

COPING STUDIES

*The coping studies are available upon request
to the Secretariat for the ISDR*

- Moderator:** Mr. D. Warner, Deputy Director for the External Relations and Special Programs, The Graduate Institute of International Studies, and Coordinator of the Coping Study Project
- Rapporteur:** Mr. R. Slooff, Consultant, IDNDR Secretariat
- Speakers:**
- ◆ Prof. W.J.R. Alexander, Department of Civil Engineering, University of Pretoria, South Africa, and Member of the United Nations Scientific and Technical Committee (STC) on Natural Disaster Reduction: *"Public Perception, Economic Aspects and Education Needs - An African Perspective"*
 - ◆ Prof. Dr. H.E.M. Minor, Director, Laboratory of Hydrology and Glaciology of the Swiss Federal Institute of Technology, Zurich, Switzerland: *"Disaster Resilient Infrastructure"*
 - ◆ Prof. S. Herath, International Center for Disaster-Mitigation Engineering (INCEDE), Institute of Industrial Science, University of Tokyo and United Nations University (UNU): *"Technology for Disaster Reduction"*
- Respondent:** Prof. Dr. O. Renn, Center of Technology Assessment in Baden, Württemberg, Stuttgart, Germany
- Content:** Having a better understanding of what might be disaster risk in the 21st century constitutes a crucial element for formulating a credible future approach to disaster reduction. To this end, the Graduate Institute of International Studies and its Program for the Study of International Organization(s) (PSIO) has been mandated by the IDNDR Secretariat to organize and coordinate three coping studies under the overall theme of "Risk and Society" in collaboration with renowned international institutions active in the field of disasters. The aim of these studies is to identify remaining gaps in disaster reduction, formulate strategic approaches to meet the requirements for improvement, and identify research needs in relation to the possible disasters of the twenty-first century.

"Public Perception, Economic Aspects and Education Needs, An African Perspective"

Prof. Alexander, Dept. of Civil Engineering, University of Pretoria, South Africa

Within the socio-economic context of disaster vulnerability in the African region, the study seeks to identify the prime causes for poverty - related high levels of disaster vulnerability, both inside and from outside the continent. It analyses critically the highly response oriented external aid Africa receives to reduce disaster impacts and concludes that without greater attention from policy - makers and more support from donor agencies for anticipatory / preventive approaches in disaster reduction, many African countries will not be able to escape from the poverty - vulnerability - environmental degradation - poverty deadlock.

“Disaster Resilient Infrastructure”

Laboratory of Hydrology and Glaciology of the Swiss Federal Institute of Technology, Zurich, Switzerland

This study examines the state - of - the - art in infrastructure design and construction to reduce physical disaster impacts from a number of natural hazards: wind loads, snow avalanches, ice avalanches, rock falls, landslides, impulse waves, earthquakes, forest fires and floods. It advocates a more extensive use of these technologies, in particular in new development of schemes, resettlements, transportation infrastructures, etc. It concludes that the promotion of disaster reduction through disaster resilient infrastructures is best secured through regional planning.

“ Technology for Disaster Reduction”

United Nations University (UNU) in cooperation with the International Center for Disaster Mitigation Engineering (INCEDE), University of Tokyo

This study emphasizes the importance of disaster reduction technology in all phases of a disaster cycle- mitigation, preparedness, response, recovery and reconstruction. The degree of mitigation efforts made through disaster reduction technologies and land use planning is crucial in determining whether a given natural hazard would turn into a disaster and, if so, its magnitude. It provides an impressive overview of such technologies such as remote sensing and geographic information systems, global positioning systems, telecommunication technologies, disaster information systems, etc. The study also stresses that in adopting such technologies, decision - makers should be conscious of their sustainability in long-term planning and of the need for increasing disaster mitigation capacity.

Respondent: Mr Renn presented the subject of handling natural disasters from a novel risk assessment and evaluation perspective which distinguishes between managing disaster risk itself, addressing uncertainty about risks, and reducing the vulnerability to damage from such risks. He proposed to adopt three broad classes of management strategies for coping with natural disaster that take the different degrees of probabilities of hazards and their potential for damage into account. Political actions required to apply the three types of management include the development of “benign” technologies, the establishment of “self-learning” organizations and the linking of economic incentives to risk avoidance behaviour. He proposed to establish an International Panel on Risk Assessment and Management.

