Chapter 4

Building understanding: development of knowledge and information sharing

4.1 Information management and communication of experience

Effective disaster risk management depends on the informed participation of all stakeholders. The exchange of information and easily accessible communication practices play key roles. Data is crucial for ongoing research, national planning, monitoring hazards and assessing risks. The widespread and consistent availability of current and accurate data is fundamental to all aspects of disaster risk reduction.

Information describes working conditions, provides reference material and allows access to resources. It also shapes many productive relationships. Rapid developments in modern communications help to record and disseminate experience, convey professional knowledge and contribute to decision-making processes.

Integrating new developments in information management with established and more traditional methods can help to create a much better understanding about hazards and risk at all levels of responsibility. This information can be disseminated through public awareness programmes. Information is also instrumental in achieving more comprehensive early warning systems and effective mitigation efforts.

This section will discuss:

- *current issues in information management;*
- *international dimensions of disaster risk management information;*
- *electronic exchange of global experience;*
- *regional initiatives;*
- *national information programmes; and*
- *technical information about hazards.*

This section deals with information management. Web site addresses have been included in the text, where relevant. More web sites for additional information are listed in the directory of organizations (see annex 2).

Current issues in information management

Advantages

Disaster risk reduction issues concern popular interest and official policy. The information available on the subject is expanding rapidly. The sources, previously associated mainly with catastrophic events or considered the domain of specialists, now reach a wider range of users. The number of interested people, educational institutions, organizations and local community users is growing, as are relevant web sites, networks, professional and often multidisciplinary exchanges.

In addition to these many sources for exchanging technical or specialized data, other means of communication have emerged to disseminate research about disaster risks and to convey information about new activities and programmes. Within the ISDR framework, Internet-based electronic conferences and discussion forums have been successful on several occasions.

Geographic Information Systems (GIS) technology is an increasingly accepted tool for the presentation and analysis of hazards, vulnerabilities and risks. Other forms of information dissemination provide new insights about knowledge engineering, management techniques and cognitive sciences. Many of these tools are becoming increasingly widespread and useful even at localized levels of activity in such matters as facilitating decision-making, planning options, working online with remote collaborators, and conducting a variety of distance conferencing or educational opportunities.

Some promising developments in the evolution of information systems relate to innovative machine/user interfaces that rely on natural language processing for searching and analysing data. Other systems rely on the expanded use of "fuzzy logic" and expert learning systems such as those based on neutral networks.

Many of these advanced techniques hold promise in communicating information in quicker or automated early warning systems, distinctive public awareness programmes, and for a wide variety of educational or community-based applications. They can assist in the development of learning materials, guided by the specific needs and interests of communities or individually targeted users or interest groups.

Limitations

The tremendous growth in the number of sources and volume of data pose challenges in the processing and dissemination of meaningful information. Users find it ever harder to assess the accuracy and validity of information. Systematic processes of gathering data and the timely provision of desired products are keys to ensuring the effective use of information. Sorting, analysing and targeting information for primary interest groups are also critical in the dissemination of knowledge.

There is a growing tendency for many information providers to rely on increasingly sophisticated means of electronic communication, thereby excluding many potential users. Women generally tend to have less access to computers than men and, across the globe, regions vary widely in the access that low-income residents have to computers.

Many institutions now rely on electronic communications to satisfy their own needs. By doing so they may unintentionally place their information beyond the reach of many people most vulnerable to hazards.

Several factors have hindered the development of efficient information systems for general use, while other constraints might be more institutional in nature.

Several commentators in Africa have conveyed to the ISDR Secretariat their view that the provision of timely, definitive information remains problematic in all aspects of disaster and risk management.

Responses from Bangladesh and others to an ISDR survey said that a plethora of government agencies, international and technical organizations, academic institutions and NGOs all produce relevant information, resulting in information overload. The need of individual organizations to have adequate information for their own programme interests has motivated most development agencies to work from their own information systems that cannot be applied easily to other settings.

As a result, information related to hazards or past disasters either can be scattered or duplicated, often appearing to be inconsistent or incompatible. Too often, the systematic coverage of data, its reliability, timeliness or general quality relating to the dynamic nature of risks is problematic or poor.

Such basic inadequacies can be further compounded by the perceived sensitivity of data about infrastructure or potential threats to a society by security services or various other governmental responsibilities. It is such features, rather than inherent limitations of modern

Box 4.1
Lack of information or lack of access?

According to ISDR reports, there are many countries in which a wealth of disaster risk information exists in archived form. Such information might be inaccessible for restricted institutional or technical reasons:

- Data is restricted for presumed security purposes or as an institutional power base.
- Inadequate cross-sector communication about the existence of data.
- Dissemination of information is not considered a priority by the organization.
- Information is maintained in specialist, non-standard or outdated formats.
- Existing information is costly to convert into more readily accessible formats.
- Data compilers have not consulted users about their data requirements.
- Information for women's advocacy organizations and other community-based groups is not readily available and gender-specific data is not consistently gathered or disseminated.

communication technologies, that are often seen to impede easier or more effective access to crucial information.

While many organizations are involved in risk reduction activities, no universally-acknowledged focal point exists to provide easy or consistent access to the great variety of pertinent information. As a consequence, important data is scattered around the globe, or valuable experiences are confined within individual institutions, with no common point of access.

One of the major constraints in the more effective use of information is the unavailability of data. Many areas are without basic data or have not maintained consistent databases over time. Even on an individual basis, precise information often is difficult to obtain as much of the existing data is either generalized or does not reflect a comprehensive picture of the situation at hand.

There is a growing need for disaster events to be geo-referenced in order to look at risk not only from a singular hazard point of view, but also from an orientation to the relative levels of exposure. This requires more attention to be given to improving the geographical and temporal coverage of publicly available hazard and risk databases. While increasing attention may be given to linking database information, there are few examples that are truly integrated, or which encourage multi-variant analysis or comparison.

Crucial limitations in the collection and use of data remain in several fundamental areas. There is a widespread lack of consistent coverage of relevant data in both time and space, with data gaps most pervasive in the poorest countries. Data quality is adversely affected by a lack of methodologies or standard protocols pertaining to data gathering, compilation, storage, analysis and dissemination. Consequently, valid comparisons or cross-referenced analysis are difficult or not even attempted.

Incomplete, spotty or inadequate data also invites a misinterpretation of information. At times this may even be intentional or biased for ulterior motives, such as to demonstrate a certain political viewpoint.

International dimensions of disaster risk management information

One of the primary functions assigned to the ISDR Secretariat by the UN General Assembly is to serve as a global information clearinghouse for disaster reduction. This role as an information hub on the subject is seen as a means to encourage more opportunities for the dissemination of information among a wide range of institutions and to foster relationships based on advocacy, networking and information management.

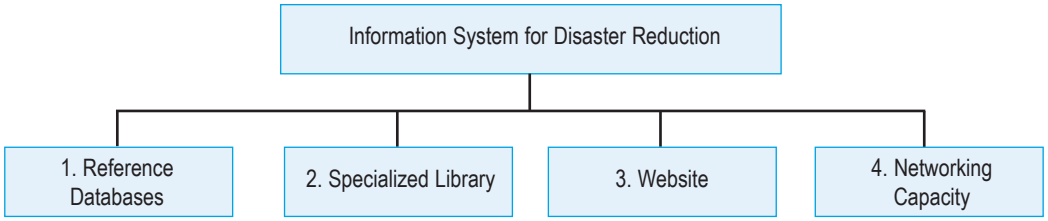
Objectives have been outlined to undertake the systematic collection, analysis and publication of information concerning natural hazards, risk reduction and disaster reduction initiatives. To fulfil the functions of an information clearinghouse for disaster reduction, the ISDR Secretariat must become an effective global focal point for sharing risk reduction information and its management in the UN and beyond. It is thereby strengthening networks, helping disaster reduction practitioners to share information, with challenges remaining to:

- Compile, analyse and disseminate data, information and related products on natural hazards, risk reduction and disaster reduction to organizations, countries, partners and communities in order to promote wider public awareness, professional access and political commitment.
- Provide worldwide access of relevant and accurate information on risk reduction freely, based on input from all stakeholders, through the further development of an interactive ISDR resource centre, including databases, library, web site and knowledge network.

These activities must rely on productive relationships with many specialized organizations and institutions. They embody a complex process of many links and involve several different elements, including:

- Related databases of specialists, organizations, projects and initiatives, country information related to risk reduction experience and information, events drawn from multiple sectors, educational and training activities and facilities.

Figure 4.1
Information system for disaster reduction



Source: UN/ISDR, 2003

- A specialized multimedia library and related documentation services.
- An upgraded web site for disaster reduction.
- Interactive networking and knowledge-based capabilities.

There are numerous examples that illustrate how information management and innovative communication practices have helped advance public understanding and professional involvement in disaster risk reduction in recent years. Several of these more comprehensive initiatives compile and process information on a global basis, although each has its own individual emphasis.

The Centre for Research on the Epidemiology of Disasters

The Centre for Research on the Epidemiology of Disasters (CRED) collaborates with the World Health Organization (WHO). It is located at the School of Public Health of the Catholic University of Louvain in Brussels, Belgium.

CRED maintains a global Emergency Events Database (EM-DAT). It is a comprehensive record of natural disasters which documents more than 12,500 events by type and country of occurrence over the last century. Initially, it was created with the support of WHO and the Belgian government.

The CRED database is widely recognized for its efforts to provide a consistent rendering of the often casual, vague or conflicting information about disasters that is frequently conveyed in different formats. <http://www.cred.be>

Munich Reinsurance

The NatCat service is another highly regarded database that is maintained by the Research and Development Department of Munich Reinsurance (Munich Re), in Munich, Germany. It provides information about major and technological natural catastrophes that have occurred around the world since 1965, although neither the social nor economic consequences of droughts are currently included in its records.

Information derived from NatCat and additional analysis of hazard trends is distributed widely by Munich Re in its publication *Topics*, an annual review of natural catastrophes, published in five languages. Munich Re also provides detailed information to commercial clients and other interested parties about specific disaster events or amalgamated information regarding regional or global exposure analyses and trend studies.

The Munich Re World Map of Natural Hazards has been a valuable source of information for risk management professionals since it was first published in 1978. The Globe of Natural Hazards, most recently updated in 1998, has also proved to be an effective information tool.

