans the internet for outbreak-related information.

Box 5.48
Early warning for agricultural pests

Early warning of agricultural pests and diseases can help reduce catastrophic losses and economic impacts. In 1994, FAO established an Emergency Prevention System (EMPRES) for Transboundary Animal and Plant Pests and Diseases in order to minimize the risks of such emergencies developing. The system's priority is animal pests and desert locusts. The EMPRES web site and its two components on Livestock, and Locust and Other Migratory Pests provide timely early warning messages. They also provide access to training material and software.
<http://www.fao.org/EMPRES/default.htm>

Communications requirements

There are two areas of communication that are integral to the success of early warning systems. The first relates to the maintenance of lifelines, the need to build and strengthen robust hazard-resistant communication systems. The second relates to the maintenance of relationships; the need to establish and maintain effective links and working relationships among the actors involved in the early warning chain.

Early warning systems are more accurate than ever and can deliver information more quickly than ever. However, most of these advanced technologies are not available or affordable throughout the world. Some of the most vulnerable populations are in areas where

Box 5.49

Radio and Internet for the Communication of Hydro-Meteorological and Climate Related Information for Rural Development (RANET)

RANET was designed to make climate and weather related information more accessible to rural populations and communities by combining the resources and knowledge of meteorological services, NGOs and regional and international organization. RANET uses an innovative digital satellite broadcast, provided through the World Space Foundation, to deliver what is in essence a one-way Internet to rural communities, remote NGOs, and national agencies whose main office or field stations cannot access necessary information.

While this new yet inexpensive technology allows RANET to provide a broadcast of information over all of Africa and much of Asia, the strength of the RANET network is its ability to connect the satellite broadcast with locally owned and existing networks of FM radio, community bulletin boards, and even word of mouth. By encouraging local ownership and management of networks, RANET further ensures the sustainability of its efforts by disseminating information over other multipurpose networks, which also carry information on HIV/AIDS, agriculture, education, local information, and even entertainment.

While the networks may only be used 1 per cent of the time for matters related to climate and weather, by addressing broader community information needs, RANET is better able to ensure equipment is maintained and people are able to better address multi-dimensional challenges. In further support of communication capacity-building, RANET provides a series of technical training and content production workshops, as well as a newsletter designed to address issues of communication related to weather and climate services.

RANET relies on a broad network of NGOs, communities, and national meteorological and related agencies. Continuing support is provided through the African Center for Meteorological Applications for Development (ACMAD), the USAID Office of Foreign Disaster Assistance, and the NOAA Office of Global Programs. <http://www.ranetproject.net>

connectivity is poor or simply does not exist. Inadequate connectivity also limits the ability of many national agencies to receive information produced by international and regional organizations, which could be used to improve forecasts and bulletins.

ISDR activities and bilateral and regional technical cooperation programmes offer assistance to developing countries to improve their communications systems, especially those relating to data collection, processing and transmission.

Communications in early warning rely on the following characteristics: timeliness, reliability, backup, accessibility, feedback, effectiveness and authoritative source. Technical requirements involve a subtle balance between traditional and advanced channels, a mixture of mass media and selective formal and informal media. Developments in information technology, especially the variety of new terrestrial and satellite-based wireless technologies, will give added protection to key communication channels in the event of a disaster, ensuring that these remain open.

For the time being, back-up communication systems such as battery-powered radio and telephone links need to be part of effective warning systems. In some countries even if communication structures extend to the local level, they are not always used effectively and communication breakdowns need to be examined. Furthermore the maintenance of dissemination systems needs to be ensured, especially when hazards are sporadic.

Emerging communication technologies, including wireless technologies such as pagers, mobile telephones and personal digital assistants are potentially valuable resources in early warning communications. They are relatively inexpensive, portable and do not rely on traditional power sources that are often damaged in times of disaster. They can be distributed among key community members and used to deliver early warnings in the poorest communities where there are often no fixed landlines in homes.

However, serious limitations remain between these technologies and their more widespread use. In this regard, the applied research initiatives launched by the Simon Fraser University Telematics Research Lab in Vancouver, Canada is relevant as it works in collaboration with Canadian federal, provincial and local government, UN and international, private sector and volunteer organizations. It aims at better understanding of both the potential benefits and resulting

implications of these advanced information networks, to enhance and strengthen emergency management practices.

Unfortunately, improvements in early warning technology do not necessarily equal greater community safety. This is often because of poor communication to and among communities at risk. To be truly effective, human and institutional inadequacies linked to communication requirements need to be addressed. They can be remedied by enhancing the relationships between technical originators, intermediaries, disseminators and the communities at risk.

EMERCOM, the Russian Federation emergency management agency, recognizes the problem between reliability of daily forecasts and actual warnings for their clientele. Thus, they give crucial importance to effective mechanisms to support information flows and interaction between various specialists involved in hazard detection and early warning.

Miscommunication between meteorologists, hydrologists, municipalities, emergency services and the public was one of the reasons put forward by the media for the disastrous impacts of the 2002 summer floods in Germany. Other criticisms included an underestimation of potential effects, which was believed by some to be a conscious effort to avoid unnecessary panic and resulted in no action after the first warning and contradictory warnings that were issued by competing meteorological services.

Communication throughout the early warning chain must be two-way and interactive. Originators, disseminators and end-users must be in continuing contact with one another in order to make the system responsive to people's needs, priorities and decisions. The system has to adjust to users; not the other way around.

The appropriate type, form and timing of meteorological information depends on its intended purpose and users. For example, the climate community recognizes the need for new user products that convey projected seasonal onsets, dry spells, and improved spatial and temporal resolutions. Forecasting capabilities cannot stop when the product is delivered as users also need assistance with climate information analysis. End-to-end coordination of forecasting and monitoring needs to be put in place.

Box 5.50
Example of a public-private partnerships to disseminate warnings

Today, several public-private partnerships are in place in the United States to ensure that the multiple communications of warnings and other vital information get to the public. These include:

- The US National Oceanic and Atmospheric Administration (NOAA) Weather Radio, a sole government radio system for providing direct warnings of natural disasters within listening range of 90 percent of the population.
- The NOAA Weather Wire Service, a satellite-based communications delivery system providing forecasts, warnings, advisories, and other data to users such as emergency managers, public safety officials and the media.
- The Weather Channel, a 24-hour-a-day private cable channel that relays National Weather Service warnings and forecasts and preparedness information including on other natural hazards, together with guidance of possible impacts for different groups.
- The Emergency Broadcast System, to communicate with the public in an event of a national crisis, now also disseminates natural hazard information to the public.
- Plans are now underway to enhance the Weather Radio and the Weather Wire Service with an all-hazards capability, as well as post-event information, such as locations of shelters and other emergency services.
- A programme is underway to place a Weather Radio receiver in every school, hospital, nursing home, and day-care centre through a partnership with state and local governments and the private sector.

The research community, including social science and human behavioural specialists, needs to be in closer contact with the public at risk to understand its requirements and ensure that the subjects and products of research lead to practical applications. The Climate Forecasting Applications in Bangladesh project provides a good example of an effort to create and increase collaboration between international and national partners in flood forecasting. It uses state of the art technology, involves user communities especially to test results of experimental forecasts, and strives to increase dialogue between scientific and user communities.

Strong partnerships are required between different social groups and organizational systems to meet

"Organizing the community to act as one in responding to threat is a live drama that requires effective orchestration, direction and a well-written script that is memorized by all the players. It requires a scenario that needs to be practiced to perfection."

Source: Overview of early warning system for hydrometeorological hazards in selected countries in Southeast Asia, ADPC, July 2002.

We're finding that women farmers prefer seasonal climate forecast information to be made available through the extension officer or school, rather than the radio. In attempting to balance farming, childcare and other domestic responsibilities, they are less able to schedule a fixed time to listen to the radio.

They also prefer information to be provided on-site, in an environment where queries can be handled immediately, and discussion can take place. This confirms a growing sense in the climate impacts and applications community that women are a crucially under-served clientele.

Source: Emma Archer, Contribution to the Online Conference on Gender Equality, Environmental Management and Natural Disaster Management. 2001.

early warning communication requirements. These include the media and public or commercial communication channels. Inter-sectoral and multi-agency communication capabilities also need to be developed outside emergency situations through training and the creation of routine relationships. This will ensure that when a hazard event occurs, the essential parties are already familiar with one another.

Such preliminary arrangements will also contribute to the dissemination of warnings based on the same official information. Established partnerships will be important to explain in a coherent manner why forecasted events sometimes do not occur especially after contingency plans had been implemented. This is crucial for the public's understanding of the inherent limitations of the forecasting exercise. Partnerships also facilitate agreements for special users to obtain advance information about imminent warnings.

Joint training of actors in the early warning chain should take place regularly. It is vital to communicate roles and responsibilities clearly, within the disaster management system. For example, in the Philippines regular training takes place where all actors in a typhoon warning system meet to practice communicating alerts. Information management and communication from the international to the local levels help countries reduce the burden of generating their own scientific and technical data.

Response to warnings

A warning in itself is of little value. The crucial element is how people react to it. This is the ultimate indicator of a warning system's effectiveness. The existence of an early warning system should not lead to a false sense of security. This last link in the early warning chain – the response to warning messages – deserves serious attention in the design and operation of any warning system.

Responsiveness is probably the most complex component of the chain. The appreciation of psychological, community and individual processes in stressful times is more important than technology. Studies on factors that affect response indicate that people have a tendency to underestimate the significance of low-probability, high-impact events (like severe storms or earthquakes). Therefore they may not prepare or respond appropriately.

Critical components that enable communities to act appropriately upon receipt of warning include:

- sufficient lead time and accuracy;
- understanding, believing the warning and the reality of the threat;
- confirmation of the warning from other sources;
- knowing how to react; and
- being prepared.

In addition to the warning itself, vulnerability assessment and resulting maps can play a key role in effective response to warnings.

References to historical events and direct personal experience of hazard events contribute greatly to how people respond to threats and warnings. Warnings must be delivered by multiple credible sources to a receptive audience in a manner that is able to personalize the risk associated with the warning. Familiar, structured, practiced and sustained contingency action plans can then therefore elicit proper responses following clear, consistent and user-friendly messages, especially when speed of response becomes crucial. In this regard regular simulation exercises and public education campaigns develop confidence.

In 1997, after the disastrous Oder River flood in Europe, the need became apparent for emergency exercises and improved coordination between government authorities on both the German and Polish sides of the river. The need for a trans-boundary early warning system became obvious.

Box 5.51
Tropical cyclone bulletins in Hong Kong

Examples of practical precautionary announcements included in tropical cyclone warning bulletins in Hong Kong are as follows:

- Some precautions against damage should be taken now, gutters and drains should be cleared of obstructions. Hinges, bolts, locks and shutters of windows and doors should be checked.
- People living in wooden huts and in low-lying areas should take necessary precautions against strong winds and flooding.
- Listen to radio or watch TV for further weather information.
- Those who have definite duties during a tropical cyclone should now remain on call or contact their control centers from time to time.
- If you are planning to visit Macau, any of the off-shore islands or remote parts of Hong Kong, you are reminded that changes in weather may affect your plans.
- Since sea state is/may be very rough, you are advised to stay away from the shoreline and not to engage in water sports.
- Engineers, architects and contractors should make sure that scaffolding's, hoardings and other temporary structures are secured.
- Owners of small craft should ensure that their moorings are in good conditions and adequate, and take any precautions they consider necessary.
- Owners of shop signs, advertisements and TV aerials which overhang public thoroughfares or which are situated on tops of buildings should make sure that the fastenings and framework of these structures are secured.

Source: WMO, 2002.

In Mauritius, a systematic and annually reviewed process of contingency planning for disaster preparedness and response has been in force since the 1960s. It is derived from the primary forecasting and early warning authority of the national meteorological service and is coordinated across all operational sectors of government under the authority of the Prime Minister's office.

Even though tropical cyclones only directly affect Mauritius every eight to ten years, the programme pays particular attention to maintaining the relevance of operational plans. The public and official acceptance of early warning and disaster preparedness as integral elements of government responsibility, and the resulting informed public behaviour displayed across generations, point to the strategy's success.

In contrast to most other early warning systems, the director of the Mauritius meteorological service is empowered by the political authority to issue warnings himself, without prior approval by any other public authority. In the course of a developing emergency, close communication is maintained with political authorities.

The national meteorological service has been central to the early warning process since its inception. Meteorological services can provide leadership by reaching out to include other partners and professional sectors. The national meteorological service and the country's disaster management unit continue to work closely with other government, commercial and public interests on preparedness and mitigation initiatives to address the possible consequences of climate change.