Conclusions: On the one hand, increasing environmental degradation, urbanization and industrialization will render natural disasters increasingly important and, hence, the need to press for sustainable development policies more forcefully. On the other, progress being made with technology development and availability will change the nature of disasters as well as the manner in which humankind will deal with their reduction.

EDUCATION AND SOCIO-ECONOMIC CONCERNS

EDUCATING FUTURE GENERATIONS

- Task Manager:** UNESCO in collaboration with the Canadian IDNDR Coordination Committee
- Moderator:** Mrs. K. White, President of Black & White Communications Inc., Executive Director of Risk & Society Initiative, Board Member of Canadian IDNDR Coordination Committee
- Rapporteur:** Mr. J. Bruce, Canadian Climate Program and former Chair of the United Nations Scientific and Technical Committee (STC) on Natural Disaster Reduction
- Speakers:**
- ◆ Mrs. K. White, : *"Education for the Future: The Risk and Society Initiative Model"*
 - ◆ Dr. A. Holloway, Project Co-ordinator, Sustainable Livelihoods Project, University of Cape Town and University of the Western Cape, South Africa, and Member of the United Nations STC on Natural Disaster Reduction: *"Developing National Policy and Political Mechanisms Sustainable Public Education Good Practices and Lessons Learned"*
 - ◆ Mr. N.K. Jain, Secretary General, Global Forum of NGOs for Disaster Reduction (GFNDR) and Director of the Joint Assistance Centre, India *"Building a Permanent Network for the Education Sector: a Case Study from GFNDR"*
 - ◆ Mr. J. Faye, Responsable de l'information, Ministère de l'Environnement, Paris, France, : *"The Culture of Risk Creating a Research Agenda in Support of an Education Curriculum for Youth and Minorities"*

Content: Education has a key cross-cutting role in disaster reduction by extending citizen engagement to the creation and maintenance of sustainable human communities.

Education should be delivered through alternative media using experiences of local communities and emphasizing the need for vulnerable people not to be passive in the face of hazards since their collective action can reduce the impact of these hazards. Films and videos, for instance, are good means of education and prove to be more interactive in their development than printing material, given that they require the investment of the stakeholders. Also, activity-based learning such as community walks, hazard mapping and community poster competitions could be very pedagogic tools as long as they are planned on a long-term basis.

The Internet technology offers great opportunities to build and share resources. Development of research (risk communication and policy) together with scientific assessments of risk and vulnerability provide a basis for effective programme design for education at both national and international level as exemplified by the Risk & Society Initiative.

Building networks for education and training sectors in disaster reduction is also essential for successful education strategies. National solidarity and international cooperation are paramount ingredients for the education of the future actors of prevention (architects, urbanists, etc...) to reduce vulnerability to hazards.

Conclusions and Recommendations:

- ◆ Education for disaster reduction must be integrated in the programme of the successor arrangement to the IDNDR which should foster regional and international co-operation, exchanges of resources and good practices.
- ◆ Education in disaster and risk reduction must be advocated nationally and internationally.
- ◆ Creative and strategic use of multi-media is essential to successful disaster reduction education
- ◆ The education sector (formal and informal) should use emerging information and communication technology and integrate evaluation methodologies to measure increased resilience, citizen engagement and improved decision-taking in the field of risk. Community memory and local knowledge are also effective tools for community-wide awareness raising.
- ◆ Education programme should include training of teachers at all levels, institutional and logistic support as well as the engagement of politicians and the media.

CIVIL SOCIETY AND PARTNERSHIPS - The Public-Private Partnership 2000: A unique U.S. experiment in collaboration among governments, NGO's and private enterprise

Task Manager: Public Private Partnership 2000 (PPP-2000) a cooperative endeavor of nineteen federal agencies composing the Subcommittee for Natural Disaster Reduction, the Institute for Business and Home Safety, and other private sector organizations

Moderator: William H. Hooke, Chair of the Subcommittee for Natural Disaster Reduction, Washington D.C., USA

Rapporteur: Ms. E. R. Padovani, Senior Scientist, Disaster Information Coordination, U.S. Geological Survey, USA

Speakers:

- ◆ William H. Hooke: *Introduction: "The Public-Private Partnership 2000: A unique U.S. experience in collaboration among government, NGOs and private enterprise"*
- ◆ Mr. D. Sullivan, Executive Vice President and Chief Administrative Officer of the State Farm Fire and Casualty Company: *Keynote address and Introduction of the Subject*

Panel presentations:

