

## 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/millenniumgoals>>
- 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.unhcr.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](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](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](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](http://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

**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](http://www.proventionconsortium.org/projects/appliedres_winners.htm)>

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>>

**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 (E.C) 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 OCIPPEP 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'Études 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'Étude 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'Étude 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, Gadjah 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.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 interdisciplinary 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](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

#### 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.

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>>



## 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 (ANAFEA) 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.