Munich Re regularly produces additional publications and has issued a CD-ROM, *World of Natural Disasters*, to advance public knowledge of hazards. By using digital technology and GIS, this CD-ROM provides basic risk identification and evaluation expertise to engineers, government officials and other interested parties. It can be used to identify quickly the predominant natural hazards and related risks at any terrestrial position

Box 4.2
Global Identifier Number

Accessing disaster information can be time consuming and laborious. Not only is data scattered but frequently identification of the disaster can be confusing in countries with many disaster events. To address both of these issues, the Asian Disaster Reduction Centre (ADRC) proposed a unique global identification code for disasters; a Global Disaster Identifier Number (GLIDE).

The Centre for Research on the Epidemiology of Disasters (CRED) and UN-OCHA ReliefWeb have adopted GLIDE for use in their databases and have been working with GLIDE partners for better information sharing. Their partners include ISDR, UNDP, IFRC, WMO, FAO, the World Bank, OFDA/USAID and LA RED.

A GLIDE number is issued every week by CRED for all new disaster events that meet certain criteria. The components of a GLIDE number consist of two letters to identify the disaster type (e.g. EQ for earthquake); the year of the disaster; a four digit sequential disaster number; and the three letter ISO code for country of occurrence. Thus, the GLIDE number for the Gujarat earthquake in India is EQ-2001-0033-IND.

This number is used by CRED, ReliefWeb and ADRC on all their documents relating to a particular disaster. Gradually other partners are expected to include it in information they generate. As more information suppliers join in this initiative, documents and data pertaining to specific events can be retrieved more easily from various sources, or otherwise linked by using the unique GLIDE numbers. GLIDE can also assist by serving as a key for national level disaster datasets to relate consistently to international disaster databases.

In 2003, GLIDE partners agreed to expand the sequential disaster number to six digits and to allow a fifth suffix for a three digit administrative code to identify the disaster-stricken area in the country. It was thought that such an addition would prove useful for national disaster datasets. Several countries will proceed to create national disaster databases accordingly, with the support of UNDP.

A search function already exists on the GLIDE web site to locate disaster information easily by any of the following parameters: disaster type, year, country, and GLIDE number. An automatic GLIDE generator function that will issue a new GLIDE number for the occurrence of new events will be available on the web site. The success of GLIDE depends on its widespread use and its level of utility for practitioners. ADRC has prepared a web site to promote GLIDE and welcomes the views and experience of users to improve its utility. <http://glidenumber.net>

in the world at the click of a button. The CD-ROM also contains comprehensive profiles and basic risk-related reference information about more than 200 states and territories. <http://www.munichre.com>

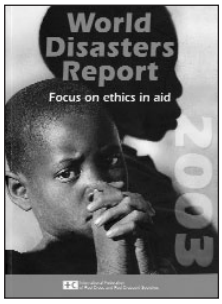
Swiss Reinsurance

Another major global reinsurance company, Swiss Reinsurance (SwissRe), has also maintained specific data on natural hazards and catastrophes since the 1970s. Some of this information is provided publicly through their *SIGMA* publication, published eight times a year. In addition to individual subject-focused publications about natural hazards, SwissRe also publishes an annual review. It summarizes annual data on disaster incidence and analyses trends in risk, exposure and commercial insurance considerations in several languages. Additional risk and disaster-related data is available on SwissRe's free online database, CAT-NET, although potential users need to register prior to accessing the password-protected web site.
<http://www.swissre.com>

ReliefWeb

Another widely used global information resource is ReliefWeb, an electronic database and information service operated by the UN Office for the Coordination of Humanitarian Affairs (OCHA). It focuses primarily on current international emergencies and disasters with humanitarian implications, although it also provides response-oriented information about natural disasters. ReliefWeb provides an excellent and wide-ranging selection of information, press accounts, related contacts and operational information. It also provides archival information drawn from public, governmental, NGO and authoritative sources about various types of emergencies and their consequences. It maintains an archive of specialized maps related to emergency and crisis events, frequently preparing them to address current or localized emergency conditions. However, as its name indicates, it largely relates to emergency preparedness and response interests.
<http://www.reliefweb.int>

Box 4.3
Global reports on disaster, risk and vulnerability

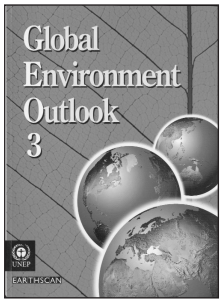


World Disasters Report

One of the most respected sources of information about disasters is the *World Disasters Report*, an annual publication of the International Federation of Red Cross and Red Crescent Societies (IFRC).

Published since 1993, the *World Disasters Report* provides the latest trends, facts and analysis of the world's humanitarian crises. Described by the World Bank as "a very valuable resource for the international community", the report is an indispensable reference work for those searching current information about strategies and tactics in the face of disaster. The report is backed by the resources and expertise of IFRC.

The 2002 edition of the *World Disasters Report* focused on risk reduction. The report examined preparedness and mitigation initiatives from disaster-prone countries around the globe. In addition, the report studied the issue of humanitarian accountability, presented a methodology to assess vulnerabilities and capacities and concluded with disaster data tables. It addressed current issues such as whether disaster preparedness and mitigation pays off in terms of lives, livelihoods and assets saved.
<http://www.ifrc.org>

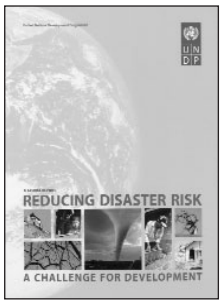


Global Environment Outlook

UNEP has launched the *Global Environment Outlook (GEO)* series, which contains baseline information on emerging environmental issues and threats, as well as policies being implemented at global and regional levels.

The findings and recommendations of the *GEO* series constitute the basis of UNEP activities in early warning, vulnerability and risk assessments. The *GEO-3* report of May 2002 addressed human vulnerability to environmental changes, including elaboration on the specific relationships between the impacts of natural hazards and emerging disasters.

UNEP also produces other reports of regional and thematic scope, such as on small island developing states.
<http://www.unep.org>



Reducing Disaster Risk: A challenge for development

UNDP has been publishing their annual *Human Development Report* since 1989. It has increased public understanding of the social dimensions of development. The Human Development Index and the Human Poverty Index are both based on carefully selected parameters for which data are available and provide alternative indicators to conventional economic measurements such as gross domestic product (GDP).

In 2004 UNDP's Bureau for Crisis Prevention and Recovery (BCPR) launched a publication entitled *Reducing Disaster Risk: A challenge for development*. It aims to shed light on the linkages between development and disaster, addressing the increasing impact of natural disasters on development and the acknowledgement of development paths as determinant configuration factors of disaster risk. It promotes disaster risk reduction by identifying appropriate development policies that integrate both disaster risk management and actions targeting the achievement of the Millennium Development Goals.

As part of this publication, UNDP presented a Disaster Risk Index, which will compare countries according to their relative risk levels over time. The index highlights the level of national progress made on mitigating disaster risk.
<http://www.undp.org/bcpr/disred/rdr.htm>

International Federation of Red Cross and Red Crescent Societies

The International Federation of Red Cross and Red Crescent Societies (IFRC) launched its Disaster Management Information Systems (DMIS) In November 2001. This web site provides a single entry point for disaster management information for members of the International Red Cross and Red Crescent Movement.

Supported by four National Red Cross and Red Crescent Societies, the UK Department for International Development (DFID) and the Ericsson Response Program, the project aims to provide information about disasters in a systematic way and to monitor factors that might signal an impending crisis.

The development of DMIS is a reflection of the *IFRC Strategy 2010*. It demonstrates three strategic directions; responsive and focused on disaster preparedness and response; supportive of well-functioning National Red Cross and Red Crescent Societies; and striving to work together effectively.

While DMIS is restricted in use to the Red Cross and Red Crescent network, it does provides a toolbox of working documents, templates, operational guidelines and links to online data sources sorted by categories. It also provides access to 400 external web sites related to disaster management, as well as to a variety of Red Cross and Red Crescent web-based initiatives.

DMIS is expected to speed up emergency awareness, encourage preparedness measures and enable effective action by providing decision makers with timely information. As the basis for both an organizational and an operational network, it facilitates the exchange of experiences from Red Cross and Red Crescent activities throughout the world.

Specific operational links to data sources during a disaster are grouped, highlighted and then archived for future reference. The preparedness section of the site allows Red Cross and Red Crescent delegates to register information about disaster trends from anywhere in the world and to obtain the latest information and responses to unfolding disaster situations.

During large-scale emergencies, ongoing operational information can be exchanged, such as logistics mobilization details. Contact references are also posted to improve communication among the different actors involved. This interactive tool continues to evolve as new features are added on a regular basis in response to the needs of its users. The password-protected site has almost 1,500 registered users and is accessible to 125 National Red Cross and Red Crescent Societies. The DMIS project team can be contacted electronically. <dmis@ifrc.org> <http://www.ifrc.org>

Global Disaster Information Network

While the objectives of the Global Disaster Information System (GDIN) are yet to be fully realized, this international collaborative association of specialists from governments, international and donor organizations, NGOs, commercial and academic institutions is working to enhance capacities to receive and use disaster information.

GDIN seeks to offer a variety of services that can link users with appropriate information providers and to encourage the use of greater technical compatibility or integration of information systems across geographical regions so that information can be shared more effectively.

While much of its interest revolves around remotely sensed data, GIS applications, mapping and display information, GDIN also tries to assist disaster specialists in obtaining information that may otherwise be difficult for them to locate or to access through individual efforts. It particularly tries to help disaster managers in areas where there are limited resources or limited access to technology through both negotiated international agreements as well as efforts to standardize communication protocols and technical compatibility. <http://www.gdin.org>

Electronic exchange of global experience

Beyond established institutional information capabilities pertaining to disaster risk reduction, there are other forms of publicly accessible and free multidisciplinary Internet-based discussion groups, listserves and related electronic networks. While they are often transitory and dedicated to facilitating either the discussion or exchange of experience related to particular subject matters or a forthcoming global event, they provide a useful global forum and attract additional users to risk reduction information.

One such online discussion forum was organized in May 2002 by an NGO network, the Stakeholder Forum for Our Common Future, and the ISDR Secretariat, prior to the World Summit for Sustainable Development. The theme was, "Links between natural hazards, environment and sustainable development: Taking action to reduce the risk of disasters".

An effort was made to broaden the discussion to a larger group of people than may otherwise have been involved with matters of sustainable development. More than 350 participants from 80 countries registered and many exchanged their views, experiences and concerns.

Numerous topics emerged, including the impact of natural hazards on development and how to reverse vulnerability; risk assessment and early warning systems; fostering community involvement and developing coping capabilities within communities; and the promotion of education and capacity-building.