- ◆ Mr. M. Armstrong, Director of the Mitigation Bureau, Federal Emergency Management Agency (FEMA), Washington D.C.: *"FEMA's leadership in fostering a new national outlook to disaster reduction"*
- ◆ Prof. W. Iwan, California Institute of Technology, California: *"The Role of Structural Engineering in Natural disaster Reduction"*
- ◆ Prof. H. Kunreuther, Wharton School, University of Pennsylvania, Philadelphia: *"The Role of Finance and Economic Considerations in Shaping the U.S. National Policy for Disaster Reduction"*
- ◆ Ms. G. Craven, USAA Property and Casualty Group (retired): *"The Crucial Role of Building Public Awareness and Reshaping Public Values"*
- ◆ Ms. M. L. Carrido, President and Chief Executive Officer of MLC & Associates Inc. Irvine, California: *"Benefits of Public-Private Partnership in Establishing a Disaster Recovery Business Alliance"*

Content: United States participation in the IDNDR consisted of a diverse range of partnerships, encompassing governments at different levels, private enterprise, and NGOs. The Public-Private Partnership 2000 (PPP 2000) is a unique U. S. experience in collaboration among governments, NGOs, and private enterprise. In a monthly forum, it seeks to surface major, complex issues in the context of the United States national agenda. Instead of attempting to resolve these issues, it brings stakeholders together and fosters the development of collaborations that will prove enduring and able to address challenges in a sustained way over a period of time. The PPP 2000 works toward six goals, namely 1) establishing natural disaster reduction as a public value; 2) focusing on pre-event mitigation measures with respect to both structural and non-structural aspects; 3) advancing national real-time warning capabilities; 4) building national capabilities for financing pre-event mitigation and spreading risk; 5) improving information access; and 6) developing international collaborations as well as focusing on domestic issues. It attempts to move beyond improving public awareness, by having the ultimate goal of making natural disaster reduction a public value.

The United States' Federal Emergency Management Agency (FEMA) leads the U.S. from a focus on emergency response to a multiple culture. Through the National Mitigation Strategy, and Project Impact, FEMA has brought local and community level resources to bear on national disaster reduction across the United States.

Structural engineering in natural disaster reduction as well as emerging financial measure to manage the financial risk associated with natural disasters are important aspects of prevention.

The formation of "Disaster Recovery Business Alliances (DRBA)" - community partnerships involving local government, business, and private citizens -- develops strategic approaches to disaster mitigation at the community level to help private enterprises - corporations normally competing with each other - to work together toward common goals of strengthening critical infrastructures needed to minimize business disruption.

Conclusions and Recommendations:

Structural engineering in natural disaster reduction as well as emerging financial measure to manage the financial risk associated with natural disasters are important aspects of prevention.

ASSESSMENT AND PROJECTION OF SOCIAL AND ECONOMIC IMPACTS

- Task Manager:** UN Economic Commission for Latin America and the Caribbean (ECLAC)
Moderator: Mr. R. Zapata, Chief, International Trade Unit, ECLAC
Rapporteur: Mr. H. Kunreuther, Wharton School, University of Pennsylvania, Philadelphia, USA
- Speakers:**
- ◆ Mr. R. Zapata: *"The Latin American Experience: Concepts and Progress - An Integrated Socio-Economic Perspective for Disaster Reduction"*
 - ◆ Mr. C. Ertuna, Chief, Environment and Natural Resources Development Division, ESCAP: *"The Asian Experience: impacts of recent disasters, responses and the Bangkok Declaration"*
 - ◆ Mr. O. Laye, Team Leader on Environment, ECA: *"The African Experience: socio-economic conditions and disaster risk management in Africa"*
 - ◆ Dr. R. Enderlein, ECE: *"The case of floods in Eastern Europe as an example of vulnerability increased by socio-economic and political transitional processes"*
- Content:** The United Nations Economic Commissions in Asia (ESCAP), Africa (ECA), Latin America (ECLAC) and Europe (ECE) reported on their work including regional experiences and insights in terms of social and economic impact of disasters as well as the linkages between socio-economic development, vulnerability to disasters and risk reduction policies.

Conclusions and Recommendations:

Asia

- ◆ Enhancing the sharing of information and experiences as well as the coordination of activities within the UN system at the regional and sub-regional levels
- ◆ Integrating disaster preparedness and mitigation activities into economic and social development process
- ◆ Increasing public awareness and participation
- ◆ Strengthening regional networking and transfer of technologies
- ◆ The UN Secretary-General to support mechanisms for bringing about concerted regional and global action
- ◆ Continuing existing regional institutions and framework similar to the IDNDR Secretariat beyond the Decade.