The interaction between the forecasting and response elements of the warning chain is important. For example, the Russian Federation has institutionalized the interaction of hazard monitoring, forecasting and mitigation in its national safety programme. The framework for interaction extends to all the member countries of the Commonwealth of Independent States through the Inter-State Council on Emergencies. A joint programme develops and adopts systems for forecasting, warning and quick response.

Clear procedures to verify that messages are received, understood and acted upon, are often overlooked. To combat this, in Hong Kong, the typhoon warning system requires that when meteorologists issue a warning message to the police and fire services, recipients must confirm that the warning has been received and they then outline actions they have taken to respond.

In some cases, slow or inadequate response to warning information can be rooted in a lack of trust in the reliability of the system. Sometimes warning messages are not adequately tailored to recipients, and do not take local or cultural beliefs into account. They can be perceived as inadequate

In a village studied in Hawaii, women who manage household budgets and secure food and water resources did not receive any warnings about the upcoming El-Niño conditions. Had they known, they would have saved more household funds and budgeted expenses differently to prepare for the event. One of the problems with male-dominated networks of information is that women cannot minimize risks associated with their regular activities.

Source: Cheryl Anderson, Contribution to the Online Conference on Gender Equality, Environmental Management and Natural Disaster Management. 2001.

Radio and TV are not always found in the homes of some families. In some countries (Bangladesh, among others), women who are confined to the house or family plot have no access through radio, TV or otherwise to warning information. Therefore, not only is there a need to develop gender/culture/economic sensitive warning systems, but also to ensure that the necessary support for women and children to act on the warning is in place.

Source: Fainula Rodriquez, Contribution to the Online Conference on Gender Equality, Environmental Management and Natural Disaster Management. 2001.

if they contradict forecasts based on other traditional warnings or natural signs.

Warnings do not always include advice on viable courses of action to reduce risk. The socio-economic, cultural or political reasons that may impede action once warnings are received need to be overcome. In some cases, the provision of additional resources can reduce losses. In others, deep-rooted barriers to the capacity of people to act on their own behalf must be addressed to advance genuine community resilience. Among these are entrenched poverty and barriers to women's decision-making power.

After the 1991 eruption of Mount Pinatubo, a survey conducted by the Philippines Institute of Volcanology and Seismology indicated some weaknesses in the dissemination process, and the failure of some inhabitants to fully appreciate the risks and take protective actions. The reasons why people did not evacuate as advised included their underestimation of the strength of the eruption, a reluctance to abandon their property, livestock and crops, the unavailability of transport, or an inability to walk long distances. There was also the traditional belief that the volcano was a god who would not harm them.

Box 5.52
Women's role in response to early warning

In the 1991 cyclone in Bangladesh, warning signals did not reach large numbers of women within the home or homestead, and many died as a result. In a highly gender - segregated society, warning information was transmitted between men in public spaces where they congregated, with the assumption that this would be communicated to the rest of the family, which did not always occur.

Many of those who heard the warning ignored it because the cyclones that had occurred after the 1970 disaster had not caused much destruction. In the ensuing procrastination, women who had comparatively less knowledge about cyclones and were dependent on male decision-making perished, many with their children, waiting for their husbands to return home and take them to safety.

Source: Engendering Disaster Preparedness and Management, Jean D'Cunha, 1997.

Box 5.53
Community flood warning systems in Indonesia

The Banorawan Farmers Association (PPB) established a flood early warning system for Indonesian communities during the 2000 floods. The system was based on four units of two-way radio communication equipment with the necessary coverage power. Two of the units came from the communities supporting the association. The warning system was effectively used during the monsoon period since the end of 2001. Upon reports of torrential rains in the upstream area, PPB carries out preparedness activities passing on and disseminating information on water levels, coordinating with government officials at sub-district and village level to evacuate villagers before inundation.

During the dry season, the early warning system is utilized as a coordination mechanism between the chair of PPB and village coordinators or other potential members in the coverage area of PPB. Training on how to use radio communication is carried out. The radio system helps arrange distribution of irrigation water when needed. The radio system contributed to build flood risk management capacity, and address other organizational issues. It was recognized that careful oral dissemination is needed to avoid distortion of information gathered through communities.

PPB is exploring ways to develop the system into a community radio to enhance its effectiveness. The following factors will be taken into account: entertainment function, media for local campaigns, means for community development in line with regional and global issues, enhanced organizational existence and performance, increased coverage and partnerships.

Source: Overview of early warning system for hydrometeorological hazards in selected countries in Southeast Asia, ADPC, July 2002.

Future challenges and priorities

Early warning systems

From the issues discussed in this section, the following areas for action stand out as future priorities:

- communication requirements;
- scope of early warning systems;
- application of scientific forecasts;
- public knowledge and participation; and
- coordination of early warning activities.

Communication requirements

This section has emphasized the need for improved communication channels among stakeholders involved in all stages of early warning. The technology required for early warning exists. However, it has been found that a weak link in the early warning chain is communicating forecasts in a manner that is understandable by intended recipients and therefore elicits an effective response.

This conclusion is not a new one. The IDNDR early warning systems working group found that system difficulties are not technological but rather are related to human and institutionally-based communications and conceptual design.

Institutionalized and regularly tested communication channels that clearly spell out the functions and roles of the actors along the warning chain will contribute to improved understanding. Greater coordination between actors will provide a comprehensive picture of conditions necessary to inform decision-making and response actions.

Specific areas for future action include:

- better linkages among stakeholders at all levels;
- integration of activities, interests and expertise of the various actors in the process;
- exchange of information and technology;
- training users;
- improved design of end-products; and
- strengthening institutional capacities.

Scope of early warning systems

Much of the conceptualization and implementation of early warning systems is still focused on rapid onset disasters or individual sectoral interests. However, disasters must be considered in a comprehensive approach and as multi-factoral events with a potential slow-onset period. This will broaden the prior focus of early warning to incorporate less explored issues linked to longer-term hazards and phenomena, including climate change, El Niño/La Niña phenomena, fire hazards, communicable diseases and social processes.

As a pillar of disaster reduction strategies, early warning systems must be integrated in sustainable development policies. There is also a greater need for institutionalized nomenclature, standards and procedures. The ability of early warning systems to deliver information about vulnerability patterns in addition to hazards forecasting needs to be developed. For example, the conversion of El Niño forecasts into locally usable information is needed to improve the decision-making process.

Perhaps the most important area for future work is the elaboration of criteria to measure the effectiveness of early warning systems. Performance evaluation system should significantly increase warning system credibility and efficiency. Evaluation criteria should consider:

- accuracy of warnings;
- timeliness of warnings;
- coverage and number of recipients;
- economic losses;
- response measures taken;
- users satisfaction rating;
- awareness of the system in place;
- any conflicting, inappropriate or inconsistent information; and
- validation processes.

Application of scientific forecasts

Unrestricted and affordable access to relevant early warning information for all users is necessary but not sufficient. Improvement of the interface between issuers and intermediaries for a better interpretation of scientific predictions and their translation into positive administrative actions is a key factor of the early warning chain. Further scientific research is essential and must address all aspects of the early warning chain - hazards, forecasting, communication and especially social factors and processes.

Advances in forecasting and monitoring must be accompanied by accurate and comprehensive vulnerability and risk information. Major efforts should be undertaken in the coming years to assess vulnerabilities, generate risk scenarios and vulnerability maps, based on standardized methodologies. Then more attention should be devoted to developing user-friendly products for decision makers and communities at risk. This will require a better understanding of user needs and preferences on how information should be presented and how to apply it in the decision-making process. Attention needs to be given to the consequence of uncertainty in forecasts on decision-making.

Public knowledge and participation

User-oriented warning information can only become a reality with the structured and focused involvement of the public. People need to understand the risks they face, be aware of the existence of the warning system, and understand the appropriate early warning reactions.

The performance of early warning systems ultimately depends on the proper consideration of the underpinning psycho-sociological mechanisms and cognitive processes. Issuers of warnings need to understand better those people at risk and what form of information is needed to secure effective responses to the warnings

Public participation is the key to trustworthy and credible early warning systems. This includes the full and equal participation of women. Integrated information systems that ensure community participation in national early warning strategies need to be developed. These systems must take into account traditional and local knowledge and coping strategies. Public participation is also essential for the regular testing of warning systems and in providing feedback for improvement.

Coordination of early warning activities

There is a need to strengthen the international framework for early warning systems drawing on the extensive experience of major early warning organizations such as WMO. Among other things, this will help ensure technology transfer and capacity building for developing countries. The early warning process will benefit from the exchange of resources and information through enhanced contacts with institutions in charge of multilateral environmental agreements, such as UNCCD and UNFCCC. Such contacts will also improve interaction between the early warning process and the international agenda for sustainable development.

The establishment of a global early warning programme and international forum would advance the early warning process. It would improve coordination and cooperation, and enhance exchange of information, experience and technologies among national, regional and international activities.

Chapter 6

Future challenges: A common vision for disaster risk reduction

Future challenges: A common vision for disaster risk reduction

A number of conclusions can be drawn following ongoing consultation and research conducted for this review since late 2001. This chapter provides a summary of the main arguments and recommendations made that appear at the conclusion of each section that will be further complemented by a review of the achievements and shortcomings since the adoption of the Yokohama Strategy and Plan of Action in 1994. As a contribution to the emerging international agenda for disaster risk reduction, these recommendations will be presented at the World Conference on Disaster Reduction to be held at Kobe-Hyogo, Japan in January 2005.

"Awareness of the potential benefits of disaster reduction is still limited to specialized circles and has not yet been successfully communicated to all sectors of society, in particular policy makers and the general public…due to a lack of attention for the issue, insufficient commitment and resources for promotional activities at all levels.

A number of positive results have been achieved during the first five years of the Decade, although unevenly and not in the concerted and systematic way as envisaged by the General Assembly [at the commencement of the International Decade for Natural Disaster Reduction]."

Yokohama Strategy and Plan of Action for a Safer World, 1994

The International Decade for Natural Disaster Reduction (IDNDR) proved to be a valuable learning experience for governments, specialists, communities and individuals in global efforts to reduce the negative impacts of natural hazards. The view that disasters are temporary disruptions to be managed only by humanitarian response, or that their impacts will be reduced only by some technical interventions has been replaced by the recognition that they are intimately linked with sustainable development activities in the social, economic and environmental fields. So-called "natural" disasters are increasingly regarded as one of the many risks that people face ranging from epidemics to economic downturns, lack of food, clean water and safe environment to unemployment and insecurity. Where many of these risks are compounded, impacts of disasters are often exacerbated. This explains the increasing use of the expression "disaster risk reduction" recognizing the importance of risk issues, in contrast to the previously employed "natural disaster reduction".

Many national and local development plans have benefited from progress in using new institutional and technical tools for improved disaster reduction practices. In particular, significant advances have been made in the increasing use of risk assessments, specific methodologies and research initiatives, early warning systems, information, training, education and public awareness activities.

Effective disaster risk management is a key element in good governance. A lack of political commitment is often cited as the main hindrance to the implementation of disaster risk reduction practices, in addition to:

- competing priorities for funding and political attention such as other development needs and conflicts;
- limited visibility of disaster risk reduction compared to humanitarian assistance and basic development practices;
- lack of coherence and coordination of advocacy activities due to the varying priorities and characteristics of members of the disaster reduction community across multi-institutional and cross-disciplinary boundaries; and
- absence of accountability for systematic implementation and monitoring of progress.

The ISDR Secretariat is committed to continually review past, present and future initiatives in cooperation with its key partners. The aim of a regular review is twofold: to compile, synthesize and disseminate information on activities related to disaster risk reduction; and to initiate the development of a framework for guiding implementation and monitoring of progress to be used by governments, civil society and other relevant actors.

Providing evidence of the benefits of reducing risk and vulnerability promotes

sustained future investment and priorities in disaster risk reduction. Ongoing commitment and collaboration among local organizations, governments, the scientific and technical community, and international and regional organizations is essential to unite efforts towards the achievement of sustainable development. This is an area where the ISDR can make a difference.

Together with UNDP and with the involvement of other international and regional organizations, the ISDR Secretariat will prepare future global reports on disaster risk reduction that will incorporate recent efforts to develop a Disaster Risk Index (DRI) as described in *Reducing disaster risk: A challenge for development* (UNDP, 2004). The DRI project measures and compares relative levels of vulnerability to four natural hazard types (earthquake, tropical cyclone, flood and drought). Joint UN/ISDR-UNDP reporting is expected to improve understanding of the relationship between development and disaster risk, identify global trends and initiatives as well as encourage further discussion on disaster risk reduction based on hazard impact and vulnerability indicators and address other natural hazards gradually.