A wealth of experience unfolded during the one month discussion, as case examples illustrated a variety of specialist knowledge. There were also insightful comments about current limitations in linking risk reduction and sustainable development and the roles and responsibilities that could lead to potential solutions.

Some of these outlooks are included in this global review. Regardless of the individual views expressed, the value of such a forum is the opportunity to exchange views with people around the world who share a professional interest and personal commitment to these issues. <http://www.earthsummit2002.org>

A similar cyber conference was organized in November 2001 by the UN Division for the Advancement of Women on disaster reduction and natural resource management with a gender perspective. Over a six-week period, contributors posted their viewpoints on five different issues.

Subjects related to gender patterns in the use of environmental resources, coping skills, and various opportunities for women's empowerment in the windows of opportunity following natural disasters. The subjects of integrating gender equity goals into disaster prevention and sustainable development initiatives also were included. This international dialogue was the basis for the subsequent 2002 Expert Working Group which met in Ankara, Turkey. <http://www.un.org/womenwatch/daw>

The ISDR Secretariat and the UN Development Programme (UNDP) jointly conducted an electronic dialogue in mid-2003 on a framework to guide and monitor disaster risk reduction. This electronic exchange was considered an excellent means to circulate a work in progress and to engage a wide range of comment about the ideas being considered.

Through this collective endeavour the overall goals encouraging and increasing effective disaster reduction practices were advanced. The online conference provided a forum for stakeholders to exchange views and identify a future course of action needed to develop a more commonly accepted framework for understanding, guiding and monitoring disaster risk reduction at all levels. The wide reach of the electronic exchange brought the global experience of many professional, geographical and institutional groups into the process. <http://www.unisdr.org/dialogue>

The Natural Hazards Disasters Network is yet another form of a managed information service and ongoing discussion group, covering socio-economic, psychological, organizational, scientific and technical aspects of disasters. Its members are drawn from operational agencies and academic institutions throughout the world, although anyone with an interest in the subject can participate. <http://www.jiscmail.ac.uk/lists/natural-hazards-disasters>

The Radical Interpretation of Disaster Experience (RADIX) is a lively web site that provides an electronic venue for discussion, working papers, opinion pieces, resources or links that can help in understanding the root causes and social dimensions of hazards, vulnerability and risks.

This includes issues such as human rights; respect for diversity; the transformation of existing knowledge into action; and links between disasters, economic development and political issues. RADIX maintains a particular emphasis in local community interests and people-centred activities for risk reduction.

The discussion group and documents which are posted bring together groups involved in various ways with disaster risk reduction, even if they have not always occupied common ground or shared information so easily with one another. The diverse community includes scientists, human rights activists, development workers, government officials, business executives and media representatives, each having some experience with risk issues. <http://online.northumbria.ac.uk/geography_research/radix/>

The Gender and Disaster Network is also a vehicle for sharing resources and ideas across regions. It provides a resource bank of international academics, activists, relief workers, and policy makers interested in integrating gender equality into all aspects of disaster prevention, response and reconstruction. A listserve enables members to share ideas and information. Publications posted to the web site include case studies and reports, field accounts, bibliographies, gender-sensitive guidelines, and the proceedings of recent international conferences on women in disasters. <http://online.northumbria.ac.uk/geography_research/gdn>

Regional initiatives

Regional information or documentation centres relating to hazard awareness or risk reduction activities have been established in several locations. A review of some of these centres will illustrate the different approaches and the diversity of interests that are served in different parts of the world. Nevertheless, the value of their products and services all contribute to the growing body of international knowledge on disaster risk management.

Africa

There is no region-wide disaster information centre covering the variety of hazards or risk conditions on the African continent. However, there are several specialized documentation centres that are expanding their activities into related fields of risk.

Box 4.4
Drought information in Africa

The Intergovernmental Authority on Development Drought Monitoring Centre, in Nairobi, Kenya, and the Southern African Development Community (SADC) Drought Monitoring Centre in Harare, Zimbabwe have expanded their scope in recent years.

They are now important regional centres for information about climate conditions and hazards. Periodic climate forecasts are produced by each of these centres and circulated widely among both technical and policy officials in most countries of Southern, Eastern and Central Africa.

Similarly, the Regional Early Warning Programme and the regional remote sensing activities of the SADC Food, Agriculture and National Resources division produce routine and specialized information on drought and related risks affecting food security. SADC also supports project activities related to the environment and land management issues as well as water resource management programmes.

AGRHYMET, the specialized hydrometeorological institute of the Permanent Interstate Committee for Drought Control in the Sahel produces and disseminates information.

These institutions work together to improve the quality of technical information available for policy makers in the region. However, in the broader context of information management, such specialized centres, working within specific professional environments, highlight the problem of incorporating information more systematically into conventional risk reduction communication. <http://www.agrhymet.net>

The Southern African Research and Documentation Centre

The Southern African Research and Documentation Centre (SARDC) is a highly regarded centre. Based in Harare, Zimbabwe, SARDC is an independent regional information and documentation centre that seeks to enhance the effectiveness of key development processes in the region. It pursues this aim through the collection, analysis, production and dissemination of information and by working to enable local capacities to generate and use information.

It has operated as a non-profit foundation since 1987 and its objective is to improve the base of knowledge about economic, political, cultural and social developments and their implications. Information is accessible to governments and policy makers, NGOs, the private sector, the media and regional and international organizations.

The documentation centre contains more than 9,000 subject files on regional issues, a library of books and periodicals, and computerized databases of selected materials. It also maintains specific bibliographic and contact databases on areas of interest.

Specific subject areas related to risk reduction include the state of the environment in Southern Africa and disaster management information devoted to drought. It also provides information on regional socio-economic and political issues relevant to development and governance that have a bearing on risk awareness and management practices.

SARDC maintains the India Musokotwane Environment Resource Centre for Southern Africa (IMERCSA) which provides users with current information on environment and disaster management in Southern Africa. It is also the leading regional centre for global reporting on the state of the environment, producing fact sheets on environmental issues and a newsletter about the Zambesi River basin. It published the comprehensive book, *State of the Environment in Southern Africa*, with the thematic updates, *Water in Southern Africa* and *Biodiversity of Indigenous Forests and Woodlands.*
<http://www.sadrc.net/Imercsa>

With offices in Dar-es-Salaam, Harare and Maputo, and by working with partner organizations in all Southern Africa Development Community (SADC) countries, SARDC is well placed to facilitate seminars, conduct briefings and undertake consultancies. Additionally, SARDC staff and correspondents produce a variety of articles and reports for the Southern African News Features media service. As part of its commitment to develop professional information and reporting capabilities in the region, SARDC also conducts regional training programmes and exchange assignments involving the Southern African media. <http://www.sardc.net>

Latin America and the Caribbean

As elsewhere, the worldwide revolution in digital communications has swept through Latin America and the Caribbean. In a crucial area for disaster and risk management, by 2000 practically all national health ministries in the region were connected to the Internet. Such networks have become essential for responding to the many emergencies in the region.

In a different context, but in providing the foundation for implementing any disaster risk reduction strategies, the UN Economic Commission for Latin America and the Caribbean (ECLAC) has developed a methodology that allows the systematic comparison of disaster data. This has proven to be crucial for building a regional database of major events that required external assistance.

A specific example is provided by the response and reconstruction activities that followed Hurricane Mitch. They may be considered to be the first in which computer-mediated communications played a major role in decision-making. Risk management institutions and professionals are now routinely accustomed to seeking information from a large number of web sites.

Regional Disaster Information Center

One of the most comprehensive sources of information on disaster and risk management in

Latin America and the Caribbean is the Regional Disaster Information Center (CRID), located in San José, Costa Rica. This centre was established from a pilot scheme originally developed by the Pan American Health Organization (PAHO) in 1990, with a mission to reduce disaster vulnerability by promoting a culture of risk reduction and cooperative efforts in risk management activities.

By 1997, CRID had the support of PAHO, IDNDR, CEPREDENAC, IFRC, Costa Rica National Risk Prevention and Emergency Response Commission (CNE) and Médecins sans Frontières (MSF). It offers information and reference documentation online, and in direct consultation at its offices, on a wide range of subjects, in both Spanish and English.

CRID provides governments, professionals and civil society organizations with abundant and unrestricted disaster information. Its web site provides online access to CRID resources as well as links to other disaster information resources, responding to more than 120,000 information requests annually.

Additional products available from CRID include the Virtual Disaster Library CD-ROM in English and Spanish, and the LILACS bibliographic database, updated periodically. Furthermore, CRID produces specialized bibliographies on specific disaster related issues. So far, 30 issues of this *Bibliodes* series have been published and distributed to several thousand users in both print and electronic versions.

Other information products developed by CRID include a variety of training modules on information management and digitizing documents, provided online and by CD-ROM. Furthermore, CRID produces specialized bibliographies on specific issues such as gender issues in disaster contexts. The centre also provides information management services and provides technical advice to sister organizations on the development of web sites and other information products.

With funding from ISDR, PAHO and the US National Library of Medicine, CRID is implementing a project aimed at creating better information management capacities in El Salvador, Honduras and Nicaragua.
<http://www.crid.or.cr>

Box 4.5
Regional Disaster Information Center, Latin America and the Caribbean (CRID)

The Regional Disaster Information Center (CRID) is a highly-regarded regional institution, which gathers, processes and disseminates high-quality information, and serves as a focal point for training and knowledge engineering related to bibliographic information technologies.

A primary aspect of all its activities is the building of additional institutional capacities for the better management and wider dissemination of disaster information, and the management of national or local disaster information centres. While its efforts contribute to the institutionalization of a regional disaster information system, CRID also promotes the concept of decentralization and disaster information exchange so that institutions and users can access materials more easily. In order to fulfil these functions CRID provides the following information services:

- assists a wide variety of institutional and individual users to search and find disaster and health-related information available through physical or electronic media;
- electronic access to an extensive collection of documents and other source materials;
- publication and distribution of information products such as bulletins, bibliographies and other materials for both public and technical use;
- development and delivery of training for disaster management information centres, in such areas as the use of databases, controlled vocabulary for disaster-related information and use of the Internet;
- design, production and distribution of training materials;
- collaboration with other institutions interested in disaster information management
- management of information projects; and
- organization of information displays and participation in specific events.

The Coordinating Centre for the Prevention of Natural Disasters in Central America

The Coordinating Centre for the Prevention of Natural Disasters in Central America (CEPREDENAC) web site contains continuously updated information on plans, programmes and projects in the region.