Africa

- ◆ Coordinating Private sector, NGOs, universities as well as research and development institutions with local communities for relief and rehabilitation activities and also for the reduction of vulnerability to disasters
- ◆ Including private sector in conceiving, designing and implementing community based programs
- ◆ Mobilizing mitigation activities according to a strategy instead of haphazardly as it is the case currently
- ◆ Enhancing resources for hazard mapping, risk evaluation, information system development and early warning systems
- ◆ Establishing a regional coordinating center for disaster issues in Africa

Eastern Europe

Enhancing construction for dams, bridges and other infrastructure susceptible to floods

- ◆ Enhancing cooperation between countries for transboundary risks associated with river floods
- ◆ Shifting paradigm when evaluating alternative policies by assessing the price for security and the need to accept some risk, bearing in mind that there is a high price to pay for zero risk.
- ◆ Including in risk management strategies land-use planning, structural measures, and warnings.
- ◆ Adopting a holistic approach regarding cooperation with key stakeholders within the country as well as between countries
- ◆ Reevaluating objectives concerning transboundary risks and proposing actions to be taken

Latin America

- ◆ Implementing an integrated risk management system with a pro-active rather than reactive strategy to reduce vulnerability to disasters
- ◆ Understanding and assessing direct as well as indirect impacts of infrastructures on a country in case of damage from a disaster
- ◆ Considering the role of mitigation in reducing both primary and secondary losses from disasters
- ◆ Taking into account technical, structural and management criteria when approaching the issue of reduction of vulnerability to and effects from natural disasters
- ◆ Giving priority to urgent rehabilitation needs (restore lifelines, provide production tools) at the beginning of the reconstruction phase
- ◆ Promoting regional co-operation and synergy as well as private sector and local community participation in order to reduce individual costs and increase economies of scale

EMPOWERMENT OF LOCAL COMMUNITIES

- Task Manager:** Periperi, NGO network in Southern Africa
- Moderator:** Mr. A. Maskrey, Senior Human Resource Development Advisor, Disaster Reduction and Recovery Programme, Emergency Response Division, UNDP
- Rapporteur:** Mrs. Z. Delica, President, Global Forum of NGOs for Disaster Reduction (GFNDR) and Manager, International Consultancies Management, Asian Disaster Preparedness Centre (ADPC)
- Speakers:**
- ◆ Mrs. M. Ariyabandu, Duryog Nivaran: "Empowering vulnerable communities in South Asia"
 - ◆ Mr. F. Ramirez, LaRed: "Empowering vulnerable communities in Latin America"
 - ◆ Ms. L. Fidalgo, Periperi: "Empowering vulnerable communities in Africa"
- Content:** The active participation of local communities and organizations is an essential ingredient for successful disaster reduction policy and practice. The experiences of three regional NGO networks (Duryog Nivaran in South Asia, Periperi in South Africa and LaRed in Latin America) in the promotion of risk reduction at community level demonstrate that vulnerability of community is not a fatality. Vulnerable communities especially in developing countries have extraordinary, but often overlooked, resources to prevent losses from disasters. The merits of incorporating community based approaches for the reduction of risks to disasters are numerous despite the existence of barriers to their full realization.
- The hereafter conclusions were exemplified by case studies on
- ◆ local initiatives and coping strategies in Sri Lanka, Nepal, Bangladesh and Pakistan;
 - ◆ information on food Security and nutrition vulnerability mapping in Mozambique; and
 - ◆ reexamination of community participation in various countries of Latin America.

Conclusions and Recommendations:

Merits of community based approach for the reduction of risks to disasters:

- ◆ Communities are rich in experiences of coping with disasters both in preparedness and emergencies. As they are knowledgeable about their own environments, they also are often able to predict unfavorable events.
- ◆ The community coping methods evolve with time, and suit best the local socio-economic cultural and political environment. Therefore, community inputs are more adequate for establishing effective and realistic planning and actions than external point of views.
- ◆ Community based initiatives are potentially more resource efficient, and better self sustained.
- ◆ Communities are often independent during disaster periods and able to increase their capacities to support their own priorities.
- ◆ Gender equity is more likely to take place as women capacities to cope with hazard is taken into consideration
- ◆ Empowered communities can remove some of the causes of vulnerability, thereby reducing the impact of future extreme natural events.