Priorities for the future

Firstly, there is a need for **disaster and risk reduction to be an essential part of the broader concerns of sustainable development,** and hence the need to make sure that risk assessments and vulnerability reduction measures are taken into account in different fields, such as environmental management, poverty reduction and financial management. These linkages introduce new challenges. Each sector, discipline or institution speaks a different language and brings new practices and experiences to the subject which need to be harmonized. The Millennium Development Goals set for the year 2015 cannot be achieved unless the heavy toll of disasters in human and economic terms is reduced. The WSSD was a milestone event in 2002 that marked unprecedented global recognition of the importance of disaster risk reduction in the sustainable development agenda, substantiated in the Johannesburg Plan of Implementation (see annex 6).

Secondly, it is essential to note that **current development practices do not necessarily reduce communities' vulnerability to disasters** – indeed, ill-advised and misdirected development practices may actually increase disaster risks. A considerable challenge remains in raising awareness of this concern and to influence and enhance existing development projects, poverty reduction strategies and other programmes to systematically reduce disaster risk.

Thirdly, **political commitment by public and private policy makers and local community leaders, based on an understanding of risks and disaster reduction concepts, is fundamental to achieving change**. Progress requires effective administration and resource allocation from higher levels of authority within a society, together with the local understanding and active participation of those people most immediately affected by disaster risks.

Fourthly, even though national and local authorities bear the main responsibility for the safety of their people, it is **the international community's duty to advocate policies and actions in developing countries** that pursue informed and well-designed disaster risk reduction strategies, and to ensure that their own programmes reduce and do not increase disaster risks.

In particular, the continuing emphasis on post-disaster relief allows the costs and responsibilities for poorly managed risks to be transferred to the international community and provides little incentive for disaster-prone and developing countries to embrace significant and sustained disaster risk management practices. In some cases, communities rely

"Many of us in our rhetoric talk about [disaster risk reduction], but in practice I think very little is done in terms of integrating this into practice". "No one is saying 'this is what I suggest for this type of solutions' that are not too expensive and appropriate for communities".

Bilateral donor agency from Tearfund study, 2003

"There are three important pillars for disaster reduction activities: Jijyo (self-help), Gojyo (mutual-help), and Koujyo (public assistance)."

Kiichi Inoue
Minister of State for Disaster Management, Japan

on disasters to attract media attention and financial assistance, from both donors and the international community.
In this respect, there is a crucial role for the UN system, international organizations and bilateral donors to play in supporting national initiatives and local efforts to build capacities for improved disaster risk reduction. **Long-term commitment to support local disaster reduction endeavours is as important as funding emergency assistance following high-profile disasters**.

International and national policymakers need to proceed beyond rhetorical resolutions and invest in practical measures that address risk and vulnerability factors. These should be incorporated in those emergency assistance grants and development assistance programmes underwritten by the international community.

Such an approach needs to be coupled with the task of accommodating the short-term needs of developing countries, while simultaneously maintaining a focus on the long-term objectives of reudcing risk to ensure sustainable development. Too often the link between disaster reduction and sustainable development is overlooked or ignored, especially in countries where development is overshadowed by immediate subsistence needs. The international community and national policymakers need to recognize their moral obligation to direct resources towards disaster risk reduction as part of sustainable development efforts. A moral obligation that in addition is cost-effective in the longer run as less resources will be needed to provide relief and reconstruction.

Areas of priority

This section outlines key disaster reduction priorities that remain in need of attention. In addition to the five areas identified in the framework for disaster risk reduction discussed later in this chapter, two additional areas of priority are identified: international and regional support for disaster reduction efforts, and the monitoring and assessment of implementation.

Some of the priorities describe action to be taken by international organizations and the UN system, in concert with bilateral and multilateral development assistance programmes. Others highlight the need for the adoption of a regional approach to disaster risk reduction, bringing together those actors sharing common characteristics such as geography and language. Many require that policymakers and stakeholders at the national level unite across a broad range of sectors, demonstrating their commitment and offering concrete solutions. Most – if not all – are applicable at the local and individual scales, whereby each individual can play a part in contributing to building sustainable societies.

Political commitment and institutional development (governance)

"Each country bears the primary responsibility for protecting its own people, infrastructure, and other national assets from the impact of natural disasters."

10th principle of the Yokohama Strategy and Plan of Action

- **Recognize disaster risk reduction primarily as national and local responsibilities.** National and local authorities need to recognize the value of investing in disaster risk reduction, ensuring sufficient resource allocation and the implementation of realistic policies. Increased national and local commitment is required, with more institutional structures set in place for the coordination of disaster reduction activities.

- **Continue efforts to decentralize disaster risk management practices.** Community

participation and local decision-making is essential to advocate increased public commitment and participation. Efforts need to be decentralized wherever possible.

- **Enhance policy development and integration** to ensure that all relevant sectors include disaster risk management as a basic tool of sustainable development. Cross-sectoral policy cooperation is necessary to ensure a coherent and consistent approach across environmental and socio-economic policy areas.

- **Increase effective intra-regional cooperation and interaction.** Policy interests and material resources need to transcend strictly national outlooks, with regional efforts strengthening national and local capacities. Information exchange and sharing of experiences at the regional level are vital to maintain a healthy dialogue for disaster risk reduction.

Risk identification and assessment

"Risk assessment is a required step for the adoption of adequate and successful disaster reduction policies and measures."

1st principle of the Yokohama Strategy and Plan of Action

- **Increase the widespread understanding of hazards and vulnerability as the two components of disaster risk.** Disaster reduction measures should be based on continuous assessment of vulnerability and hazards, ensuring a comprehensive understanding of disaster risks. Environmental impact assessments need to routinely consider risk. Early warning systems need to be better understood and recognized for their value in informing authorities and the public on impending risks, allowing for timely action to be taken.

- **Increase accuracy of risk assessment.** Risk assessments need to reflect the dynamic nature of the environment, taking into consideration new and complex forms of danger. Emerging trends in hazards and vulnerability such as provoke changes in risk perception as well as risk assessment procedures, such as climate change, urban growth, disease and environmental degradation.

- **Improve quality of information and data.** Reliable data is crucial for the identification of trends in hazards and vulnerability and for forecasting and early warning. Decision-makers need access to relevant and accurate data in order to make sound decisions and adopt appropriate strategies, including factoring disaster risk reduction into national planning and budgets.

- **Improve communication channels among early warning stakeholders.** There is a need to capitalize on existing early warning technologies by strengthening the link between forecasts and the intended recipients. Better coordination is needed among actors in the early warning chain to provide optimum conditions for informed decision-making and response actions.

"An integrated, multi-hazard, inclusive approach to address vulnerability, risk assessment and disaster management, including prevention, mitigation, preparedness, response and recovery, is an essential element of a safer world in the 21st century. Actions are required at all levels to…develop and strengthen early warning systems and information networks in disaster management…[actions are required to] promote the access and transfer of technology related to early warning systems and to mitigation programmes to developing countries affected by natural disasters."

Johannesburg Plan of Implementation, World Summit on Sustainable Development, 2002

Knowledge management

"The development and strengthening of capacities to prevent, reduce and mitigate disasters is a top priority area.

Vulnerability can be reduced by the application of proper design and patterns of development focused on target groups, by appropriate education and training of the whole community."

4th and 7th principles of the Yokohama Strategy and Plan of Action

- **Increase education and public awareness on risk and disaster risk reduction options** adapted according to geographical and cultural contexts. Inclusion of disaster reduction in educational programmes at all levels, effective public awareness and information campaigns, media

involvement in advocacy and information dissemination, community training programmes and access to technical specialists are key ingredients to support the knowledge base for effective disaster risk reduction.

- **Develop educational programmes about the social dimensions of risk with a strong gender balanced approach.** Further support should be provided to academic studies and formal educational programmes that address socio-economic and environmental conditions of vulnerability, matters of social equality related to risk and local community participation with a gender balanced approach, in particular those courses targeted at public administrators.

- **Integrate disaster risk issues into professional training.** Educational institutions need to include disaster risk issues in the training of professionals such as engineers, meteorologists, social scientists, teachers, social communicators and journalists, urban planners, environmental managers and physical scientists.

- **Expand partnerships and networking at all levels**, including among the private sector, academic institutions, NGOs, local communities and government. This should be a primary focus for national platforms for disaster risk reduction, bringing together a range of actors and valuable resources, harmonizing efforts and leading to greater overall impact.

- **Improve information availability and access to support research.** There is a growing need for research centres dedicated to the compilation and dissemination of the wide range of research and experience available to support policy development and decision-making. Documenting risk factor analysis and disaster statistics can represent a valuable investment for disaster risk reduction.

Risk management applications and instruments

"Environmental protection as a component of sustainable development consistent with poverty alleviation is imperative in the prevention and mitigation of natural disasters."

9th principle of the Yokohama Strategy and Plan of Action

Instruments for risk management have proliferated especially with the recognition of environmental and natural resources management, poverty reduction and financial management tools as complementary solutions.

- **Bring the ecological sphere into disaster risk reduction and vice versa.** Disaster reduction has primarily focused on physical protection to hazards and the economic and social spheres of sustainable development. Disaster risk reduction needs to be integrated into environmental and natural resource management. Wetland and watershed management to reduce flood risks, deforestation to control landslides, ecosystem conservation to control droughts are among the best-known applications.

- **Use social and economic development practices and policies for poverty alleviation to reduce vulnerability to hazards.** Social protection and safety nets are increasingly recognized as useful tools for reducing risks and self-reliance in recovery. Financial instruments in the form of insurance, calamity funds, catastrophe bonds as means to spread risks still prove difficult to establish in low-income countries. However, micro-finance and public-private partnerships in insurance could be easily developed in the poorest countries and communities.

- **Improve and use physical and technical measures** such as flood control techniques, soil conservation practices, retrofitting of buildings and land use planning. Existing tools and technologies need to be utilized and enhanced, using lessons learned to further enhance their effectiveness. Consistent emphasis on the protection of critical facilities is vital, focusing in particular on schools and health facilities and lifeline infrastructure such as water, energy and communications.

- **Acknowledge and adopt local and traditional knowledge and practices.** Examples of peoples and communities of the past successfully protecting themselves and their resources by traditional methods should be recognized, documented and applied wherever appropriate. Local experience should be promoted, as it often proves superior to foreign "quick-fix" remedies imposed on the community.

Disaster preparedness, emergency management and contingency planning

"Disaster prevention and preparedness are of primary importance in reducing the need for disaster relief."

2nd Principle of the Yokohama Strategy and Plan of Action

Disaster risk reduction requires better synergy between disaster risk management practices and sustainable development, and greater recognition of the role of early warning.

Effective contingency planning and response capacities are important tools for humanitarian assistance. This is a significant area in its own right, which has not been elaborated on in this review.

- **Increase synergies and coordination between disaster managers and development sectors.** Disaster risk reduction includes investing in preparedness and emergency management, both effective instruments in reducing fatalities from direct and indirect effects of disasters. A well-organized disaster management system - often represented by civil protection or defence organizations - comprises effective early warning systems, contingency plans, well-rehearsed national and local preparedness plans, a well-organized network of volunteers and close coordination with local Red Cross/Red Crescent societies, seamless communication and coordination as well as the logistics infrastructure and emergency funds to respond in an appropriate manner. Preparedness at the local level requires careful attention as individuals and communities are often the greatest contributors to the reduction of life and livelihood losses.

- **Strengthen people-centred early warning systems** Early warning systems need to blend technical and social capacities, to ensure useful information is available and can be acted upon by authorities and individuals. This requires a more integrated approach than is often the case, combining skills in risk monitoring and prediction, communication of timely and clear warnings, and effective responses, which requires education, training and community involvement. Early warning can be a powerful vehicle for achieving many of the other priorities.

Sustained international and regional support and cooperation for disaster reduction efforts at national and local levels

"The international community accepts the need to share the necessary technology to prevent, reduce and mitigate disaster; this should be made freely available and in a timely manner as an integral part of technical cooperation.

...The international community should demonstrate strong political determination required to mobilize adequate and make efficient use of existing resources, including financial, scientific and technological means, in the field of natural disaster reduction, bearing in mind the needs of the developing countries, particularly the least developed countries."

8th and 10th principles of the Yokohama Strategy and Plan of Action

Disaster risk reduction needs to become a higher priority within bilateral and multilateral donor policy and international financial institutions, in relation to both relief and development planning and programming.

- **Increase resources for disaster risk reduction, and allocating them where needs are the most urgent.** Reporting on the "success" of disaster reduction activities is extremely complex, whereby organizations and practitioners are often expected to speculate on the number of lives and losses that were avoided due to donor investment. Both donors and recipients of funds need to overcome this obstacle, by the former having a better understanding of the subject and the latter an appreciation of accountability to donors.