The web site contains disaster statistics and analysis for the region, as well as links to the web sites of each of the national disaster organizations in Central America and many other risk and disaster management organizations active in the region.

As the regional coordination centre for disaster prevention, CEPREDENAC has an important responsibility in encouraging economic and social planners working at national, regional and international levels to incorporate all information available in project design.

This includes information about hazards and risks and their cost-benefit analysis for development and infrastructure projects, leading to possible design modifications for more durable investments.

In 1999, CEPREDENAC produced a detailed inventory of available hazard, risk and vulnerability maps and related information available to decision makers regionally and investors worldwide. This inventory of more than 300 different cartographic references is presented in a conventional database format. A simplified version is available on the CEPREDENAC web site, and an interactive format allows users to conduct searches and queries online.

Source categories include:

- type of map support, digital format, original software;
- thematic nature of map (hazard, vulnerability, risks);
- scale on which map is displayed, geographical coverage, year of last update;
- institution in charge of compiling map information; and
- means of accessibility, reciprocity conditions.

The inventory includes institutions located outside the region that have produced additional cartographic materials about Central America. The relational format of the database allows searches by country, institution and type of hazard. <http://www.cepredenac.org>

The Latin American Network for the Social Study of Disaster Prevention

The Latin American Network for the Social Study of Disaster Prevention (LA RED) created the disaster inventory programme called DESINVENTAR. This innovative software permits the storage and recovery of statistical analysis and graphic presentation of information about damaging events at the smallest territorial scale.

Through an agreement with CEPREDENAC, DESINVENTAR has become the software used by all of the national disaster organizations in the region. It will be introduced in the Caribbean under the auspices of the Association of Caribbean States (ACS) and CEPREDENAC.

In addition to the disaster inventory, the LA RED web site contains publications, reports about ongoing projects and additional information about social science initiatives in vulnerability and risk reduction throughout Latin America and the Caribbean. <http://www.desenredando.org>

The Caribbean Disaster Information Network

The Caribbean Disaster Information Network (CARDIN) was established in 1999 at the University of the West Indies in Mona, Jamaica. By drawing on the experience of CEPREDENAC and CRID, CARDIN has pursued similar information objectives.

Box 4.6
Caribbean Disaster Information Network

The Caribbean Disaster Information Network's (CARDIN) focus is to provide wider access and coverage of disaster information in the region and to facilitate the dissemination of disaster-related information to the general Caribbean public. It strives to do this by working through the Internet, by publishing a newsletter and by document delivery services. It also intends to create a database of disaster-related information that is available on the Internet, in CD-ROM and in print format that will provide essential resources for policy makers, practitioners, researchers and the general public. CARDIN offers the following services:

- documentation centre;
- document delivery;
- online search for disaster information;
- reference services;
- electronic journals;
- links to selected full-text databases;
- dissemination of disaster information to the public through a web site and newsletters;
- creation of full documents and scanned images pertaining to disaster-related issues in the Caribbean for wider electronic circulation; and
- expanded working relationships with other agencies for more effective coordination of disaster information activities within the region.

CARDIN serves as a subregional disaster information centre and as the focal point for the exchange of disaster information in the Caribbean. CARDIN provides important information and communication links between the various national disaster management organizations in Caribbean countries. <http://www.cardin.uwimona.edu.jm>

North America

The Natural Hazards Research and Applications Information Center

The Natural Hazards Research and Applications Information Center at the University of Colorado, United States, was founded 30 years ago to "strengthen communication among researchers and the individuals and organizations concerned with mitigating natural disasters".

Its *Natural Hazards Observer* is a free publication published ten times a year to provide current hazards and risk reduction information, resource and institutional contacts. It publishes research initiatives and findings across the entire range of professional disciplines and jurisdictional responsibilities involved with risk issues, predominantly in North America.

Disaster Research, an e-mail newsletter and *Natural Hazards Informer*, a peer-reviewed series that summarizes current trends in natural hazard interests, are available on the centre's web site. The centre also has an extensive specialized library which is catalogued on the web site as well as a wealth of material related to hazards research and the mitigation of natural disasters.

There are many other noteworthy disaster risk management or hazard research centres in the United States, covering different subject areas or specializations. As interest increases, new centres dedicated to various aspects of risk management are being established.

While many exist as part of a university or academic institution, others have been established as charitable institutions, foundations, professional or scientific organizations, NGOs or commercial enterprises. Practically all of them are engaged in the exchange and dissemination of information related to risk reduction and virtually all such centres have web sites and additional information materials.

An extensive list of these sources of hazard and disaster information, institutes for study in related fields and all of their contact information are available on the Natural Hazards Research and Applications Information Center web site. <http://www.colorado.edu/hazards>

Box 4.7
North American Map of Natural Hazards and Disasters

During the later years of the 1990s, Emergency Preparedness Canada and its successor, the Canadian National Office of Critical Infrastructure Protection and Emergency Preparedness (OCIPEP) coordinated research with the Mexican National Centre for Disaster Prevention (CENAPRED) and the US Geological Survey to produce the North American Map of Natural Hazards and Disasters.

This comprehensive and informative series of maps drew on information from a number of existing sources and was published with very wide circulation by the American National Geographic Society (National Geographic, July 1998). The distribution of different natural hazards was combined with population characteristics to provide a simplified picture of risk and vulnerability throughout North America.

Beyond the public education values served by the map, the joint exercise in producing it was instrumental in initiating cross border dialogue and the sharing of knowledge between hazard experts and national, provincial and local organizations with interests in supporting hazard awareness and risk reduction in the three countries. <http://www.nationalgeographic.com>

Asia

In Asia, barely a start has been made to compile the vast range of regional information available on disaster risk reduction. There are important institutional focal points for the subject such as the ones that follow, but there are many more academic and technical facilities that address risk matters in their own areas of professional expertise or within the context of individual country needs.

Asian Disaster Preparedness Center

The Asian Disaster Preparedness Center (ADPC) is a regional resource centre dedicated to disaster reduction for safer communities and sustainable development in Asia and the Pacific. Located in Bangkok, Thailand, ADPC is recognized as an important focal point for promoting disaster awareness and developing capabilities that foster institutionalized disaster management and mitigation policies.

ADPC maintains a specialized library of disaster-related materials. The library database can be accessed online through its web site. It also publishes a quarterly newsletter, *Asian Disaster Management News*, for the disaster management communities in Asia and the Pacific.

It supports regional information exchange, networking and capacity-building by providing a range of information and documentation resources on urban disaster mitigation, climate variability, community-based disaster mitigation and flood preparedness among other subjects.

ADPC distributes CD-ROMs, case studies, newsletters, videos and other public awareness materials under its regional programmes and projects.
<http://www.adpc.net>

Asian Disaster Reduction Center

By collaborating with partners in Asian countries the Asian Disaster Reduction Center (ADRC) in Kobe, Japan accumulates and provides disaster reduction information throughout the region. The body of information available at ADRC provides a basis for conducting research in Asian disaster reduction, particularly as it relates to multidisciplinary and multinational cooperation.

ADRC has developed a unique geographical information system for disaster management called VENTEN with the objective of providing a common structure for referring to disasters and related data.

It has also developed a comprehensive database on disaster and risk management in collaboration with existing institutions including CRED and ReliefWeb. ADRC also draws on the information resources of its members and advisory countries.

A network of Asian NGOs called the Asian Disaster Reduction and Response Network has been formed by ADRC to exchange information and to promote more collaborative relationships. There is also a bi-weekly ADRC newsletter. Also, by including an extensive list of related institutional links in its web site, ADRC seeks to further opportunities of cooperation among existing institutions.
<http://www.adrc.or.jp>

Pacific region

In addition to the programmatic and information services provided by the South Pacific Applied Geoscience Commission (SOPAC) and the South Pacific Regional Environmental Programme (SPREP) the Pacific Disaster Center is also engaged in the applied uses of information and related services for disaster reduction.
<http://www.sopac.org.fj>
<http://www.sprep.org.ws>

Pacific Disaster Center

The mission of the Pacific Disaster Center (PDC) is to provide applied information research and analysis support for the development of more effective policies, institutions, programmes, and information products for the disaster risk management and humanitarian assistance communities in the Asia and Pacific regions and beyond.

These activities are crucial as more than 80 per cent of lives lost to disasters in the past decade have occurred in the Asia and Pacific regions. As disaster losses are often due to interactions between changing natural environments and rapidly growing societies, by using state of the art technologies PDC joins data and produces information products that relate hazard information with human conditions and needs.

Recognizing that natural and human-induced disasters are predominantly local issues with regional, national or global impacts, PDC works in conjunction with its managing partner, the East-West Center in Honolulu, to create an extensive network linking US research and

technology organizations with specialists in the Asia and Pacific regions. This cooperation fosters the establishment of viable personal and institutional relationships among regional decision makers who then work together on real-life issues.

PDC's strategic programme focuses on four areas: decision and policy support, risk and vulnerability, institutional capacity development, and humanitarian assistance support. Through these programmes the Pacific Disaster Center promotes the partnerships and technology required to create disaster information networks and disaster resistant communities in its areas of activity.

The innovative use of information, technology and applied research in support of comprehensive disaster risk management is central to these strategic areas. PDC applies advanced digital technologies, including remote sensing, GIS technology, disaster modelling, and Internet-based information distribution. These activities have several purposes:

- Promote proactive planning that includes hazard mitigation as a key element of sustainable development.
- Foster partnerships to raise awareness among the many segments of the disaster management community.
- Increase the operational efficiency of organizations by introducing innovative and appropriately scaled information resources, tools, and analyses.

PDC's highly skilled professional team is strategically located on the islands of Maui and Oahu, Hawaii. <http://www.pdc.org>

Europe

There are many European institutions involved with risk reduction information management and dissemination. However, as there are many overlaps in organizational relationships and subject matter, they compose a mosaic of sources with many different audiences. Following is a selection of some of the information centres and initiatives. Additional European institutions and projects which deal with information management in particular fields are reviewed in discussions about regional cooperation and research (see chapters 3.3 and 4.4).