Barriers to community based approach for the reduction of risks to disasters:

- ◆ Community efforts lack effectiveness if they are not supported and treated as an important part of any integrated and sustainable disaster mitigation strategy
- ◆ Practices by states and many agencies are increasing the "dependent victim mentality" or "donor-recipient culture", weakening local capacities, destabilizing community organizations and preventing effective leadership
- ◆ Administrative barriers, relative absence of civil society concerns in most countries in Latin America and gaps in management planning between national and local levels constitute a major impediment to the full realization of a community based approach
- ◆ **Aviable information is not fully utilized as this is a crucial component for the reduction of vulnerability**

DISASTER, ECONOMY AND TRADE - The Effects of Natural Disasters on the Development of Tourism

Task Manager: United Nations Conference on Trade and Development (UNCTAD)
Moderator: H. E. Ambassador F. Cuello, Permanent Mission of the Dominican Republic in Geneva
Rapporteur: Mr. R. Whiter, UNCTAD Consultant

Panelists and Speakers:

- ◆ Mr. D. Diaz, Chief, Trade and Services, UNCTAD Division on International Trade in Goods and Services and Commodities: *"UNCTAD's Mandate on the Impact of Natural Disasters on Tourism"*
- ◆ Mr. P. Encontre, Economic Affairs Officer, Office of the Special Coordinator for Least Developed, Land-locked and Island Developing Countries, UNCTAD: *"Least Developed Countries, Land-Locked and Island Developing Countries"*
- ◆ Mr. R. Wither: *"The Effects of Natural Disasters in the Tourism Sector of Developing Countries"*
- ◆ Mrs. L. Valenty, Project Director, Secretaría de Integración Turística Centroamericana, Nicaragua: *"The Impact of Hurricane Mitch in the Central American Tourism Sector"*
- ◆ Ms. S. Scotland, Director, Antigua and Barbuda Tourist Office: *"The effects of Hurricane George on Antigua the role of the media in directing the impact on foreign markets"*

Content: The session concentrated on the tourism sector and the implications of trade and development on the vulnerability to natural disasters of Least Developing Countries (LDC) and Small Island Developing States (SIDS). Natural disasters have a strong impact on social and economic structures generally and in particular on tourism as commercial activities can be disrupted for a long time. Tourism, however, can play an important role in post disaster recovery programmes. UNCTAD sponsored a special study on the effects of Natural and Man-made Disasters on the Tourism Sector of Developing Countries. UNCTAD is also currently looking, as a special mandated task, into the support of new initiatives on post disaster recovery programmes to assist countries, especially LDCs and SIDSs, on the following aspects.

- ◆ parameters to estimate the impact of disasters on tourism
- ◆ guidelines to assist Government accelerate their recovery programmes.

Response to vulnerability issues is extremely complex and has to be dealt with at national levels. Handicaps for certain countries to recover from disasters include the lack of resources and remoteness while reconstruction costs are not a dominant cause for long term economic stability. It should be noted that there is little difference between countries predominately exporters of goods and countries predominately exporters of services.

Vulnerability of tourism to any disaster is due to the fragility of the markets. However, the diversity of small and medium Enterprises (SMEs) in the tourism sector contribute to its strength. The SMEs enable the tourism sector to recover quickly provided that trade opportunity are offered to destinations hit by disasters, and that mitigation of the social impact is achieved by the empowerment of the local communities to develop new tourism products.

The social impact of disasters is critical in most vulnerable developing countries and this was highlighted by the Mitch experience. The detrimental impact of Hurricane Mitch on Central American tourism was due primarily to a lack of preparedness of Central American states. Also, mitigation could have been enhanced by development plans.

Lessons learnt from 44 hurricanes striking in Antigua and Barbuda this century contributed to the 1998 recovery programme after the Hurricane George episode. Media played also an important role in influencing Antigua's markets at a time when an improving image was needed.