- **Disaster risk reduction is both a humanitarian and a development issue, which requires the integration of the subject in both sectors.** Neither relief nor development sectors "own" disaster reduction outright. Rather, they both need to invest in reducing risk and vulnerability to natural and technological hazards within their specialist domains. Their respective investments simultaneously complement one another, in addition to those of other sectors such as education, health, agriculture, urban management, employment, transport, infrastructure, among others.

Monitoring and assessment of implementation

"You do not see results in 3 years, you do not achieve political commitment without persistence and time (and a couple of major disasters unfortunately). Benchmarks have to reflect this long-term dimension."

Claude de Ville de Goyet
On-line conference on the framework to guide and monitor disaster risk reduction, 2003

- **Measure progress.** The overarching challenge in disaster risk reduction is to achieve a reduction in fatalities and property loss across an increasing number of countries and communities. In order to do this, it is essential to document increased understanding of the concept and its implications, develop benchmarks and indicators and put disaster reduction measures into practice. Self-assessment is a first step, which should be guided by a commonly agreed framework for disaster risk reduction.

- **Develop indicators for disaster risk reduction measures.** Monitoring and evaluation of the impact of disaster reduction initiatives increases appreciation of and promotes investment to achieve its long-term benefits. Developing indicators is a multifaceted process that requires the adoption of a qualitative approach to assess progress.

The basis for a common framework for disaster risk reduction

At the outset of the task to conduct this global review of disaster reduction initiatives in 2001, the advisory panel recommended that a set of criteria be developed to measure the effectiveness of disaster risk reduction. These should ultimately reflect how lives and assets have been saved, as well as where countries stand in accomplishing the objectives of the ISDR.

As the conclusions indicate, throughout the review it became evident that a globally agreed framework for disaster risk reduction would help to harmonize and systematize the various elements and achievements in the field of comprehensive disaster risk management. In collaboration with UNDP, the ISDR Secretariat developed a model for this framework, with the aim of both guiding action as well as monitoring progress. This was done in conjunction with a growing number of stakeholders in UN, international, national and local organizations, through the Inter-Agency Task Force on Disaster Reduction as well as by means of an on-line consultation in August 2003, attracting over 300 participants from around the world. <http://www.unisdr.org/dialogue>

Such a framework could constitute the necessary backbone to collect information and data as well as capture and disseminate good practices. It could help to analyze trends in disaster reduction practices, identify gaps and constraints for informed decisions. The framework is expected to:

- provide a basis for political advocacy as well as practical action and implementation;
- reflect the multi-dimensional, inter-disciplinary and multi-hazard nature of disaster risk reduction;
- assist a wide range of users in determining roles, responsibilities and accountabilities for their own circumstances;
- assist users to highlight areas where capacities are to be developed; and
- provide the basis for setting goals and targets, adapted to different contexts, against which progress can be measured and gaps identified.

The framework can also provide a strong impetus for the promotion of disaster risk reduction in a coherent and thus effective manner. This role is essential in the lead up to the second World Conference on Disaster Reduction in early 2005. As described earlier, the review of progress since the Yokohama Strategy and Plan of Action is based on the thematic areas of the framework and the findings will feed into the outcomes of the Conference.

These outcomes will complement and enhance the International Strategy for Disaster Reduction and facilitate the attainment of the objectives of the Johannesburg Plan of Implementation and the Millennium Development Goals forming a stronger basis to reduce risk and vulnerability to natural hazards and ensure sustainable development.

Setting goals and targets offers a means to build momentum and accelerate the pace of progress in disaster reduction and measuring its results. It would also facilitate implementation by governments and organizations. While such goals and targets would be set at the global level, they need to be carefully designed to be easily adapted for implementation at national, local or organizational levels. The framework is intended to guide the setting of these goals and targets, in addition to identifying gaps, defining national priorities and action plans to meet them.

Table 6.1
A framework to guide and monitor disaster risk reduction (see graphic representation in figure 1.3)

Thematic area 1: POLITICAL COMMITMENT AND INSTITUTIONAL DEVELOPMENT (GOVERNANCE)
Governance is increasingly becoming a key area for the success of sustained reduction of risks. Defined in terms of political commitment and strong institutions, good governance is expected to elevate disaster risk reduction as a policy priority, allocate the necessary resources for it, enforce its implementation and assign accountability for failures, as well as facilitate participation from civil society private sector.

Thematic areas/ Components	Characteristics	Criteria for benchmarks (very tentative)
Policy and planning	• Risk reduction as a policy priority • Risk reduction incorporated into post-disaster reconstruction • Integration of risk reduction in development planning and sectoral policies (poverty eradication, social protection, sustainable development, climate change adaptation, desertification, natural resource management, health, education, etc)	• National risk reduction strategy and plan • Disaster reduction in poverty reduction strategy papers, in national Millennium Development Goals reports • Disaster reduction in National Adaptation Plan of Action (for LDCs) on climate change • National follow up on WSSD Plan of Implementation
Legal and regulatory framework	• Laws, acts and regulations • Codes, standards • Compliance and enforcement • Responsibility and accountability	• Requirement of compliance by law· • Existence and update of codes and standards • Existence of systems to ensure compliance and enforcement
Resources	• Resource mobilization and allocation: financial (innovative and alternative funding, taxes, incentives), human, technical, material, sectoral	• Evidence of budgetary allocation • Staffing allocation • Public-private partnerships
Organizational structures	• Implementing and coordinating bodies • Intra and inter-ministerial, multidisciplinary and multisectoral mechanisms • Local institutions for decentralized implementation • Civil society, NGOs, private sector and community participation	• Existence of an administrative structure responsible for disaster reduction • Sectoral programmes in line ministries • Consultation with and role for civil society, NGOs, private sector and the communities. • Existence of "watchdog" groups

Thematic area 2: RISK IDENTIFICATION AND ASSESSMENT
Identification of risks is a relatively well-defined area with a significant knowledge base on methods for disaster impact and risk assessment. Systematic assessment of losses, particularly the social and economic impact of disasters, and mapping of risks are fundamental to understand where to take action. Pre-investment appraisals of disaster risk to development and vice versa, consideration of disaster risks in environmental impact assessments is still to become routine practice. Early warning is increasingly defined as a means to inform public and authorities on impending risks, hence essential for timely inputs to reduce their impact.

Thematic areas/ Components	Characteristics	Criteria for benchmarks (very tentative)
Risk assessment and data quality	• Hazard analysis: characteristics, impacts, historical and spatial distribution, multi-hazard assessments, hazard monitoring including of emerging hazards • Vulnerability and capacity assessment: social, economic, physical and environmental, political, cultural factors • Risk monitoring capabilities, risk maps, risk scenarios	• Hazards recorded and mapped· Vulnerability and capacity indicators developed and systematically mapped and recorded • Risk scenarios developed and used • Systematic assessment of disaster risks in development programming
Early warning systems	• Monitoring and forecasting • Risk scenarios • Warning and dissemination • Response to warning	Effective early warning systems that include: • Quality of forecasts • Dissemination channels and participation at local level • Effectiveness of response to warnings

Table 6.1 *(Continued)*

A framework to guide and monitor disaster risk reduction (see graphic representation in figure 1.3)

Thematic area 3: KNOWLEDGE MANAGEMENT

Information management and communication, education and training, public awareness and research are all parts of improving and managing knowledge on disaster risks and their reduction. Inclusion of disaster reduction with a strong gender balanced approach at all level of education, effective public awareness and information campaigns, media involvement in advocacy and dissemination, availability of training for the communities at risk and professional staff, targeted research are the ingredients to support the knowledge base for effective disaster reduction.

Thematic areas/ Components	Characteristics	Criteria for benchmarks (very tentative)
Information management and communication	• Information and dissemination programmes and channels • Public and private information systems (including disaster, hazard and risk databases & websites) • Networks for disaster risk management (scientific, technical and applied information, traditional/local knowledge)	• Documentation and databases on disasters· • Professionals and public networks • Dissemination and use of traditional/local knowledge and practice • Resource centres and networks, in particular educational facilities
Education and training	• Inclusion of disaster reduction at all levels of education (curricula, educational material), training of trainers programmes • Vocational training • Dissemination and use of traditional/local knowledge· • Community training programmes	• Educational material and references on disasters and disaster reduction • Specialised courses and institutions • Trained staff • Evidence of systematic capacity development programmes
Public awareness	• Public awareness policy, programmes and materials • Media involvement in communicating risk and awareness raising	• Coverage of disaster reduction related activities by media • Public aware and informed • Visibility of disaster reduction day
Research	• Research programmes and institutions for risk reduction • Evaluations and feedback • National, regional and international cooperation in research, science and technology development	• Existence of a link between science and policy (evidence-based policy and policy-oriented research) • Indicators, standards and methodologies established for risk identification • Regional and international exchange and networking

Thematic area 4: RISK MANAGEMENT APPLICATIONS & INSTRUMENTS

Instruments for risk management have proliferated especially with the recognition of environmental management, poverty reduction and financial management tools as complementary solutions. The role of **environmental and natural resource management** in reducing climatic disaster risks is acknowledged. Wetland and watershed management to reduce flood risks, deforestation to control landslides, ecosystem conservation to control droughts are among the best known applications. For effective results, synergies need to be built between sustainable development and disaster risk management practices. **Social and economic development practices** with proven results in poverty alleviation such as social protection and safety nets are increasingly regarded as ways of reducing risks and instruments for self-reliance in recovery. Financial instruments in the form of micro-financing and public-private partnerships can be of great help. Others such as insurance, calamity funds, catastrophe bonds are useful in spreading risks though still difficult to establish in low-income countries. **Physical and technical measures** such as flood control techniques, soil conservation practices, retrofitting of buildings or land use planning are well known practices and have been implemented with mixed results. Their failure is often due to poor governance rather than knowledge of what to do. Moreover, such measures, while effective in hazard control, can often be inadequate for social protection and economic recovery.

Thematic areas/ Components	Characteristics	Criteria for benchmarks (very tentative)
Environmental and natural resource management	• Interface between environmental management and risk reduction practices, in particular in coastal zone, wetland and watershed management, integrated water resource management; reforestation, agricultural practices, ecosystem conservation	• Use of wetland and forestry management to reduce flood and landslide risk • Trends in deforestation and desertification rate • Use of environmental impact assessments in disaster reduction planning

Table 6.1 *(Continued)*
A framework to guide and monitor disaster risk reduction (see graphic representation in figure 1.3)

Thematic areas/ Components	Characteristics	Criteria for benchmarks (very tentative)
Social and economic development practices	• Social protection and safety nets • Financial instruments (involvement of financial sector in disaster reduction: insurance/reinsurance, risk spreading instruments for public infrastructure and private assets such as calamity funds and catastrophe bonds, micro-credit and finance, revolving community funds, social funds) • Sustainable livelihood strategies	• Access to social protection and safety nets as well as micro-finance services for disaster risk reduction • Use of safety nets and social protection programmes in recovery process· Insurance take up • Public-private partnerships for micro-financing and insurance at community level
Physical and technical measures	• Land use applications, urban and regional development schemes • Structural interventions (hazard resistant construction and infrastructure, retrofitting of existing structures, drought, flood and landslide control techniques) • Soil conservation and hazard resistant agricultural practices	• Construction reduced/zoning plans enforced in floodplains and other mapped hazard-prone areas • Compliance of public and private buildings with codes and standards. • Public buildings (health facilities, schools, lifelines, etc) at high risk retrofitted • Regular maintenance of hazard control structures
Thematic area 5: DISASTER PREPAREDNESS, CONTINGENCY PLANNING AND EMERGENCY MANAGEMENT **Preparedness and emergency management** have been effective instruments in reducing life losses from direct and indirect effect of disasters. A well-prepared system is expected to be effectively informed by early warning, have in place national and local preparedness plans regularly rehearsed establish communication and coordination systems, as well as adequate logistics infrastructure and emergency fund to respond from. Local level preparedness, particularly of the communities, including their training deserves special attention as the most effective way of reducing life and livelihood losses.		
Thematic areas/ Components	**Characteristics**	**Criteria for benchmarks (very tentative)**
Preparedness and contingency planning	• Contingency plans (logistics, infrastructure)· National and local preparedness plans • Effective communication and coordination system • Rehearsal and practice of plans	• Testing and updating of emergency response networks and plans (national/local, private/public) • Coverage of community training and community based preparedness • Emergency funds and stocks
Emergency management	• Civil protection and defence organizations and volunteer networks	• Effective response to disasters and mobilization of volunteers, including NGOs, in particular Red Cross/Red Crescent Societies

Source: UN/ISDR, October 2003

Building disaster risk reduction targets

The objectives and targets for disaster risk reduction should be "SMART", in order to develop and assess effective disaster risk reduction strategies:

- **S**ustainable over time.
- **M**easurable, with defined criteria for success and specific benchmarks.
- **A**chievable within the timeframes that governments set. This may extend over months or years depending on available resources and national priorities.
- **R**elevant, to satisfy varied national situations related to national hazards, vulnerabilities and capacities and set within national governmental structures.