Council of Europe

There are many information sources affiliated with the Council of Europe and with the EUR-OPA Major Hazards Agreement:

- European Natural Disasters Training Centre (AFEM) is located in Ankara, Turkey. Its main goal is to reduce the destructive effects of hazards through research, training and education at all levels, from policy makers and operational managers to field workers associated with disaster preparedness and response. It gives particular emphasis to the dissemination of information on earthquakes, floods and technological disasters to political leaders, practitioners and the public. It organizes seminars on disaster prevention and management, television broadcasts and other awareness activities, in collaboration with the Oxford Centre for Disaster Studies. <http://www.europarisks.coe.int/afem50.htm>
- European Centre for Geodynamics and Seismology (ECGS) is in Walferdange, Luxembourg. It acts as a link between scientific research and its application to the prevention and interpretation of hazards. <http://www.ecgs.lu>
- Euro-Mediterranean Centre on Insular Coastal Dynamics (ICoD) is in Valletta, Malta. It concentrates on education, research and information-related activities. <http://www.icod.org.mt/>
- European Centre for Research into Techniques for Informing the Population in Emergency Situations (CEISE) is located in Madrid, Spain. Its main area of work is to inform the public in emergency situations. <http://www.protecccioncivil.org>
- European Centre of new Technologies for the Management of Natural and Technological Major Hazards (ECNTRM) is located in Moscow, the Russian Federation. One of its objectives is the use of space technologies for forecast, prevention and relief in major natural and technological disasters. <http://www.europarisks.coe.int/ecntrm50.htm>

- European Centre on Training and Information of Local and Regional Authorities and Population on the Field of Natural and Technological Disasters (ECMHT) is in Baku, Azerbaijan. It provides training and information to local and regional authorities in the field of major hazards. <http://www.europarisks.coe.int/ecmht50.htm>

European Space Agency

Space-based and related remotely sensed information pertinent to disaster risk reduction is managed and disseminated by several information centres in Europe. One of these, the European Space Agency (ESA), has undertaken several initiatives to support disaster and risk management. ESA surveyed existing disaster management activities and established the Disaster Management Database (DISMAN) to provide information about the primary natural disasters in the 18 countries which belong to ESA.

DISMAN synthesizes information about each country and issues country reports and risk monographs. Summaries are prepared by type of disaster and survey the most significant disasters in each country. The database has also identified organizations and companies in the countries with key roles in different phases of disaster management, as in forecasting and planning, crisis management or rescue activities, and in the conduct of damage assessment.

To provide current information from its satellites, ESA routinely monitors reports of natural disasters and special events, updating satellite orbital plans to obtain the best imagery for specific needs. <http://www.esa.int>

ESA also has established MEDNET, a network of high resolution seismographic stations primarily installed in Mediterranean countries. It is coordinated by the Istituto Nazionale di Geofisica in Rome, Italy. <http://mednet.ingv.it>

After the UNISPACE III conference in Vienna, in July 1999, ESA and the French space agency CNES initiated the International Space Charter on Major Disasters. Each agency has committed resources to support this collaborative effort in information access, which became operational in November 2000.

The agreement provides the basis for a unified system of acquiring space data and delivering it to those areas affected by natural or human-induced hazards through authorised users. An authorized user can contact a single source to request the mobilization of the agencies' various space and associated ground resources to obtain data and information on an actual or threatening disaster situation.

European Commission

Launched by the European Commission and European space agencies, (including ESA) for an initial period of 2001-2003, the Global Monitoring for the Environment and Security initiative seeks to bring together the needs of society related to the issue of environment and security with the advanced technical and operational capability offered by terrestrial and space-borne observation systems. In compliance with the goals of the European Research Area, the aim is to deliver to users high-level and technical information about the environment and to develop security policies.

Related information capabilities provide such products as guidelines for entire risk management operational systems that relate to sustainable development policies, protection from environmental threats and natural disasters, and their respective concerns to security in Europe. GMES information also contributes to raising the awareness of hazards and related risks. The continuous monitoring of resources and environmental conditions, detection and assessment of changes or threatening events, and means for verifying the impact of policies and practices are the three primary areas of attention. By bringing these various parameters together, the programme seeks to become the focal point of attention of a range of stakeholders in various fields related to environment monitoring. <http://gmes.jrc.it>

The European Commission also is part of the Global Disaster Information Network (GDIN) and its Mediterranean working group, EU-MEDIN. These collaborations bring together organizations and specialists from many fields, including scientists, government ministers, disaster management authorities, local

community leaders, researchers, members of the press, as well as representatives from the international banking community, the UN system, and others. EU-MEDIN develops regional disaster information networks and databases for the Mediterranean to facilitate timely, easy and reliable contacts with disaster managers in the region. <http://www.eu-medin.org>

In the framework of the Euro-Mediterranean Partnership, Italy has launched an initiative for closer cooperation to mitigate the impacts of natural disasters. In GDIN's sixth annual conference held in Washington in March 2004, sessions were held with relevance for continental information applications in disaster risk management in such areas as GIS and remote sensing, NGO and community needs and early warning.

National information programmes

Individual countries have established their own distinctive approaches to institutionalizing information functions for disaster reduction. Information needs of countries vary and there are reasons for different emphases.

The examples that follow demonstrate some of the challenges that countries have faced. In all of the cases cited, improved hazard and disaster risk information was an essential precursor to the development of strategic national disaster risk management programmes.

Case: South Africa

In South Africa, the University of Cape Town's Disaster Mitigation for Sustainable Livelihoods Programme (DiMP) has developed a disaster information management system for the Monitoring, Mapping and Analysis of Disaster Incidents in South Africa (MANDISA).

The project is co-financed by OFDA/USAID and DFID. Its objective is to create a system that can document hazards, vulnerabilities and trends related to small to medium-scale disasters and to organize that information for better decision-making.

Previously, information about small disasters was fragmented or non-existent, with the result that it was frequently overlooked. Moreover, as information about these smaller disaster events is stored in different government services, it has proven difficult to create a consolidated profile on municipal disaster occurrences and losses either by type, location or consequences.

Smaller events are now considered to have disproportionate impacts on already marginalized communities, so consolidated information on such events is very important.

In 1999-2000 a team of researchers identified more than a dozen sources concerning disaster losses in Cape Town alone, containing more than 10,000 records of disasters. This was in glaring contrast to only 20-30 disasters that had been officially declared during the same period.

One of the telling observations of the research was that, with the exception of two electronic sources, all other information was on paper. Such incompatible sources of information highlight the challenges of creating effective, synthesized disaster information systems. This has made integrated disaster reduction planning virtually impossible. The information collected is now maintained in a database and linked to GIS technology on a publicly accessible web site.

Since 2001, MANDISA has been consolidating data on disaster events that occurred in Cape

Box 4.8
MANDISA database, South Africa

The Monitoring, Mapping and Analysis of Disaster Incidents in South Africa (MANDISA) database was conceived with the following considerations in mind:

- Public access to information about local patterns of disaster risk is empowering and facilitates community participation in decision-making.
- Disaster incidents can occur at different scales, ranging from household to provincial and national levels.
- Disaster risk is driven by the interaction between triggering hazard factors and underlying conditions of social, economic and environmental vulnerability.
- Disaster impacts can occur in different socio-economic sectors and therefore may be recorded in a wide range of formats or institutional locations.
- Disaster risk can be reduced by minimizing vulnerability through ongoing initiatives that achieve multiple development objectives.

Town from 1990-1999 and has been displaying them with related information in tables, maps, graphs and photos. Users can query the database online and generate additional information about trends, locations and patterns of disaster risk.

It is anticipated that this will enable municipal planners and residents to consider disaster risks more strategically, just as crime, public health, traffic accidents and other forms of risk are considered to be important developmental priorities underlying broader aspects of basic human security. Improved access to information has created a more readily understood concept of hazards. <http://www.mandisa.org.za>

Case: China

China's National Disaster Reduction Plan (NDRP) aims to establish a comprehensive information system for the entire country. It seeks to strengthen the institutional abilities of sharing information, communication technology and operational experience among the many government departments and agencies.

In 1997, the central government authorities approved a project to create the China National Center for Natural Disaster Reduction (CNCNDR). It acts as the comprehensive national disaster information system serving the state council, all ministries and government commissions, and it links central government authorities with provinces and municipalities. A purpose designed facility was officially opened in 2002.

The system incorporates data from satellite remote sensing systems and provides comprehensive management system displays of disaster information. It forms the basis of assessment and decision-support systems by drawing on the widest possible range of professional and technical expertise throughout the country.

This wealth of material is analysed by the technical specialists across the many professional disciplines involved at the National Academy of Sciences. Through this process, CNCNDR makes full use of the disaster reduction information and operational experience of all the relevant ministries, commissions, research institutions and social groups.

It provides senior officials with comprehensive information, professional services and technical guidance for more effective decision-making in matters of disaster risk management. Moreover, CNCNDR is also expected to play an important role in professional training and public education in fields concerned with national risk reduction.

Case: India

India has embarked on a strategic plan to improve the extent and availability of information for risk management activities. The government of India's High Powered Committee on Disaster Management plans to develop a national natural disaster knowledge network.

The details of an India Disaster Resource Network (IDRN) are being developed as a precursor to a fully established network of networks, able to store, manage and disseminate information. It is envisaged to connect and facilitate an interactive, simultaneous dialogue among government departments, research institutions, universities, community-based organizations and individuals throughout the country working with hazards in all aspects of disaster management.

The system is intended to serve as a common repository for accumulated experience, with the advantage that the network may then also be used for distance learning. By including access to libraries and other resource institutions, these digital services will be able to provide much wider access to global databases, training materials and early warning systems.

Current preliminary efforts are concentrated on improving information flows related to immediate response requirements in the event of a "L-3 level" disaster, an event in which a state government becomes overwhelmed and the national government would be required to supplement the state's own efforts.

As the programme is developed further, it is also anticipated that more technical, academic and professional institutions will become motivated to link into an integrated professional network that spans multiple professional sectors of interest.

Case: Australia

The Australian Geological Survey Organization (AGSO) has been working with Emergency Management Australia (EMA) to establish the Australian Disaster Information Network (AusDIN). AusDIN is a consortium of national agencies, state emergency authorities, universities and private enterprise representatives.

AusDIN is working to develop a network that provides information for crisis management including risk assessment, mitigation, planning, response and recovery. This Internet-based service is being developed to provide information easily and widely. In the international arena, the framework will be linked with GDIN information systems around the world.

AusDIN is just one part of a more comprehensive Australian undertaking to improve the management of information for disaster and risk management purposes. Additional non-technical approaches are being developed to foster networks and forums for people involved in the provision of disaster information.

One such related initiative has been undertaken by the Urban Geoscience Division of Geoscience Australia, the national agency for geoscience research and information. The Australian Disaster Management Information Network (ADMIN) undertakes comprehensive assessments and numerical modelling of hazards in urban areas and addresses issues of concern to urban communities that require geoscientific information.