Conclusions and Recommendations:

- ◆ Tourism should be considered as an economic partnership between tourism destinations and source markets
- ◆ Negative social impacts on tourism should be mitigated by the creation of economic partnerships between destinations and source markets
- ◆ With regards to post disaster recovery strategies, the tourism sector should be included in national disaster management planning as tourism has a crucial role in generating foreign currency resources for the countries, a prime component in sustainable development.
- ◆ Support for recovery should be provided by trade development programmes rather than by direct aid provision.
- ◆ Governments of many developing countries could enhance their capacity to manage efficiently post disaster management plans by appreciating the economic importance of tourism
- ◆ Effective institutions should be established in developing countries in order to manage disaster recovery programmes
- ◆ Support for recovery should be provided by trade development programmes rather than by direct aid provision

HEALTH DIMENSION IN DISASTER REDUCTION

Task Manager: The World Health Organization (WHO), in collaboration with the UK IDNDR Coordination Committee

Moderators: Dr. A. Denton, Chairman, UK IDNDR Coordination Committee, and Dr. R. Flores, WHO/EHA

Rapporteur: Prof. I. Davis, Cranfield University, UK

Speakers:

- ◆ Dr. P. Baxter, UK: "Health impacts of the recent volcanic eruption at Montserrat"
- ◆ Dr. J. Larusdottir, WHO/SEARO: "Health impacts of Bangladesh flood in 1998"
- ◆ Dr. S. Asahi, WHO/WPRO: "Health impacts of Kobe earthquake"
- ◆ Dr. R. Saenz, WHO/AMRO: "Health impacts of Hurricane Mitch"

Content: Due to insufficient disaster prevention and inadequate health sector preparedness, natural disasters continue to cause injury, death and disease among vulnerable communities. This session reviewed health impacts of some of the following recent natural disasters:

- ◆ Volcanic eruption in Montserrat (1995-1999)
- ◆ Flooding in Bangladesh (1998)
- ◆ Earthquake in Kobe, Japan (1995)
- ◆ Hurricane in Central America (1998)

Issues raised included whether losses due to human health could have been further reduced cost-effectively and how health impact reduction should be improved in the future, based on more preventive strategies such as the improved use of early warning.

Volcanic eruption threatened the Montserrat Island's population of 12,000 people over the period 1995-1999. Lessons learned from an extended period of disaster management contributed to the development of policies on early warning system, evacuation planning and emergency management. Gained experience confirmed the importance of:

- 1) close collaboration between scientists and authorities,
 - 2) the development of risk communication with the public, and
 - 3) the new approach adopted for the first time in volcanic risk management using "expert judgement" and quantified risk assessment.
- The session also underlined the problems faced by the authorities in maintaining for over 2 years a state of readiness to evacuate the population.

The devastating flood of 1998 in Bangladesh was one of the greatest floods to occur during the Decade. Key lessons from this event included

- 1) the importance of health information for effective flood management,
- 2) the need to maintain a disaster information system throughout the flood event, and
- 3) the need to decentralize resources prior to seasonal floods to aid rapid relief and recovery.

It should be reminded that flood mitigation is a multi-sectoral issue which includes environment management.

The Kobe earthquake was the first large scale sinister to hit the city in 50 years. It resulted in 6,430 deaths and affected 2 million people. Nearly 80% of the city's hospitals were damaged or collapsed. Kobe is a Japanese mega city with supposedly plenty of resources. However, in the first two days after the event, local communities had to handle their own health and medical problems. It showed that a sound multi-connected communication "fail - safe" system is vital. The disaster has confirmed that a pro-active health emergency plan is an essential element of a disaster contingency plan.

The full impact of Hurricane Mitch on the countries of Central America is still being calculated. Nearly 10,000 were killed, with a similar amount of missing people, nearly 13,000 wounded and 590 health centers affected. Experience showed the importance of providing equitable assistance with the active participation of local communities and the necessity to identify priorities to establish and implement an effective disaster recovering programme despite the chaos and confusion. In the aftermath of Hurricane Mitch rumours abounded concerning the risks of epidemics. This demonstrates the importance of providing accountable information to the communities affected by major disasters.

Conclusions and Recommendations:

- There is a need for:
 - pro-active health emergency planning
 - foolproof information communication systems
 - key role played by local communities in the early stages of major disasters
 - multi-sectoral response

SUB-SESSION ON HEALTH DIMENSION IN DISASTER REDUCTION: Capacity-Building and Supply Management for Health Impact Reduction

Task Manager: UK IDNDR Coordination Committee, in collaboration with the World Health Organization (WHO)

Moderator: Dr E. Noji, WHO/EHA

Rapporteur: Dr. S.W.A. Gunn, President of the Mediterranean Club of Burns and Fire Disasters, Switzerland

Speakers:

- ◆ Prof. J.S.P. Lumley, UK: *"Training on the medical care in disaster situations: the UK experience"*
- ◆ Dr. C. De Ville, WHO/PAHO. *"Developing human resources for coordination and logistics: the experience in the Americas"*

Content: The current situation witnesses a growing impact of disasters with inadequate health response. Health response can be improved with training. However, there is a great difficulty in identifying organizations and finding trained individuals to respond to health disasters. This sub-session examined training systems for

- 1) Medical care in disasters as developed in the UK, and
- 2) Coordination of the logistics of health relief (SUMA), as developed in PAHO.