Box 6.1
Example of a disaster reduction objective and target

Objective
Make disaster risk reduction a national policy.

Targets
- A national disaster risk reduction policy adopted by [year].
- Supporting legislation for disaster reduction adopted by [year], including regulations and mechanisms to determine non-compliance and its treatment.
- A special budget line allocated for disaster risk reduction in the national budget [by year] and local administrative budgets by [year] [%].
- Disaster risk reduction integrated into sectoral policies and programmes [health, agriculture, infrastructure, environment, education] by [year].

- Timely, related to carefully framed tasks, with clear short and long-term goals.

Targets need to be adapted to each specific geographical and cultural context and tested accordingly and should build on goals to be defined following each thematic area of the framework for disaster risk reduction.

Measurement of progress – the benefits of reporting

A number of experts, scholars and agencies have called for the determination and application of specific disaster risk reduction baselines, targets and indicators during the last decade. To date several valuable global or regional initiatives have been developed to accomplish this, among them being UNDP and UNEP/GRID's Disaster Risk Index as part of its report *Reducing Disaster Risk: A challenge for development*; the development of indicators for disaster risk management in the Americas carried out by the Instituto de Estudios Ambientales, Universidad Nacional de Colombia and the Inter-American Development Bank; the Global Disaster Risk Hotspots project developed at Columbia University supported by the ProVention Consortium, the World Bank and the ISDR Secretariat; as well as the development of risk indicators for water management, coordinated by the inter-agency World Water Assessment Programme coordinated UNESCO (see chapter 4). All aim at supporting international and national policy development through the determination of baseline data on risk and vulnerability.

In the past, scientific and technical approaches have focused on indicators to suggest a hierarchy of accomplishment (for example, number of risk assessments carried out, existence of databases, number of decrees or legal acts, research programmes, educational reforms). The quantitative measurement of the impact of individual disaster reduction initiatives often spanning a relatively short period of time is particularly challenging. If no disaster were to occur after measures had been put in place it would be difficult to test the relative effectiveness of these measures. One approach to deal with this dilemma would be an attempt to identify situations where a before-and-after scenario could apply.

Box 6.2
Benefits of reporting

Benefits of systematically compiling information about disaster reduction initiatives include:

- identification of existing problems, increasing their accepted importance on the political agenda, and promoting solutions through new or improved policies, programmes, plans, institutional relationships and resource allocation;
- relationship and the integration of disaster risk management issues into broader development agendas;
- establish generic standards and guidelines for disaster reduction;
- determine priorities within the domain of disaster reduction;
- develop systematic, comprehensive data and information management systems about disaster reduction;
- guide research and advancement in disaster reduction; and
- compare approaches and analyze trends.

Measuring qualitative accomplishments is even more demanding as changes in perceptions, values, attitudes and behaviour through education and public awareness activities are difficult to assess. Nevertheless, these are the essential factors needed to make progress in the pursuit of sustainable development. Benchmarks and indicators for reducing disaster risk can also become valuable instruments to monitor other sustainable development requirements in fields such as education, gender balance, community participation, local management and self-reliance, sustainable livelihoods, environmental management and land-use planning.

Measuring progress of disaster risk reduction in a country or region requires different frameworks at different timescales. In the long-term, disaster-induced changes in indicators of sustainable development such as the human development index, gross domestic product, poverty reduction and improved environmental management practices should reflect, to a degree, the extent to which a community has become more resilient to disasters as in the case of developed countries as well as some in the developing world.

A collective effort to implement disaster risk reduction

While the motivation and the responsibility to evaluate progress towards more effective risk reduction rest within individual countries and local communities, there is a collective requirement that extends throughout the international community to increase knowledge about available methodologies and resources.

Disaster risk reduction benchmarks require focussed and practical action to ensure progress towards reducing risk and vulnerability to natural hazards. It is important that the process adopted be regularly reviewed and adjusted to reflect progress as well as changing circumstances and capacities.

At the national and local level, each country would adapt goals and targets to their own priorities and timetables, developing implementation plans as appropriate. The process could be supported by national, regional and international partnerships, with many activities taking place at the community level. Work in larger urban areas will be of particular relevance given the rapid urban and vulnerability growth expected in the coming years.

At the regional level, countries would cooperate in sharing information and resources, exchanging experiences and seeking solutions to common problems in similar contexts. Regional organizations and regional development banks in cooperation with NGOs and the private sector could provide guidance as well as technical support and assistance for national implementation, monitoring and reporting of progress. Regional "centres of excellence" in areas related to disaster risk reduction can support national efforts, facilitate knowledge and information transfer, technical cooperation, capacity-building and assistance policies.

At the international level, donors, international financing institutions, the UN system and other international organisations as well as NGOs and the private sector should provide incentives and guidance, as well as technical and financial support for national and local implementation. These can address sectoral needs and requirements for monitoring and reporting progress, and can integrate goals and targets for disaster risk reduction as part of their priorities, work programmes, investment and technical cooperation, capacity-building and assistance policies.

For coordination purposes at the global level and in line with the recommendations of the Johannesburg Plan of Implementation, the ISDR Secretariat stands ready to facilitate monitoring and reporting of progress on implementation with support from relevant partners, in particular with UNDP and other UN agencies, technical, regional and international organizations working in the Inter-Agency Task Force on Disaster Reduction. The ISDR Secretariat is gradually strengthening its capacity as an information clearinghouse to follow ongoing and emerging global initiatives and develop partnerships to support disaster risk reduction.

A window of opportunity

Two Chinese characters, which together form the word crisis, separately mean threat and opportunity. A combined concept like this is a reminder that, as conditions change, so can attitudes. In a world in which things seem sure to get worse, there is increasing incentive to make sure they do not.

When old menaces seem to multiply, new thinking must provide the solutions. Communities must adopt the notion that disaster impacts can be reduced and therefore not wait for disasters to be managed. In some cases, it might even be possible to reduce hazards. In others it is certainly possible to reduce human vulnerability to those hazards.

The combination of science and history is instructive – it provides the assurance that disasters that happen once can happen again and again. Earthquakes, for instance, are a fact of life at tectonic plate boundaries and these have been well mapped. Floods are a fact of life on flood plains and their rich soils are down-to-earth proof of this.

To shift from disaster management to disaster risk reduction is to exploit hindsight and develop foresight through insight.

危机

Crisis = threat + opportunity

Acronyms

A

ACC	Administrative Committee on Coordination (now CEB), United Nations
ACDS	African Centre for Disaster Studies, Potchefstroom University, South Africa
ACMAD	African Center of Meteorological Applications for Development (Centre africain des applications de la météorologie pour le développement), Niamey, Niger
ACS	Association of Caribbean States, Trinidad and Tobago
ADB	Asian Development Bank, Manila, Philippines
ADESO	Asociación para la investigación del desarrollo sostenible de las Segovias, Nicaragua
ADMIN	Australian Disaster Management Information Network
ADPC	Asian Disaster Preparedness Center, Thailand
ADRC	Asian Disaster Reduction Center, Japan
ADRRN	Asian Disaster Reduction and Response Network
AECF	European Centre on Floods/Centre Européen sur les Inondations, Moldova
AEDES	Agence Européenne pour le Developpement et la Santé, Belgium
AEGDM	ASEAN Experts Group on Disaster Management
AfDB	African Development Bank
AFEM	European Natural Disasters Training Centre/Centre Européen de Formation sur les Risques, Turkey
AGIS	Agriculture Geo-referrenced Information System
AGMP	Agricultural Meteorology Programme, WMO
AGRHYMET	Specialized Hydrometeorological Institute of the Permanent Interstate Committee for Drought Control in the SAHEL (CILSS).
AGSO	Australian Geological Survey Organization
AIDIS	Asociación Interamericana de Ingeniería Sanitaria y Ambiental (Panamerican Engineering Association for the Public Health and Environment)
AIST	National Institute of Advanced Industrial Science and Technology, Japan
AIT	Asian Institute of Technology, Thailand
AJWS	American Jewish World Services
AKNF	Africa Knowledge Networks Forum
ALIDES	Alianza para el Desarrollo Sostenible (Alliance for Sustainable Development), Central America
ALITE	Augmented Logistics Intervention Team for Emergencies
ANAFAE	Honduran National Network for the Promotion of Ecological Agriculture
AOSIS	Alliance of Small Islands States
APEC	Asia-Pacific Economic Cooperation, Singapore
APELL	Awareness and Preparedness for Emergencies at the Local Level (UNEP)
APUR	Atelier Parisien d'Urbanisme, France
ARC	Agricultural Research Council, South Africa
ARF	ASEAN Regional Forum
ARPDM	ASEAN Regional Program on Disaster Management
ART	Alternative Risk Transfer
ARTEMIS	Advanced Real Time Environmental Information Monitoring System
ASEAN	Association of South East Asian Nations
AU	African Union
AUDMP	Asian Urban Disaster Mitigation Program, ADPC, Thailand
AusDIN	Australian Disaster Information Network
AVHRR	Advanced Very High Resolution Radiometer

B

BCAS	Bangladesh Centre for Advanced Studies
BCPR	Bureau for Crisis Prevention and Recovery, UNDP (formerly Emergency Response Division)
BenfieldHRC	Benfield Hazard Research Centre, University College London, United Kingdom
BHRC	Building and Housing Research Centre, Iran
BIBEX	Biomass Burning Experiment
BICEPP	Business and Industry Council for Emergency Planning and Preparedness
BIT	Bandung Institute of Technology, Indonesia
BPIEPC	Bureau de la protection des infrastructures essentielles et de la protection civile, Canada. See also: OCIPEP, Office of Critical Infrastructure Protection and Emergency Preparedness
BRGM	Bureau de recherches géologiques et minières, France
BWG	Bundesamt für Wasser und Geologie (Federal Office for Water and Geology), Switzerland

C

CABEI	Central American Bank for Economic Integration, Honduras
CAC	Consejo Agricola Centroamericano (Central American Agricultural Advisory Board)
CAF	Corporación Andina de Fomento (Andean Development Corporation), Venezuela
CAMI	Central American Mitigation Initiative
CARDIN	Caribbean Disaster Information Network
CARE	Cooperative for Assistance and Relief Everywhere
CARICOM	Caribbean Community
CAS	National Academy of Sciences, China
CAT	Catastrophe bonds
CATEX	Catastrophic Risk Exchange
CBD	Convention on Biological Diversity, United Nations
CBDM	Community Based Disaster Management
CEBOT	Chicago Board of Trade
CBRI	Central Building Research Institute, India
CCA	Common Country Assessment
CCAD	Comisión Centroamericana de Ambiente y Desarrollo (Central American Commission for Environment and Development), El Salvador
CCFSC	Central Committee for Flood and Storm Control, Viet Nam
CCGC	Coordinating Council for Disaster Management, Mozambique
CCOP	Coordinating Committee for Coastal and Offshore Geoscience Programmes in East and Southeast Asia, Thailand
CCP	Cluster Cities Project
CDB	Caribbean Development Bank
CDC	Center for Disease Control and Prevention, USA
CDERA	Caribbean Disaster Emergency Response Agency
CDM	Clean Development Mechanism, UNFCCC
CDMP	Caribbean Disaster Mitigation Project
CDPC	Cranfield Disaster Preparedness Center, United Kingdom
CDRN	Citizen's Disaster Response Network, Philippines
CEA	California Earthquake Authority
CEB	United Nations System Chief Executives Board for Coordination (formerly ACC)
CEDERI	Centro de Estudios sobre Desastres y Riesgos (Study Centre on Disasters and Risks), Colombia
CEH	Center for Ecology and Hydrology, United Kingdom
CEI	Central European Initiative
CEISE	European Centre for Research into Techniques for Informing Populations in Emergency Situations/Centre Européen de Recherche sur les Techniques d'Information de la Population dans les Situations d'Urgences/Centro Europeo de Investigacion de Técnicas de Information a la Poblacion en Situaciones de Emergencias, Spain
CEMEC	Centre Européen pour la Médecine des Catastrophes/European Centre for Disaster Medicine, San Marino
CENAPRED	National Center for Disaster Prevention, Mexico