The geophysical network carries out synoptic observations of earthquakes, tsunamis, geomagnetic fields as well as nuclear explosions. It seeks to increase national capacities for the distribution of comprehensive technical data and information for better disaster risk reduction and response.

The *Australian Emergency Management Manual* series, developed by Emergency Management Australia over recent years, has proven to be a highly regarded means to assist in the management and delivery of support services in disaster contexts. Built around individual subject areas, each of 38 manuals present principles, strategies and actions informed by practical experience, and relate to a variety of hazards.

Volumes recently added to the series reflect an increasing attention given to the social and economic dimensions of risk management practices. *Economic and Financial Aspects of Disaster Recovery* presents national best practice guidelines. *Planning Safer Communities – Land Use Planning for Natural Hazards* relates integrated land-use ideas for practical application at local levels of activity. *Disaster Loss Assessment Guidelines*, developed jointly by EMA and the Queensland Department of Emergency Services, provides practitioners with a comprehensive approach to assess the economic impacts of disasters in a broader regional context. Additional information about the manuals can be obtained from EMA. <http://www.ema.gov.au>

Another useful information portal in Australia is an Internet gateway to resources and links from the University of New England, in New South Wales. Information related to on-line study and discussions is available on a web log. <http://radio.weblogs.com/0111775/>

Related information packaged as a Risk Management Approach to Emergency Management, includes resources including summaries, readings, links and assignment questions. <http://users.senet.com.au/~jsalter/a_risk_management_approach_to_emergency_management.htm>

Case: Russian Federation

The Russian System of Disaster Mitigation (RSDM) information programme is establishing a comprehensive national information network on emergencies throughout the country. This system is being developed by EMERCOM, working through networks of various government bodies responsible for providing data about natural hazards. It aims to establish the basis for integrated data exchange and the systematic storage of operational and statistical data. Analytical as well as operational information about natural hazards and the management of emergency events is expected to be shared between central and regional authorities, providing cumulative data for decision makers.

An electronic information network was established connecting the emergency operational centres with

other government departments, the EMERCOM Emergencies Management Centre, and regional emergency management centres. This network will be extended to additional administrative authorities in the Russian Federation, to individual municipalities, regional executives, with eventual linkages made to early warning and disaster mitigation centres throughout the Commonwealth of Independent States (CIS).

In 2001, an automated system of consulting services was initiated to provide information services about safety and disaster risk reduction to the public as well as decision-making bodies responsible for emergency management and various organizations. One of its features incorporates data on legislation pertinent to disaster risk reduction measures.

In the Russian Federation, EMERCOM maintains an Internet portal to provide public information about the history, goals, structure and activities of EMERCOM, as well as statistics on natural and technological disasters in Russia. It elaborates on existing legislation and contains basic information about safety issues. A hotline releases daily information updates on specific emergencies that occur anywhere in the country.

One of the engaging initiatives is the Young Rescuer. The page on the Internet presents games which provide children with a basic knowledge about hazards and emergencies, and encourages communication among them. It also invites members of the public to ask specialists questions about possible risks or to seek additional information about hazards. EMERCOM also publishes a journal, *Public Defence*, as another means of disseminating information. <http://www.emercom.gov.ru>

Case: France

PRIM.NET is a French educational multidisciplinary Internet portal from the ministry of land-use planning and environment. It promotes natural and technological disaster prevention. It underlines the close relationship between humans and the natural environment in the framework of sustainable development. It is a forum for teachers, students and citizens where they can find useful information. <http://www.prim.net>

Technical information and hazards

Aside from the specific requirements of early warning, there are other examples of information centres devoted to specific hazards. Typically they convey frequently updated technical data as well as more general information about the changing events and circumstances pertaining to their individual hazard interests.

They all fulfil a public information function and many are engaged in providing specialist reference material or advice to policy makers. A selection of these hazard information centres is provided.

While most of them focus on a single type of hazard, the range of professional sectors and considerations they cover is typically quite extensive and often includes scientific and environmental disciplines as well as social and economic dimensions of local communities.

Integrated hazard information

In the United States, the NASA Earth Observatory is a particularly useful and award-winning source of information related to natural hazards, climate, water resources, the environment and natural resources, human habitats and land use. Its mission statement explains that the purpose of the Earth Observatory is "to provide a freely-accessible publication on the Internet where the public can obtain new satellite imagery and scientific information about our home planet. The focus is on Earth's climate and environmental change." The web site is designed for particular use by public media and educators, and in that respect any materials published on the Earth Observatory are freely available for re-publication or re-use, except where copyright is otherwise indicated.

The Earth Observatory contains data and images, feature articles, news, reference materials, and details about specific missions and experiments. Within the specific area of natural hazards, the Earth Observatory notes that scientists around the world use NASA satellite imagery to understand the causes and effects of natural hazards better. The goal in sharing such images is to help people visualize where and when natural hazards occur, and to help mitigate or reduce their effects.

One feature of the site provides a map every week that displays current locations of natural hazards observed by NASA satellites, with icons linked to both the latest images and additional information about any of the extreme events noted. People can also subscribe to a free daily or weekly service that advises about the latest events and images on the Earth Observatory web site.

The range of these interests, their combined relevance to disaster risk reduction, and an expressed commitment to provide reference material freely for public information and educational purposes underline the excellent value of the web site. <http://earthobservatory.nasa.gov/>

NASA's web site on space weather is another interesting resource. As electronic mechanisms and processes increasingly control and manage much of the physical infrastructure of the world, geomagnetic storms, solar flares, and other elements that compose space weather are increasingly understood to represent legitimate risks to planet earth. <http://helias.gsfe.nasa.gov/weather.html>

The US Geological Survey (USGS) Center for Integration of Natural Disaster Information (CINDI) is another facility which collects and integrates hazard information and disseminates it to the public. Its web site provides information about drought, earthquakes, floods, hurricanes, landslides, volcanoes, wildfire and geomagnetism.

With outreach, research and response dimensions, CINDI is able to provide near real time monitoring of hazards. It integrates a variety of technical information drawn from many sources and then communicates with technical teams and decision makers.

Following a disaster, the centre can combine remotely sensed data with archived information to assess the nature and extent of impact from a particular event. The compiled information is also available internationally for interdisciplinary research that contributes to the improved use of data for hazard and risk assessment. It can also be used to develop risk management strategies by local or national officials.
<http://www.cindi.usgs.gov>

Back on earth but still in a global context, the UN Environment Programme (UNEP) Global Resources Information Database (GRID) initiated a Project for Risk Evaluation, Vulnerability, Information and Early Warning (PREVIEW) in 1998. The project aim was to collect and disseminate data, information and methods that could be used through public access to identify risk and vulnerabilities related to natural and complex hazards. The project has since developed three components:

- PREVIEW-IMS is an application for visualizing spatial information about the global occurrence of tsunami, wildfires, volcanoes, floods, cyclones and earthquakes in relation to other socio-economic parameters. This tool is intended to visualize the distribution of multiple hazards and related issues as well as to provide the opportunity for accessing and downloading all supporting data.

Box 4.9
NASA Earth Observatory website

Examples of the comprehensive data, images and information services and weblinks provided by the Natural Hazards information listserve of the NASA Earth Observation website are listed below. The website reflects past and present natural hazards occurring worldwide.

- In the News: <http://earthobservatory.nasa.gov/Newsroom/>
- Latest Images: <http://earthobservatory.nasa.gov/Newsroom/NewImages/>
- NASA News: <http://earthobservatory.nasa.gov/Newsroom/NasaNews/>
- Media Alerts: <http://earthobservatory.nasa.gov/Newsroom/MediaAlerts/>
- Headlines from the press, radio, television: <http://earthobservatory.nasa.gov/Newsroom/Headlines/>
- New Research Highlights: <http://earthobservatory.nasa.gov/Newsroom/Research/>
- New Data: <http://earthobservatory.nasa.gov/Observatory/>
- Updated Data: <http://earthobservatory.nasa.gov/Observatory/Datasets/>

Source: <http://earthobservatory.nasa.gov/>.

- PREVIEW-Net is a gateway providing links to more than 250 organizations with reliable data and relevant information or reports that can be accessed through 16 types of hazard classifications.
- A general information component provides public access to a variety of articles, maps and other information products related to risk and vulnerability issues.

Additional activities include research analysing trends in disaster occurrence in relation to elements of global change, vulnerability assessment for tropical cyclones and landslides. More information products will become available relating to the frequency of hazards, prevalence of vulnerability and various risk factors, and the evaluation of a specific population's risk exposures.

All of these activities are undertaken in collaboration with other technical institutions and international organizations, including the Norwegian Geotechnical Institute, Columbia University, the European Union Joint Research Centre, WHO, WMO, and UNDP's Bureau for Crisis Prevention and Recovery. <http://www.grid.unep.ch/preview>

Innovative commercial groups are developing information products using advanced monitoring techniques, electronic technology and visual materials to assist the media, government agencies and emergency managers to understand environmental issues better. One such company, StormCenter Communications, aims to enable the media and educators to expand public awareness about the environment and issues related to it, including natural and environmental risk factors.

This commercial endeavour provides a unique approach of using media, environmental science and meteorological expertise packaged specifically to meet the expanding role of public weather reporting and emergency management communications. It seeks to utilize the latest capabilities in remote-sensing and scientific data from government and commercial sources. Expert science writers and graphics designers translate and package this information ranging from international to local scales in formats, images and explanations that can be used easily and understood by a wide variety of users.

StormCenter produces both weather and environmentally related information products for the media, educators or other interested user groups involved with public outreach activities. They include innovative satellite imagery, interviews, centralized weathercasts, purpose-designed graphics, animations, and video packages built around environmental awareness issues.

The concept relates to a television station's weather report, a newspaper's news section, or a teacher in a classroom providing their audiences accessible and engaging science overviews about issues that affect them directly. These include such hazard concerns as flood potential, wildfire locations, tornado paths, or likely strike zones of approaching storms. Broader environmental topics are a crucial element of the strategy, like the changing conditions of watersheds, altered land use, the agricultural impacts of variable climate conditions or changes in the coastal environment that can threaten the well-being and livelihood of local communities.

Envirocast is a suite of products and services developed specifically for broadcasting use, providing environmental and remote-sensing imagery, graphics and information for the television industry. The focus of this suite of products is Envirocast TV which delivers broadcast-ready earth observation satellite imagery for use on air through its media partners and by decision makers. Imagery is chosen that addresses important environmental and earth science situations that are critical to communicating accurate information. In addition to the media's use, decision makers can focus on local implications related to major natural and technological disasters and hazards.