SCIENTIFIC AND TECHNOLOGICAL CONCERNS

TOWARD INTEGRATED RISK REDUCTION

Task Manager: National Department of Civil Protection (ONEMI), represented by Dr. Maturana, Director of ONEMI, Ministry of Interior, Government of Chile, and Member of the United Nations Scientific and Technical Committee (STC) on Natural Disaster Reduction

Moderator: Dr. A. Maturana

Rapporteur: Mr. S. Weber, Office of the Director General, United Nations, Geneva

- Speakers:**
- ◆ Prof. Wang Ang-sheng, Director of the Center for Disaster Reduction, China Academy of Sciences, and Director of Experts Group, China National Committee for IDNDR (CNCIDNDR): "*China Disaster Reduction Plan and Integrated Disaster Reduction*"
 - ◆ Dr. M. Saenz, Board of Directors of the National Emergency Commission, Government of Costa Rica, San Jose, Costa Rica: "*Basic Legislation and Information for Risk Management*"
 - ◆ Mr. N-G Camp'huis, Representative of the Equipe Pluridisciplinaire du Plan Loire Etat (EPALA), Orléans, France: "*Flood Reduction Strategy on the Loire River in France*"
 - ◆ Mr. L. Preciado Barragan, Secretariat of Housing and Urban Development, Government of Mexico City, in conjunction with Mr. L. Wintergerst Toledo, General Director of Civil Protection, Mexico City: "*Vulnerability Reduction through Urban Development Planning*"
 - ◆ Mr. D. Kurbanbekov, Head of the Ecology and Emergency Situations Section, Office of the President, Government of Tajikistan, Dushanbe, Tajikistan: "*Applied Risk Reduction in the Case of Lake Sarez, Tajikistan*"

Content: Discussions during the session centered around the ways in which an integrated risk reduction strategy as both a discipline and a goal is approached in a coordinated fashion given the increasing complex impacts of natural phenomena.

Conclusions and Recommendations:

- ◆ *Integrated strategies for risk reduction must take full account of local capacities and experience when devising practical measures for disaster reduction at the local or regional level.* Local level participation in the decision-making is an essential element in this approach as it ensures local ownership of the effort and increases awareness of risk, respects local cultural, historic, political, and economic considerations, all the while improving the success rate of such initiatives.
- ◆ *Multi-sectoral boards with executive powers must be established as the central coordinating body to steer the integrated strategy from planning to implementation.* An important aspect of the board's work must be a regular reappraisal and adjustment process based on lessons learned and information sharing with other such boards in other countries
- ◆ *A synergy between the national and local level decision-making bodies must be maintained not simply in times of crisis but on a regular basis through established channels.* One such example in the case of Costa Rica is the collection and analysis of information regarding past disasters. The process of data collection begins at the district level within the country and is processed at the national level. As a result, the districts are able to pool their individual knowledge base and produce regional maps or risk studies essential to disaster reduction efforts.

- ◆ ***Risk assessment and risk mitigation must be integrated at the core of all development and environmental protection planning.*** The Mexican experience has shown that reducing the externalities of human activities such as pollution and poor land-use management in effect reduces the scale of the impact of some natural disasters. Also, maintaining a dialogue with the people in local communities is the most important element of risk awareness raising and is an activity which saves lives. Education, training of both high and mid-level decision-makers and building a culture of prevention are the foundation of integrated risk reduction efforts.
- ◆ ***Partnerships with the private sector are also an essential element of integrated risk reduction.*** With regard to engaging the private sector in risk reduction planning, the French experience along the Loire river has shown that forcing industries in flood zones to relocate is not an effective strategy. A more successful approach is to work with the industries to ensure that should a flood occur, neither the factories nor the environment stand to suffer beyond the “natural” inconvenience to business and agricultural continuity. Parallel to this, legislative norms should be established in order to prevent the further expansion of existing industrial areas in zones at risk from natural disasters.
- ◆ ***The integration of development, construction and planning activities within an overall strategy for disaster reduction has proven most effective in combating the effects of natural disasters.*** The experience in China has shown that an investment in prevention activities of 1 Billion Yuan can save as much as 20-40 Billion Yuan in damages and lost economic productivity.
- ◆ ***Emergency planning which clearly defines the roles of all governmental and non-governmental actors is essential.*** The Tajik experience has shown the progress that can be achieved in focusing the different elements of the Government dealing with natural disaster reduction on a given issue, in this case Lake Sarez. Creating a specific Lake Sarez Committee has been an effective way of avoiding the duplication of efforts and accomplishing a great deal with scant resources. The issue of Lake Sarez has also highlighted the importance of raising the awareness of the international community to problems of transboundary consequence and of developing international strategies, coupled with national programmes, to reduce the risk of large scale natural disasters.
- ◆ ***Educational and information policies for disaster reduction must be introduced into curriculum in schools and disseminated with the active participation of the media.*** China’s experience with frequent large scale natural disasters has underscored the prime importance of prevention activities and of the value of an educated and knowledgeable leadership and workforce. Educating the public gives the tools and knowledge needed to save people and is a necessary element of an integrated risk reduction strategy.