CENAT	Swiss Natural Hazards Competence Centre
CENDIM	Centre for Disaster Management, Bogazici University, Turkey
CEOS	Committee on Earth Observation Satellites
CEPREDENAC	Centro de Coordinación para la Prevención de Desastres Naturales en America Central (Coordinating Centre for the Prevention of Natural Disasters in Central America)
CEP	Caribbean Environment Program, UNEP
CEPAL	Comisión Económica para America Latina (Economic Commission for Latin America)
CEPT	Center for Environmental Planning and Technology, India
CEPR	Centre Européen de Prévention des Risques (European Center for Risk Mitigation), France
CEPRIS	Euro-Mediterranean Centre on Evaluation and Prevention of Seismic Risk/Centre Européen sur l'Evaluation et la Prévention du Risque Sismique, Morocco
CERG	European Centre on Geomorphological Hazards/Centre Européen sur les Risques Geomorphologiques**,** France
CERG-UNIGE	Centre d'Etude des Risques Géologiques, University of Geneva, Switzerland
CERU	European Centre on Urban Risks/Centre Européen sur les Risques Urbains, Portugal
CESE	Centre for Environmental Science and Engineering, Indian Institute of Technology, India
CEUDIP	Central European Disaster Prevention Forum
CFA	Country Fire Authority, Australia
CFAB	Climate Forecasting Application in Bangladesh
CGIAR	Consultative Group for International Agricultural Research
CGMW	Commission for the Geological Map of the World
CHARM	Comprehensive Hazard and Risk Management Program (Pacific Island States)
CHED	Philippine Commission on Higher Education
CICESE	Center of Scientific Investigation and Higher Education, Mexico
CIDA	Canadian International Development Agency
CIERRO	Inter-African Centre for studies on Rural Radio/Centre interafricain d'études en radio rurale (CIERRO), Burkina Faso
CIFAL	International Training Centre for Local Actors, France
CIIFEN	Centro Internacional de Investigación sobre el Fenómeno El Niño, **(**International Research Centre for the El Niño Phenomenon), Ecuador
CILSS	Comité permanent Inter Etats de Lutte Contre la Sécherresse dans le SAHEL (Permanent Interstate Committee for Drought Control in the SAHEL)
CIMDEN	Center for Disaster Research and Mitigation, Guatemala
CINDI	Center for Integration of Natural Disaster Information, USA
CIRDAP	Center on Integrated Rural Development for Asia and the Pacific, Bangladesh
CIS	Commonwealth of Independent States
CISMID	Centro Peruano Japonés de Investigaciones Sísmicas y Mitigación de Desastres
CITTA	Center for Research and Transfer of Appropriate Technology, Argentina
CLIVAR	Climate Variability and Predictability, Project, World Climate Research Programme
CMEPC	Civil Military Emergency Planning Council
CNCIDR	China National Committee for International Disaster Reduction
CNCNDR	China National Center for Natural Disaster Reduction
CNDR	Corporate Network for Disaster Reduction
CNE	Comisión Nacional de Prevención de Riesgos y Atención de Emergencias, Costa Rica (National Risk Prevention and Emergency Response Commission)
CNES	Centre National d'Etudes Spaciales
CNHAP	Canadian Natural Hazards Assessment Project
COEN	Comite de Emergencia Nacional, El Salvador (Committee for National Emergency)
COHG	Conference of Heads of Governments of the Caribbean Community
COMPASS	Comparability of Technological Risk Assessment Methodologies
CONRED	Coordinadora Nacional para la Reducción de Desastres, Guatemala (National Coordinator for Disaster Reduction)
COP	Conference of the Parties
COPECO	Comisión Permanente de Contingencias, Honduras (Permanent Commission Contingency)
COPUOS	United Nations Committee for Peaceful Use of Outer Space
CORDES	Corporación para el Desarrollo, El Salvador (Development Corporation)

CORECA	Consejo Regional de Cooperación Agricola para America Central, Mexico y la Republica Dominicana (Regional Council for Agricultural Cooperation in Central America, Mexico and the Dominican Republic)
COST	European Cooperation in the Field of Scientific and Technical Research
COSUDE	Agencia Suiza para el desarrollo y la cooperación, (Swiss Agency for Development and Cooperation (SDC))
CPACC	Caribbean Planning for Adaptation to Global Climate Change
CPP	Cyclone Preparedness Programme (Bangladesh Red Crescent Society)
CRED	Centre for Research on the Epidemiology of Disasters, Catholic University of Louvain, Belgium
CRID	Centro Regional de Información sobre Desastres, América Latina y El Caribe, Costa Rica (Regional Disaster Information Centre, Latin America and the Caribbean)
CRS	Catholic Relief Services
CRSTRA	Euro-Mediterranean Centre for Research on Arid Zones/Centre Euro-Mediterranéen sur les Zones Arides, Algeria.
CRTO	Regional Remote Sensing Centre, Africa
CSC	Coastal Services Centre, NOAA, USA
CSD	Commission on Sustainable Development, United Nations
CSEM	Euro-Mediterranean Seismological Centre/Centre Sismologique Euro-Méditerranéen, France
CSDS	Countries in Special Development Situations
CSIR	Council for Scientific and Industrial Research, South Africa
CSLT	European Centre for School Training in Risk Prevention/Centre Européen sur la Formation Scolaire à la Prévention des Risques, Bulgaria
CSRE	Centre for Studies in Resources Engineering, India
CST	UNCCD's Committee on Science and Technology
CSW	Commission on the Status of Women, United Nations
CTGC	Disaster Management Technical Council, Mozambique
CUEBC	European University Centre for Cultural Heritage/Centre Universitaire Européen pour les Biens Culturels
CUREE	Consortium of Universities for Research in Earthquake Engineering, USA

D

DAPSA	Department of Early Warning and Food Security, Mozambique
DAW	Division for the Advancement of Women, United Nations
DDMC	District Disaster Management Committee, Bangladesh
DDMFC	Department of Dyke Management and Flood Control, Vietnam
DEPHA	Data Exchange Platform for the Horn of Africa
DEPI	Division for Environment Policy Implementation, UNEP
DESA	United Nations Department of Economic and Social Affairs
DESINVENTAR	Inventario de Desastres (Disaster Inventory), LA RED
DEWA	Division for Early Warning and Assessment, UNEP
DFID	Department for International Development, United Kingdom
DFNK	Deutsches Forschungsnetz Naturkatastrophen (German Research Network for Natural Disasters)
DHA	Department of Humanitarian Affairs (now OCHA), United Nations
DHM	Department of Hydrology and Meteorology, Nepal
DIAB	Dubai International Award for Best Practices to improve the living environment
DiMP	Disaster Mitigation for Sustainable Livelihoods Programme, University of Cape Town, South Africa
DIPECHO	Disaster Preparedness, European Community Humanitarian Office
DISMAC	Disaster Management Committee at National Divisional and Districts levels, Fiji
DISMAN	Disaster Management Database
DKKV	Deutsches Komitee für Katastrophenvorsorge (German Committee for Disaster Reduction)
DMB	Disaster Management Bureau (DMB), Bangladesh
DMC	Drought Monitoring Centres, Zimbabwe and Kenya

DMFC	Disaster Mitigation Facility for the Caribbean
DMI	Disaster Mitigation Institute, India
DMIS	Disaster Management Information System, IFRC
DMISA	Disaster Management Institute of Southern Africa, South Africa
DMMU	Disaster Management and Mitigation Unit, Zambia
DMT	Disaster Management Teams
DMTP	Disaster Management Training Programme, United Nations
DMU	Disaster Management Unit, Viet Nam
DNA	National Directorate of Water, Mozambique
DOTRS	Department of Transport and Regional Services, Australia
DPCC	National Disaster Prevention and Preparedness Commission, Ethiopia
DPCCN	Department for the Prevention and Control of Natural Disasters, Mozambique
DPCSS	Disaster, Post-Conflict and Safety Section, UN-HABITAT
DPPC	Disaster Prevention and Preparedness Commission, Ethiopia
DPPI	Disaster Preparedness and Prevention Initiative
DRBA	Disaster Recovery Business Alliance
DRRP	Disaster Reduction and Recovery Programme, UNDP
DRM	Disaster Reduction Management, Network of the World Institute for Disaster Risk Management
D&SCRN	Disaster and Social Crisis Research Network (European Sociological Association)
DSD	Division for Sustainable Development, United Nations
DWAF	Department of Water Affairs and Forestry, South Africa
DWS	Disaster Warning System

E

EAECEP	European Advisory Evaluation Committee for Earthquake Prediction
EANHMP	Eastern Asia Natural Hazards Mapping Project
EAPAP	Environment Assessment Program for Asia-Pacific (Asian Institute of Technology, Thailand)
EAWAG	Swiss Federal Institute for Environmental Science and Technology
EC	European Commission
ECA	Economic Commission for Africa, United Nations, Addis Ababa, Ethiopia
ECE	Economic Commission for Europe, United Nations, Geneva, Switzerland
ECE	Extreme Climate Events Program
ECGS	European Centre for Geodynamics and Seismology/Centre Européen de Géodynamique et de Sismologie, Luxemburg.
ECHO	European Community Humanitarian Office
ECILS	European Centre for Vulnerability of Industrial and Lifeline Systems/Centre Européen sur la Vulnérabilité des Réseaux et Systèmes Industriels, Skopje (Former Yugoslavia Republic of Macedonia)
ECLAC	Economic Commission for Latin America and the Caribbean, United Nations, Santiago, Chile
ECMHT	European Centre on Training and Information of Local and Regional Authorities and Population on the Field of Natural and Technological Disasters /Centre Européen de Formation des Autorités Locales et Régionales dans le domaine des Catastrophes Naturelles et Technologiques, Azerbaïjan
ECMWF	European Centre for Medium Range Weather Forecast
ECNTRM	European Centre of New Technologies for the Management of Major Natural and Technological Hazards/Centre Européen des Nouvelles Technologies pour la Gestion des Risques Naturels et Technologiques Majeurs, Federation of Russia
ECOMOG	ECOWAS Cease-Fire Monitoring Group
ECOSOC	United Nations Economic and Social Council
ECOWAS	Economic Community of West African States
ECPC	Experimental Climate Prediction Centre, USA
ECPFE	European Centre for Prevention and Forecasting of Earthquakes/Centre Européen pour la Prévention et la Prévision des Tremblements de Terre, Greece
ECTR	European Inter-regional Centre for Training Rescue Workers/Centre Européen de Formation Inter-Régionale pour les Sauveteurs, Armenia
EDM	Earthquake Disaster Mitigation Research Center, Japan

EEA	European Environment Agency, Denmark
EERI	Earthquake Engineering Research Institute, USA
EEZ	Exclusive Economic Zone
EHC	Earthquake Hazard Centre, New Zealand
EHP/USGS	Earthquake Hazards Program of the United States Geological Survey
EIA	Environmental Impact Assessment
ELMS	Environment and Land Management Sector of SADC, Southern Africa
ELSA	European Laboratory for Structural Assessment – Earthquake Engineering, Ispra, Italy
EMA	Emergency Management Australia
EMAI	Emergency Management Australia Institute (former AEMI)
EM-DAT	Emergency Events Database (CRED, Catholic University of Louvain)
EMERCOM	Emergencies and Natural Disasters Mitigation, Ministry of Civil Defense, Russian Federation
EMI	Earthquake and Megacities Initiative
EMPRES	Emergency Prevention System
EMS	Environmental Management Systems
EMSC	Euro-Mediterranean Seismological Centre, France
ENDA	Environment and Development Action in the Third World, Senegal
ENSO	El Niño Southern Oscillation
EPC	Emergency Preparedness Canada
EPN	Escuela Politécnica Nacional, Ecuador
EPOCH	European Programme on Climatology and Natural Hazards
EQTAP	Earthquake and Tsunami Disaster Mitigation Technologies in the Asia-Pacific Region
ERA	European Research Area
ERD	Emergency Response Division, UNDP (now BCPR)
EMWIN	Early Warning System for tropical cyclone, Cook Islands
ESA	European Space Agency
ESB	Emergency Services Branch, OCHA
ESCAP	Economic and Social Commission of Asian and the Pacific, United Nations, Bangkok, Thailand
ESCWA	Economic and Social Commission for Western Asia, United Nations, Beirut, Lebanon
ESI	Environment and Society Institute, USA
ESPRIT	European Strategic Programme for Research and Information Technology
ETH	Swiss Federal Institute of Technology, Switzerland
ETS	Emergency Telecommunications Service, ITU
EU	European Union
EU-MEDIN	GDIN Mediterranean working group
EUR-OPA	Major Hazards Agreement of the Council of Europe
EWARN	Early Warning and Response Network, Southern Sudan
EWSs	Early Warning Systems