Studio Earth productions deliver live updates on breaking environmental news developments around the world via the Internet by utilizing advanced streaming video technology to target decision makers in industry and government, including agricultural interests and emergency managers.

Some of StormCenter's other approaches and registered products display the innovative possibilities that commercial commitments can bring to enhancing public access and knowledge about environmental conditions and related risk

reduction issues. Earth Update is a set of materials including television news content on earth and environmental topics, associated web-based content, an interactive CD-ROM and other educational materials aimed at improving public understanding of environmental issues that affect peoples' lives. <http://www.stormcenter.com>

Climate change

Climate information, including probabilistic and deterministic forecasts, as well as long-range climate change projections have traditionally been produced by meteorology departments and then communicated in various forms to disaster managers and sectoral agencies.

Seasonal forecasts can play an important role in reducing vulnerability as the longer lead time affords decision makers time to plan appropriate interventions to prepare for and mitigate the impacts of extreme climate events. Nevertheless, the potential application of this information for decision-making has yet to be fully realized.

This is especially true in the case of probabilistic seasonal forecasts for which the systematic use of information coordinated across disciplines is essential. In recent years, however, institutional capabilities have been developing rapidly as the connections between the El Niño events and local weather conditions are modelled with greater skill.

In part, continuing challenges remain to integrate end-users into the information system. While user groups and related stakeholders are commonly involved in design phases, resulting management information systems could be expanded to create more opportunity for both the users and producers of climate information to maintain a dialogue about their respective information needs and decision-support tools.

If the production and application of climate information are viewed as a joint problem-solving exercise, then interpersonal communication between potential partners also becomes a critical component of information management. The value of bringing the users and producers of climate information together in an end to end system lies in building a shared understanding of the role of climate information in disaster management and vulnerability reduction initiatives.

With a greater appreciation of the types and timing of disaster management decisions, producers of climate information are better positioned to prepare more tailored information. Likewise, through discussions with the technical staff responsible for generating forecasts and other climate information, user groups have the opportunity to understand the processes better, as well as the associated assumptions and limitations of climate information. Only then can the improved technical interpretation of climate information lead to making more effective policy decisions.

This is the aim of the Extreme Climate Events (ECE) programme undertaken by ADPC, and funded by OFDA/USAID and the US National Oceanic and Atmospheric Administration (NOAA). The programme aims to demonstrate the applicability of seasonal forecasts in Indonesia, Viet Nam and the Philippines through building capacity of the national meteorological agencies and climate-sensitive sectoral agencies.

Building on training modules developed by the East-West Center in Honolulu and working closely with the International Research Institute for Climate Prediction (IRI) and partners in national governments throughout South-East Asia, the ECE programme brings the users and producers of climate information together to learn from each other. Jointly they develop valued decision-support tools based on climate information.

Moreover, its effort to reduce vulnerability to extreme climate events, the ECE programme works to promote the institutional mechanisms needed to sustain such dialogue. As an initial step, the significance of two-way communication should be recognized and reflected in the design of information management systems.
<http://www.adpc.net/ece/>

Another important initiative with global implications has been pursued by the WMO's Inter-Commission Task Team, its technical commissions and member states. In 2001, they began work to create a group of associated Regional Climate Centers (RCC). Once established, RCC will increase collaboration

among climate, meteorological and hydrological research communities. They will facilitate the widespread availability of climate information pertaining to long-term forecasting.

Work is continuing to define the organizational and functional responsibilities of RCC. This endeavour will draw on established national meteorological and hydrological services of individual countries, as well as the WMO Regional Specialized Meteorological Centers (RSMC). The initiative is an indication of institutional moves to address emerging global needs for both technical and public information about changing perceptions of risk.

In recent years, the Regional Climate Outlook Forums have played a key role in defining the requirements of RCC. The distinctive requirements of different geographical regions around the world are a crucial consideration in defining the objectives of RCC.

As a conceptual framework for RCC emerges, specific regional requirements will be considered, as well as assessments being made of the operational and technical abilities available to meet them.

A specific institutional development that reflects such a regional interest is the International Research Center on El Niño Phenomenon (CIIFEN), established in Guayaquil, Ecuador in January 2003. Its creation resulted from a resolution of the UN General Assembly and has been realized with the support of the government of Ecuador, WMO and ISDR.

CIIFEN brings together information on El Niño and its impacts in order to provide to regional and national partners with climate data processing, probable scenarios and information for the application of scientific knowledge applicable for national and sectoral disaster risk management plans and activities. It strives to reduce losses in agriculture, fisheries, health, economy, trade, tourism, infrastructure and environment. Initially, the primary focus will be given to the needs and interests throughout the eastern equatorial Pacific Ocean and among the countries in the western areas of South America.

In addition to becoming the operational centre in Ecuador, CIIFEN includes a scientific committee and an international board to facilitate the implementation of its activities. As such, the centre expects to serve as a coordination mechanism, involving the participation of global climate prediction centres, UN agencies, regional and national institutions and individual specialists. These various institutions will contribute to the structure of CIIFEN and work to secure the necessary financial support.

Hydrometeorological hazards

Information about hydrometeorological hazards is widely available through institutional sources around the world. Current information as well as archived data related to individual countries is accessible through every national meteorological and hydrological service.

A wide variety of products, including 10-30 day forecasts, are available from the three World Meteorological Centres located in Melbourne, Moscow and Washington, DC.
<http://www.bom.gov.au>
<http://www.mecom.ru/roshydro>
<http://www.nws.noaa.gov>

Specialized geographical products and information related to specific hazards are compiled and widely disseminated by RSMCs.

There are 24 RSMC located in Algiers, Beijing, Bracknell, Brasilia, Buenos Aires, Cairo, Dakar, Darwin, Jeddah, Khabarovsk, Melbourne, Miami, Montreal, Moscow, Nairobi, New Delhi, Novosibirsk, Offenbach, Pretoria, Rome, Tashkent, Tokyo, Tunis/Casablanca and Wellington.

There are also eight designated RSMC for the provision of computer-generated models for analysing environmental crises and for providing hydrological or meteorological guidance in emergency situations. These centres provide specialized transport, dispersion and deposition models with respect to various geographical regions in accordance with internationally recognized standards. They are located in Bracknell, Toulouse, Montreal, Washington DC, Beijing, Obninsk, Tokyo and Melbourne.
<http://www.wmo.ch>

UNEP/GRID in Geneva has developed a global database specifically for tropical cyclones called the PreView Global Cyclones Asymmetric Wind Speed Profile. This dataset provides users with comprehensive related information about the technical parameters of wind speed, central pressure and other variables obtained from six different reporting centres. A model for wind speed profiles was developed from data over 20 years from 1980-2000 in order to provide a consistent measure for wind speed categories, following the Saffir-Simpson scale. With this development, each individual cyclone can be identified and mapped. This geographical information can be downloaded freely.<http://www.grid.unep.ch/data/grid/gnv200.php>

Hydrological information is also available from many regional centres as hydrology and water-related issues are the focus of many international agencies. One such centre with a global focus is the Centre for Ecology and Hydrology (CEH) in the United Kingdom. <http://www.nerc-wallingford.ac.uk>

Extensive information and widespread institutional links related to drought and associated environmental conditions can be found through the International Drought Information Center affiliated to the National Drought Mitigation Center at the University of Nebraska, in the United States. The linkages provided inform about a wide variety of educational, research, policy and documentation opportunities engaging scientists and policy makers around the world involved with drought management and related preparedness issues. <http://www.drought.unl.edu>

Wildfire and related hazards

Fire research, fire ecology and the results of bio-geo-chemical and atmospheric research of the last decade provide sufficient knowledge to support decision-making in fire policy at most levels of management responsibility.

However, in many countries, knowledge and expertise are not readily accessible for developing adequate fire policies and related measures of operational management.

The prolonged and severe fire and smoke episode that occurred in South-East Asia in 1997-1998 demonstrated that the available knowledge about fire and the related management expertise was utilized only to a limited extent.

These circumstances led to confusion and uncertainty at national, regional and international levels of responsibility. In turn, this resulted in delayed decisions and the late application of appropriately targeted response to the emergency. This can be explained by the lack of an adequate fire information system for South-East Asia.

The international community first proposed the establishment of a global fire management facility in 1996. On the basis of these recommendations, in 1998, the German Office for the Coordination of Humanitarian Assistance of the ministry of foreign affairs established the Global Fire Monitoring Centre (GFMC) at the Max Planck Institute for Chemistry in Freiburg, Germany.

The GFMC collects information and monitors activities of the fire science and management community, the engineering and technical professions, policy makers, and others interested in developing related technologies.

It provides timely information in long-term strategic planning for the prevention of potentially disastrous wildland fires as well as enabling preparedness measures and appropriate responses for fire emergencies. A worldwide network of institutions and individuals generates GFMC products at both national and global scales. All information is collected, interpreted and posted on the GFMC web site. The information is updated frequently and archived for future reference and research purposes.

Primary GFMC products and services include early warning of fire danger; near real time monitoring of fire events; synthesis of fire information; archive of global fire information; facilitation of links between institutions involved in fire research and policy development; and an emergency hotline for providing assistance in rapid assessment for responding to wildland fire emergencies. <http://www.fire.uni-freiburg.de>

UNEP/GRID also developed a methodology to produce weekly reports on fire status during the

latter years of the 1990s based on existing sources of public information from web sites of agencies including NOAA, NASA, ESA and national meteorological agencies. While this practice ceased in April 2002, UNEP/GRID in Geneva currently produces an electronic web page portal through which users can access the latest information on early warning and current status of individual wildfires in different regions of the world. This page is linked to other related or specialized wildfire web sites including GFMC, the MODIS Land Rapid Response System and 20 other selected web sites that provide data, information or reports about wildfire activities. http://www.grid.unep.ch/fires/>

A related information tool, the Global Burned Area Interactive Mapping Application (GBA 2000) enables users to visualize and download data of global burnt areas. This project is associated with the Global Vegetation Monitoring Unit of the European Union's Joint Research Centre and is conducted in partnership with seven other organizations including UNEP/GRID. Users can integrate maps of burnt areas with other information such as country or locality boundaries as well as land cover and land-use data. The web site provides free access and the possibility to download GBA 2000 data. <http://www.grid.unep.ch/activities/earlywarning/preview/ims/gba/index.htm>

Seismic hazards

There are many seismological and seismic engineering institutes around the world, widely known among practitioners involved in technical and information services. Two examples that are particularly engaged in the dissemination of information about seismic hazards are cited here.

The Earthquake Hazards Program of the US Geological Survey (EHP/USGS) is part of the National Earthquake Hazards Reduction Program led by the Federal Emergency Management Agency (FEMA).

The objective of the programme is to provide relevant earthquake science information that will help reduce deaths, injuries, and property damage from earthquakes. Particular emphasis is given to understanding the characteristics of the hazard and by providing knowledge that can help to mitigate losses. <http://www.earthquake.usgs.gov>

The US Earthquake Engineering Research Institute (EERI) is a national non-profit, technical society of engineers, geo-scientists, architects, planners, public officials and social scientists. Its objective is to reduce earthquake risk by advancing the practice of earthquake engineering.

EERI seeks to accomplish its objective by improving the understanding of the impact of earthquakes on the physical, social, economic, political and cultural environments. It advocates comprehensive and realistic measures for reducing the harmful effects of earthquakes.

EERI is recognized as the authoritative source for earthquake risk reduction information in the United States. By working through partner organizations it is involved in contributing to earthquake risk reduction information worldwide.

The institute is best known for its field investigations and reconnaissance reports detailing the effects of destructive earthquakes. Often, EERI serves as the coordinator for investigations undertaken jointly by several organizations. Leading earthquake investigators from many countries belong to EERI.

For many years, EERI has been engaged in a project supported by the US National Science Foundation to maximize the learning process from destructive earthquakes. Preliminary information on the effects of destructive events is published in their monthly newsletter. Detailed reports on major earthquakes are published as supplements to *Earthquake Spectra*, EERI's quarterly journal. EERI also sponsors post-earthquake technical briefings in an effort to reach professional communities throughout the United States.

In addition to its publications, EERI has produced more than 50 slide sets covering specific earthquakes and their impacts, earthquake-resistant design, loss reduction measures and mitigation of earthquake hazards. Videotapes produced by EERI include technical briefings on the Armenia, Loma Prieta and Kobe earthquakes, and additional comprehensive reports on later major earthquakes such as those in Turkey, India and Iran are available on CD-ROM. <http://www.eeri.org>

Volcanic hazards

The World Organization of Volcano Observatories (WOVO), a commission of the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI), is building a volcano database.

WOVO is providing information to researchers and the public on volcanic activity that scientists are currently monitoring. This will help people to understand that monitoring a volcano is not simply a matter of deciding if an eruption is imminent, as the information will clarify what can and cannot be forecast.

Initially, the WOVOdat database will provide an historical record so that observatories can conduct their own research for two years before providing data to WOVOdat. Eventually, it is anticipated that observatories will realize the benefits of sharing data in real time.
<http://www.volcano.undp.nodak.edu/vwdocs/wovo>

In a separate initiative, efforts are underway to update a global compendium on current information about the effects of volcanic eruptions and mitigation activities. This global compendium will be available on the Internet. Pictures will illustrate the problems, while text will provide details and suggest possible mitigation measures.

Other outlets with useful global volcanic hazard information are the Volcanism Programme <http://www.volcano.si.edu/gvp/reports/notices/index.htm> and the Volcanic Ash Global Advisory Centre<http://www.cmc.ec.gc.ca/cmc/CMOE/ vaac/A-vaac.html>.

Future challenges and priorities

Information management and communication of experience

The information services and programmes described in this section provide a basis to identify areas for improvements in information management and the communication of experience in disaster risk management. Future challenges in this field concern the following:

- availability of information;
- necessary capacities to use data;
- improvements in data quality;
- clearing house responsibilities;
- expanded access to information; and
- future technology.

Availability of information

There is currently abundant information available globally on disaster risk reduction. But that does not necessarily translate into its widespread availability or utility. Nor is it particularly well targeted for all users.

In many places and cultures there is little relevant information conveyed in local languages or suited to the actual living conditions of people exposed to natural hazards. Language barriers must also be overcome for existing information to be accessible.

Among other specific subject areas, a case in point is the growing field of gender and disasters to which writers from every region have contributed. Much of this dialogue remains internal, however, due to limited funds for translation.

Documents and dialogue at international conferences on many web sites are often only in the dominant language of the region concerned, and frequently in English only. This is a common limitation of risk reduction programmes and dialogue which greatly constrains opportunities for communication across regions.

The abundance of information also creates a problem for non-specialized users to ascertain the relative value or quality of specific information. This is particularly true if they are unaware of the originating source or broader professional context of the various sources. Useful information demands that databases be kept current, bibliographic resources be continually expanded and that search criteria be consistent.

Necessary capacities to use data

Frequent observations are made by country authorities about the inability of many institutions to assist in enabling them to develop a broader exposure to the types of relevant information that exists. Much remains to be done in providing greater familiarization of the wide variety of available information, where to find it and how to access it in the most efficient manner.

An initiative of considerable benefit would be a national audit about risk-related information needs, availability and limitations. International organizations could help by providing guidance about existing sources or means of obtaining gender-sensitive and culturally inclusive information in all areas of concern.

A key area for additional future support lies in enhancing the institutional capacities necessary to produce statistics related to risk factors and disastrous events in developing countries. Indeed the benefits would be multiplied, with the appreciation of this need in relation to the various dimensions of sustainable development.

While much of this may revolve around the creation of locally available statistical and analytical skills, equal attention and incentives could productively be given to ensuring terms of professional engagement that can sustain the growth of institutional abilities.

A common problem experienced in many developing countries is the high level of staff turnover, resulting in the failure to capitalize on individual efforts or to maintain a sense of methodological rigour. Both are necessary to build a cumulative stock of experience and gain the consistency of routine procedures for data collection. This, and the expanded use of existing regional or subregional information centres and their experience in linking suppliers of information with practitioners, would be particularly valuable.

Improvements in data quality

There is a need to work towards the standardization and systemization of all issues related to the accuracy and technical soundness, political neutrality, appropriateness of methodologies and consistently applied processes related to the collection, analysis, storage, maintenance and dissemination of data. In addition, there is a need to improve systematic reporting of risk factors and disaster occurrence.

More focus is required on the interaction between data compilation and its intended use. This particularly requires that more effort be given to ensure that the intended end users and practical applications of the information are considered foremost when determining data needs in the early stages of all programme designs.

Clearing house responsibilities

There is a glaring need for an international capacity to fulfil clearing house functions specifically related to the identification, ordering and dissemination of hazards and disaster risk management information.

This role could foster the exchange of relevant information through the use of directories, catalogues and bibliographies, as well as through linked professional networks. It would direct and connect a very wide range of users and practitioners. Such facilities as ReliefWeb and GDIN exist, but concentrate on international disaster response or disaster preparedness, rather than on matters of risk reduction and related experience.

The ISDR Secretariat is in the process of strengthening its web site and resource centre to build a comprehensive and accessible series of directories and links that can form the basis of a global clearing house for disaster reduction information. By pursuing this effort globally, information gaps, irrelevant data and geographical shortfalls in information availability may be more easily identified and addressed.

Such a coordinated approach can also contribute to establishing commonly accepted protocols and procedures for recording and exchanging disaster risk reduction information. Conventionally understood or agreed nomenclature and consistent search procedures should be developed to facilitate information searches related to key words, or to obtain contact details of widely recognized specialist institutions and international experts in key areas of risk reduction.

Experience gained over the years from the evolution of ReliefWeb as an acknowledged information-rich resource could be beneficial to the development of a similar comprehensive information platform dedicated to disaster reduction.

A PreventionWeb does not yet exist but by placing such a facility within ISDR it could become a powerful instrument to serve the different constituencies associated with disaster risk reduction worldwide.

Expanded access to information

Beyond the technical limitations of information systems, more attention needs to be devoted to the human dimension of communication. There is a need to support and expand local, national and regional documentation centres and library services.

Policies and facilities that encourage a wider opportunity for community-based involvement in information processing and dissemination should be developed. This can be achieved through the preparation of local risk maps based on community needs and values, public access information portals, or facilities that enable the wider exchange of locally-derived risk information among communities.

It can also be promoted through strategies that reduce gender, age and economic barriers to the use of new information technologies. These include literacy and education for women as well as training in computer skills, and the development of community-based computer centres and related training in low-income regions and neighbourhoods.

In bringing information to people most at risk, greater attention must be given to ensure that the costs associated with the availability or exchange of disaster information are affordable. This is particularly important when applied to low and medium income countries, or among more isolated and distant communities.

The widespread use of mobile telephones and the economies associated with their use offer promising opportunities to marry technology with local capacities. Effective use of radio and the broadcast media is another way of expanding traditional means of communication, updated by such innovative devices as the wind-up radio, or through the widespread popularity of video cassettes, and increasingly CD-ROMs and Digital Video Discs.

Future technology

Greater public use of information systems can lead to more access to risk management information tailored to the needs of specific users. Both distance learning and the increasingly common examples of artificial intelligence interfacing with electronic applications have extended the reach of information services to distant communities.

The applications offered by the latest information technology provide powerful interactive tools for the disaster risk management community. Applications such as electronic conferencing and distance learning via the Internet now allow the immediate sharing of documents and data on demand, increasing the efficiency, timeliness and overall utility of information available to a larger number of people.

Other advanced technological applications could be developed further to enhance information about hazards and risk reduction. GIS, remote sensing data and satellite imagery in particular can help considerably to assess vulnerability, enhance mapping, monitor threatened areas systematically, and to improve the understanding of hazards.

While space technology has advanced rapidly in recent years, a number of countries still lack the human, technical and financial resources required to conduct even the most basic space-related activities. A need remains to provide the benefits of available space technology to all countries. Several programmes, including those implemented by the UN Office for Outer Space Affairs (UN/OOSA) are proceeding in this direction.

A crucial area in which space-based assets can have a major impact is in the provision of unique forms of information for disaster reduction. While emergency relief operations demand near real time applications which satellites are not yet able to address fully, the assessment of natural hazards and deployment of tools for the management of disaster risks are currently well-suited to benefit from the increased application of both existing and forthcoming space-based applications.

In this respect, entities such as UN/OOSA, the Committee on the Peaceful Uses of Outer Space (COPUOS), the Committee on Earth Observation Satellites (CEOS), EUR-OPA, and the European Commission's Directorate General Joint Research Centre already contribute much to extending the use of high technology information systems.

Similarly, there are many examples of important and technologically advanced information products for hazard monitoring and disaster risk management being provided routinely by several individual space agencies, including NASA, and the Canadian, European Union, Russian Federation, Indian, and Chinese space agencies.