F

FANR	Food, Agriculture and Natural Resources Sector of SADC, Southern Africa
FAO	Food and Agriculture Organization
FAO/AGL	Food and Agriculture Organization/Land and Water Development Division
FDR	Fire Danger Rating
FEDE	Fundación de Edificaciones y Dotaciones Educatives, Venezuela
FEMA	Federal Emergency Management Agency, Government of USA
FEMID	Fortalecimiento de Estructuras Locales para la Mitigación de Desastres (Strengthening of Local Structures for Disaster Mitigation)
FEWS	Famine Early Warning System
FEWSNET	Famine Early Warning System Network
FHWA	Federal Highway Administration, US government
FICCI	Federation of Indian Chambers of Commerce and Industry
FIMA	Federal Insurance and Mitigation Administration, USA
FINCA	Foundation for International Community Assistance
FIVIMS	Food Insecurity and Vulnerability Information and Mapping Systems, FAO
FLACSO	Facultad Latinoamericana de Ciencias Sociales (Latin American Social Science Faculty)

FONDEN	Fund for Natural Disasters, Mexico
FOREC	Fondo para la Reconstruccion y el Desarrollo Social del Eje Cafetero, Colombia
FSWW	Foundation for the Support of Women's Work
FUNDE	Fundación Nacional para el Desarrollo (National Development Foundation)
FUSAI	Fundación Salvadoreña para la Asistencia Integral, El Salvador (Salvadorian Foundation for Integral Assistance)

G

GA	General Assembly, United Nations
GADR	Global Alliance for Disaster Reduction, USA
GAV	Vulnerability Analysis Group
GCOS	Global Climate Observing System
GDIN	Global Disaster Information Network
GDP	Gross Domestic Product
GECHS	Global Environmental Change and Human Security
GEF	Global Environmental Facility (implemented by UNDP, UNEP and the World Bank)
GEO	Global Environment Outlook Report, UNEP
GESI	Global Earthquake Safety Initiative, Japan
GFMC	Global Fire Monitoring Center, Germany
GHHD	European Centre on Geodynamical Hazards of High Dams/Centre Européen sur les Risques Géodynamiques liés aux Grands Barrages, Georgia
GHI	GeoHazards International, USA
GIEWS	Global Information Early Warning System, FAO
GIS	Geographic Information Systems
GLIDES	Global identifier number
GLO-DISNET	Global Disaster Information Network
GLOF	Glacial Lake Outburst Flood
GMES	Global Monitoring for the Environment and Security (EU initiative)
GMGS	Groupe Maghrébin de Génie Sismique
GNP	Gross National Product
GOOS	Global Ocean Observing System
GPHIN	Global Public Health Intelligence Network
GPS	Global Positioning System
GRID	Global Resource Information Database, UNEP
GROOTS	Grass Root Organization Operating in Sisterhood
GSDMA	Gujarat State Disaster Management Authority, India
GSJ	Geological Survey of Japan
GSHAP	Global Seismic Hazard Assessment Program
GSI	Geological Survey of Iran
GTOS	Global Terrestrial Observing System
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation)

H

HAZ TAIWAN	Earthquake Loss Estimation Methodology, Taiwan
HAZUS	Natural Hazard Loss Estimation Methodology, FEMA
HDR	Human Development Report, UNDP
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HMU	Hazard Management Unit, World Bank (formerly DMF, Disaster Management Facility
HNDGDM	Hungarian National Directorate General for Disaster Management
HOMS	Hydrological Operational Multipurpose System of WMO
HPC-DMP	High Powered Committee on Disaster Management Plans, India
HRHIP	Hurricane-Resistant Home Improvement Programme
HRRC	Hazard Reduction and Recovery Center, Texas A &M University, USA
HWRP	Hydrology and Water Research Programme
HYCOS	Hydrological Cycle Observing System
IACNDR	Inter-American Committee for Natural Disaster Reduction, OAS
IADB	Inter-American Development Bank. See also: IDB

IAEA	International Atomic Energy Agency
IAEE	International Association of Earthquake Engineering, Japan
IASC	Inter-Agency Standing Committee
IASSI	Indian Association of Social Science Institutions
IASPEI	International Association of Seismology and Physics of the Earth's Interior
IAVCEI	International Association of Volcanology and Chemistry of the Earth's Interior
IBHS	Institute for Business and Home Safety, USA
IBRD	International Bank for Reconstruction and Development, World Bank
ICA	Insurance Council of Australia
ICAO	International Civil Aviation Organization
ICCA	International Council on Chemical Associations/UNEP
ICDRM	Institute for Crisis, Disaster and Risk Management, George Washington University, USA
ICET	Intergovernmental Conference on Emergency Telecommunications
ICIMOD	International Center for Integrated Mountain Development, Nepal
ICL	International Consortium on Landslides
ICLR	Institute for Catastrophic Loss Reduction, Canada
IcoD	Euro-Mediterranean Centre on Insular Coastal Dynamics/Centre Européen de la Dynamique Côtière Insulaire, Malta
ICPR	International Commission for the Protection of the Rhine (Internationale Kommission zum Schutz des Rheins
ICRC	International Committee of the Red Cross
ICSU	International Council of Science, France
ICTP	International Center for Theoretical Physics, Italy
ICVA	International Council of Voluntary Agencies, Switzerland
ICWE	International Conference on Water and the Environment, United Nations
IDA	International Development Association, World Bank
IDAACA	International Distributed Active Archive Centre for Africa
IDB	Inter-American Development Bank (Banco Interamericano de Desarrollo). See also: IADB
IDF	Institutional Development Fund, World Bank
IDIC	International Drought Information Center, University of Nebraska, USA
IDMC	Inter-departmental Disaster Management Committee, South Africa
IDNDR	International Decade for Natural Disaster Reduction, 1990-1999
IDRC	International Development Research Centre, Canada
IDRM	International Institute for Disaster Risk Management, Philippines
IDRN	India Disaster Resource Network
IERMP	Iran Earthquake Risk Mitigation Programme
IFAD	International Fund for Agricultural Development
IFFM	Integrated Forest Fire Management, Indonesia
IFP/Crisis	In-Focus Programme on Crisis Response and Reconstruction, ILO
IFRC	International Federation of Red Cross and Red Crescent Societies, Geneva, Switzerland
IGAC	International Global Atmospheric Chemistry
IGAD	Intergovernmental Authority on Development, Republic of Djibouti
IGADD	Intergovernmental Authority on Drought and Development (now IGAD since 1996)
IGBP	International Geosphere-Biosphere Programme
IGCP	International Geological Correlation Programme, UNESCO
IG-EPN	Instituto Geofisico, Escuela Politécnica Nacional, Ecuador
IGOS	Integrated Global Observing Strategy
IHDP	International Human Dimensions Programme on Global Environmental Change
IHP	International Hydrological Programme, UNESCO
IIASA	International Institute for Applied Systems Analysis, Laxemburg, Austria
IIEES	International Institute of Earthquake Engineering and Seismology, Iran
IIPA	Indian Institute of Public Administration
IISD	International Institute for Sustainable Development, Canada
IKSR	Internationale Kommission zum Schutz des Rheines, Germany (International Commission for the Protection of the Rhine)
ILO	International Labour Organization
IMC	Inter-Ministerial Committee for Disaster Management, South Africa

IMCC	Interdepartmental Mitigation Coordinating Committee, Canada
IMD	India Meteorological Department
IMERCSA	India Musokotwane Environment Resource Centre for Southern Africa, Zimbabwe
IMF	International Monetary Fund
IMO	International Maritime Organization
INAM	National Institute for Meteorology, Mozambique
INCAP	Instituto de Nutrición de Centro América y Panama (Central American and Panamanian Institute for Nutrition)
INCEDE	International Centre for Disaster Mitigation Engineering, University of Tokyo
INDECI	National Civil Defence System, Peru
INGC	Instituto Nacional de Gestao de Calamidades, Mozambique (National Institute for the Management of Calamities)
INES	International Network on Environment and Security
INETER	Instituto Nicaraguense de Estudios Territoriales (Nicaraguan Institute for Territorial Studies)
INFRAID	Infrastructure Damage Prevention, Assessment and Reconstruction following a Disaster
INSAH	SAHEL Institute, Mali
IOC	Intergovernmental Oceanographic Commission, France
IOM	International Organization for Migration
IPCC	Intergovermental Panel on Climate Change
IPSC	Institute for the Protection and Security of the Citizen, Technological and Economic Risk
IRI	International Research Institute for Climate Prediction, Columbia University, USA
IRIS	Incorporated Research Institutions for Seismology, USA
ISA	International Sociological Association
ISDR	International Strategy for Disaster Reduction
ISFEREA	Information Support for Effective and Rapid External Aid
ISO	International Organization for Standardization, Switzerland
ISP	Integral Sustainable Production Units
ISPU	Higher Institute of Emergency Planning/Institut Supérieur de Planification d'Urgence, Archennes, Belgium
ITC	International Institute for Geo-information Science and Earth Observation, The Netherlands
ITCA	Information Technology Centre for Africa
ITIC	International Tsunami Information Center, Hawaii
ITT	Indian Institute of Technology, Bombay
ITU	International Telecommunication Union
IUCN	World Conservation Union
IUED	Institut universitaire d'études du développement (Graduate Institute of Development Studies), Switzerland
IWRM	Integrated Water Resources Management

J

JICA	Japan International Cooperation Agency
JMA	Japan Meteorological Agency
JRC	European Commission Directorate General Joint Research Centre

K

KBDI	Keetch-Byram Drought Index
KEERC	Korea Earthquake Engineering Research Center, Seoul National University, Korea
KOVERS	Compentence Center for Technical Risks, ETH, Switzerland
KVERMP	Kathmandu Valley Earthquake Risk Management Project, NSET, Nepal

L

LA RED	La Red de Estudios Sociales en Prevención de Desastres en América Latina (The Latin American Network for the Social Study of Disaster Prevention)
LCAS	Logistics Capacity Assessments, WFP
LDCs	Least Developed Countries
LDUC	Land Development and Utilization Commission, Jamaica
LIDERES	Curso Internacional para Gerentes sobre la salud, desastres y desarrollo (PAHO)
LILACS	Latin American and Caribbean Health Science Literature

M

MAB	Man and Biosphere Programme, UNESCO
MADER	Ministry of Agricultural and Rural Development, Mozambique
MAHB	Major Accident Hazards Bureau
MANDISA	Monitoring, Mapping and Analysis of Disaster Incidents in South Africa
MARN	Ministerio de Medio Ambiente y Recursos Naturales, El Salvador (Ministry of Environment and Natural Resources)
MATE	Ministère de l'Aménagement du Territoire et de l'Environnement, France (Ministry of Land Use Planning and Environment)
MCEER	Multi-disciplinary Center for Earthquake Engineering Research, USA
MCT	Ministry of Science and Technology, Venezuela
MDMR	Ministry of Disaster Management and Relief, Bangladesh
MEER	Marmara Earthquake Emergency Reconstruction Project
MEGS	Maharashtra Employment Guarantee Scheme
MERCOSUR	Southern Common Market, South America
MOEF	Ministry of Environment and Forest, Bangladesh
MOST	Management of Social Transformations Programme, UNESCO
MRC	Mekong River Commission, Cambodia
MSC	Meteorological Service of Canada
MSF	Médecins sans Frontières

N

NADIMA	National Disaster Management Authority, Kenya
NaDiVA	National Disaster Vulnerability Atlas, South Africa
NANADISK-NET	National Natural Disaster Knowledge Network, India
NASA	National Aeronautics and Space Administration, USA
NASG	North African Scientific Group
NATO	North Atlantic Treaty Organization
NBA	Niger Basin Authority
NBI	National Botanical Institute, South Africa
NCAR	National Center for Atmospheric Research, USA
NCCM	National Centre for Calamity Management
NCCR	National Centre of Competence in Research North-South, Switzerland
NCDM	National Center for Disaster Management, India
NCDM	National Committee for Disaster Management, Cambodia
NDC	National Development Commission, El Salvador (Comisión Nacional de Desarrollo)
NDCC	National Disaster Coordinating Council, Philippines
NDMC	National Disaster Management Centre, South Africa
NDMO	National Disaster Management Office
NDMS	National Disaster Mitigation Strategy, Canada
NDRP	National Disaster Reduction Plan, People's Republic of China
NDVI	Normalized Difference Vegetation Index
NEAP	National or regional Environmental Action Plan
NEDIES	Natural and Environmental Disaster Information Exchange System
NEMA	National Emergency Management Association, USA
NEMO	Network of State Hazard Mitigation Officers, USA
NEPA	National Environment and Planning Agency, Jamaica (former NRCA)
NEPAD	New Partnership for Africa's Development
NHIA	Natural Hazard Impact Assessment
NHRC	Natural Hazards Research Centre, Australia
NRC	Nuclear Regulatory Commission (NRC), USA
NRCA	Natural Resources Conservation Authority (now NEPA), Jamaica
NEWU	National Early Warning Unit, Africa
NFIP	National Flood Insurance Program, USA
NGI	Norvegian Geotechnical Institute
NIBS	National Institute of Building Sciences, USA
NICT	New Information and Communication Technologies
NIDP	National Institute for Disaster Prevention, Republic of Korea
NIRD	National Institute of Rural Development, India
NMHSs	National Meteorological and Hydrological Services, WMO

NOAA	National Oceanic and Atmospheric Administration, USA
NOVIB	Netherlands Organisation for International Development Cooperation
NPDPM	National Policy on Disaster Prevention and Management, Ethiopia
NRA	National Resource Accounts
NRC	Nuclear Regulatory Commission
NRDF	National Research and Development Foundation, Saint Lucia
NSA	National Systems for Environmental Accounting
NSF	National Science Foundation, USA
NSET	National Society for Earthquake Technology, Nepal

O

OAS	Organization of American States (Organización de Estados Americanos), Washington, DC, USA
OCD	Office of Civil Defence, Philippines
OCDS	Oxford Center for Disaster Studies
OCIPEP	Office of Critical Infrastructure Protection and Emergency Preparedness, Canada, See also: BPIEPC
ODA	Official Development Assistance
ODI	Overseas Development Institute, United Kingdom
ODPEM	Office of Disaster Preparedness and Emergency Management, Jamaica
OECD	Organization for Economic Cooperation and Development, France
OECS	Organization of Eastern Caribbean States, Castries, Saint Lucia
OFDA/USAID	Office for Foreign Disaster Assistance/US Agency for International Development
OFEFP	Office Fédéral de l'Environnement, des Forêts, et du Paysage, Suisse (Swiss Agency for the Environment, Forests and Landscape, Economics and Climate Section)
OGP/NOAA	Office of Global Program/ National Oceanic and Atmospheric Administration, USA
OHCHR	Office of the United Nations High Commissioner for Human Rights
OOE	Scientific Centre of Monaco, European Oceanological Observatory/Centre scientifique de Monaco, Observatoire Océanologique Européen, Monaco
OOSA	Office for Outer Space Affairs, United Nations
ORAP	Organisation of Rural Associations for Progress, Zimbabwe
ORSEC	Organisation des Secours
OSDMA	Orissa State Disaster Mitigation Authority, India
OSIRIS	Operational Solutions for the Management of Inundation Risks in the Information Society

P

PACD	Plan of Action to Combat Desertification
PAHO	Pan American Health Organization (Organización Panamericana para la Salud), Washington, DC, USA
PAMERAR	Programme for Assessment and Mitigation of Earthquake Risk in the Arab Region
PBSP	Philippines' Business for Social Progress, Manila
PDC	Pacific Disaster Center
PERI	Public Entity Risk Institute
PHIVOLCS	Philippine Institute for Volcanology and Seismology
PICCAP	Pacific Island Climate Change Assistance Program
PIK	Postsdam Institute for Climate Impact Research, Germany
PLANAT	National Platform for Natural Hazards, Switzerland
PPP 2000	Public Private Partnership – 2000, Washington DC, USA
PRA	Participatory Rapid Appraisals
PREANDINO	Andean Regional Programme for Risk Prevention and Reduction, Venezuela
PRECLIF	Project for the Local Prevention and Control of Forest Fires, Guatemala
PREVAC	Programa de Prevención de Desastres en América Central (Disaster Prevention Program in Central America)
PREVIEW	Project for Risk Evaluation, Vulnerability, Information and Early Warning
PSI	Paul Scherrer Institute, Switzerland
PSMP	Public Sector Modernization Programme, Jamaica
PTWS	Pacific Tsunami Warning System
PTWC	Pacific Tsunami Warning Centre, Hawaii, USA
PWS	Public Weather Services, WMO

R

RADIUS	Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters
RADIX	Radical Interpretation of Disaster
RCB	Response Coordination Branch, OCHA
RCC	Regional Consultative Committee on regional cooperation in disaster management, Bangkok, Thailand
RCC	Regional Climate Centers, WMO
RCOF	Regional Climate Outlook Forums
RDMP	Risk Disaster Management Programme, UN-HABITAT
REIS	Regional Environmental Information System
RELEMR	Reduction of Earthquake Losses in the Eastern Mediterranean Region
RELSAT	Strengthening of local structures and early warning systems
RESCDAM	Development of rescue actions based on dam-break flood analysis
REWS	Regional Early Warning System, Africa
REWU	Regional Early Warning Unit, SADC, Zimbabwe
RIKEN	Institute of Physical and Chemical Research, Japan
RRSU	Regional Remote Sensing Unit, SADC, Zimbabwe
RSDD	Regional and Sustainable Development Department, ADB
RSMC	World Meteorological Organization Specialized Regional Meteorological Centers
RTD	Research and Technological Development, EU
RUTA	Regional Unit for Technical Assistance (Project UNDP/World Bank)

S

SAARC	South Asian Association for Regional Cooperation, Nepal
SACP	State Agency for Child Protection and Child Protection Policy, Bulgaria
SADC	Southern African Development Community
SADCC	Southern African Development Coordination Conference
SAFIRE	Southern Alliance for Indigenous Resources
SAR	Synthetic Aperture Radar
SARS	Severe Acute Respiratory Syndrome
SAQA	South African Qualifications Authority
SARCOF	Southern Africa Region Climate Outlook Forum
SARDC	Southern African Research and Documentation Center, Zimbabwe
SAREC	Swedish Agency for Research Cooperation with Developing Countries
SBO	School Building Organization, Greece
SCF-UK	Save the Children Fund, United Kingdom
SCHR	Southern Centre for Human Rights, USA
SDC	Swiss Agency for Development and Cooperation
SEAGA	Socio-Economic and Gender Analysis
SEEA	System for Environmental Economic Accounting
SEEDS	Sustainable Environment and Ecological Development Society, India
SEGEPLAN	Secretaría General de Planificación, Guatemala (Planning Secretariat)
SEI	Stockholm Environment Institute
SEISMED	Cooperative Project for Seismic Risk Reduction in the Mediterranean Region
SERMP	Suva Earthquake Risk Management Scenario Pilot Project, Fiji
SESAME	Secure European System for Applications in a Multi-vendor Environment
SESI	School Earthquake Safety Initiative, UNCRD/DMPHO
SETSAN	Secretariat for Food Security and Nutrition, Mozambique
SEWA	Self Employed Women's Association
SICA	Sistema de Integración Centroamericana (Central American Integration System)
SIDS	Small Island Developing States
SIDS-POA	Small Island Developing States Program of Action
SIDA	Swedish International Development Agency
SIF	Social Investment Fund, Honduras
SLF	Swiss Federal Institute for Snow and Avalanche Research
SINAPROC	Sistema Nacional de Protección Civil, Panama (National Civil Protection System)
SNET	National Service for Territorial Studies, El Salvador
SNPMAD	Sistema Nacional de Prevención, Mitigación y Atención de Desastres, Nicaragua (National System for Disaster Prevention, Mitigation and Attention)

SNET	Servicio Nacional de Estudios Territoriales, El Salvador (National Service for Territorial Studies)
SOPAC	South Pacific Applied Geoscience Commission, Fiji
SOPAC-DMU	South Pacific Applied Geoscience Commission - Disaster Management Unit
SPDRP	South Pacific Disaster Reduction Program
SPFS	Special Programme for Food Security, FAO
SPPO	South Pacific Program Office
SPREP	South Pacific Regional Environmental Programme, Apia, Western Samoa
SRAP	Sub-Regional Action Programme to combat desertification in West Africa and Chad
SSP	Swayam Shiksam Prayong, India
START	System for Analysis, Research and Training
Swiss Re	Swiss Reinsurance Company

T

TCP	Tropical Cyclone Programme
TEFER	Turkish Emergency Flood and Earthquake Recovery
TESAG	School of Tropical Environment Studies and Geography, James Cook University
TESEC	European Centre of Technogenic Safety/Centre Européen de Sécurité Technologique, Kiev, Ukraine
TDCPU	Turkana Drought Contingency Planning Unit, Kenya
TRL	Simon Fraser University Telematics Research Lab
TRM	Total Disaster Risk Management (RCC strategy)
TPD	Town Planning Department, Jamaica
TWAS	Third World Academy of Sciences, Italy

U

UCR	Universidad de Costa Rica (University of Costa Rica)
UEMOA	West Africa Economic and Monetary Union
UNA	Universidad Nacional (National University), Costa Rica
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNAM	National Autonomous University of Mexico
UNAN	Universidad Nacional de Nicaragua (National University of Nicaragua)
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNCSD	United Nations Common Supply Database
UNCED	United Nations Conference on Environment and Development
UNCHS	United Nations Centre for Human Settlements (now UN-HABITAT)
UNCRD	United Nations Center for Regional Development
UNCRD/DMPHO	United Nations Center for Regional Development/Disaster Management Planning Hyogo Office, Japan
UNCTAD	United Nations Conference on Trade and Development
UNDAC	United Nations Disaster Assessment and Coordination team
UNDAF	United Nations Development Assistance Framework
UNDCP	United Nations International Drug Control Programme
UNDG	United Nations Development Group
UNDHA-SPO	United Nations Department of Humanitarian Affairs-South Pacific Office
UNDP	United Nations Development Programme
UNDP-SPO	United Nations Development Programme-South Pacific Office
UNDRO	Office of the United Nations Disaster Relief Coordinator
UNEP	United Nations Environment Programme
UNEP/DEPI	United Nations Environment Programme/Division of Environmental Policy Implementation
UNEP/DEWA	United Nations Environment Programme/Division of Early Warning and Assessment
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNFIP	United Nations Fund for International Partnerships
UNFPA	United Nations Population Fund
UNHCR	United Nations High Commissioner for Refugees
UN-HABITAT	United Nations Human Settlements Programme (formerly UNCHS)

UNICEF	United Nations Children's Fund
UNISPACE	United Nations Conference on the Exploration and Peaceful Uses of Outer Space
UNIDO	United Nations Industrial Development Organization
UNIFEM	United Nations Fund for Women
UNITAR	United Nations Institute for Training and Research
UN-OCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNOPS	United Nations Office for Project Services
UNRWA	United Nations Relief and Works Agency for Palestine Refugees in the Near East
UNSC	United Nations Staff College
UNSO	Office to Combat Desertification and Drought, UNDP (now Drylands Development Centre)
UNU	United Nations University
UNU/RTC-HSE	United Nations University Research and Training Centre on Human Security and the Environment, Bonn, Germany
UNV	United Nations Volunteers
UPU	Universal Postal Union
USAID	US Agency for International Development
USDE/OAS	Unit for Sustainable Development and Environment of the Organization of American States
USGS	United States Geological Survey
USSA	Uganda's Seismic Safety Association
USTDA	United States Trade and Development Agency
UWI	University of the West Indies, Jamaica

V

VAAC	Volcanic Ash Advisory Centre
VAG	Vulnerability Analysis Group
VAM	Vulnerability Assessment and Mapping, WFP
VAT	Vulnerability Assessment and Techniques
VCA	Vulnerability and Capacities Assessment
VEI	Volcanic Explosivity Index
VHF	Very High Frequency

W

WAEMU/ UEMOA	West Africa Economic and Monetary Union (WAEMU), Union Economique et Monetaire de l'ouest Africaine (UEMOA)
WAICENT	World Agricultural Information Centre, FAO
WB	World Bank
WCP	World Climate Programme, WMO
WDNH	Weather-Driven Natural Hazards
WFP	World Food Programme, United Nations
WHO	World Health Organization, United Nations
WIPO	World Intellectual Property Organization, United Nations
WMO	World Meteorological Organization, United Nations
WOVO	World Organization of Volcano Observatories
WOVOdat	World Organization of Volcano Observatories' database
WRCU	Water Resources Coordination Unit, SADC, Southern Africa
WSL	Swiss Federal Institute for Forest, Snow and Landscape Research
WSSD	World Summit on Sustainable Development
WSSI	World Seismic Safety Initiative
WTO	World Trade Organization
WVI	World Vision
WVR	World Vulnerability Report, UNDP
WWAP/WWDR	World Water Assessment Programme/World Water Development Report
WWF	World Wide Fund for Nature
WWRP	World Weather Research Programme, WMO
WWW	World Weather Watch, WMO

Z

ZRA	Zambesi River Authority
ZENEB	Zemtrum für Naturrisiken und Entwickung, Germany (Centre for Natural Risks and Development)
ZFFHC	Zimbabwe Freedom From Hunger Campaigns

Subject index

Page references to UN agencies and international, regional, national and specialized organisations are not listed in this index. Instead, they appear in annex 2 (international, regional, national and specialized organisations) and annex 3 (UN agencies).