INFORMATION TECHNOLOGY FOR ASSESSMENT AND SIMULATION CAPACITIES

Task Manager: Japan National Committee for the IDNDR
Moderator: Dr. Y. Ogawa, Deputy Director, Asian Disaster Reduction Center (ADRC), Japan
Rapporteur: Dr. S. Tanaka, Assistant Professor, Disaster Prevention Research Institute, Kyoto University, Japan

Speakers:

- ◆ Mr. J. Kondo, Chairman, Japan National Committee for the IDNDR: *Opening address: "Science Technology and Disaster Reduction"*
- ◆ Mr. K. Mochizuki, Earthquake Disaster Countermeasures Division, Disaster Prevention Bureau, National Land Agency, Japan: *"Disaster Information System Against Earthquakes (DIS)"*
- ◆ Mr. R. Kojiroi, Office of IDNDR, River Bureau, Ministry of Construction, Japan: *Video presentation: "If the banks of the Yodogawa River Broke Today - Flood Inundation Simulation (Predicted Underground Facility Damage)"*
- ◆ Mr. N. Erdenesaikhan, Officer, International Cooperation Department, Ministry of Environment, Mongolia: *"Forest and Steppe Fire Monitoring in Mongolia using Remote Sensing Data"*
- ◆ Dr. H. Hayashi, Japan National Committee for the IDNDR and Professor, Kyoto University, Japan: *"Development of Pictogram System for Natural Disaster Reduction through Internet"*
- ◆ Mr. A. Hodges, Director General, Emergency Management, Australia: *"Technology and Disaster Management: Issues for the Next Decade"*

Content: This session introduced recent research topics and their implementation with regard to information technology for disaster assessment and simulation. Based on progress made in computer and network technology, new technologies for assessment just after disaster (real-time damage assessment) as well as post-disaster situation have been developed. Real-time damage assessment has proved useful for setting up an appropriate disaster response operation. Progress made in remote sensing and GIS technology will increase the role of information processing for disaster mitigation. However, barriers for applying these technologies include the costs of introducing information technology, the lack of specialists, and an inadequate recognition from policy makers. Professional skills in information technology is crucial in order to convey the appropriate knowledge of disasters to the public.

Conclusions and Recommendations:

- ◆ training of specialists in information technology is a fundamental element to overcome barriers for applying technologies
- ◆ countries with advanced technologies should offer to train information specialists through multilateral and bilateral cooperation.
- ◆ institutional approach such as the Asian Disaster Reduction Center (ADRC) should be considered by the international community for the transfer of knowledge and technology to developing countries.

SAFE HUMAN SETTLEMENTS IN DISASTER-PRONE AREAS

Task Managers: National Disaster Prevention Center (CENAPRED), Mexico

Moderator: Prof. A. Davenport, Chairman of the Canadian IDNDR Coordination Committee, and Dr. R. Meli, Director of CENAPRED, Mexico

Rapporteur: Dr. R. Meli

Speakers:

- ◆ Prof. A. Davenport: *Introduction*
- ◆ Dr. S. Alcocer Mexico: "*Reduction of Seismic Vulnerability of buildings: the Mexican Experience*"
- ◆ Mr. L. Ludvigson, UNCHS (Habitat): "*Safe Human Settlements in Disaster Prone Countries*"
- ◆ Dr. Yang Quinje, China: "*Disaster Resettlement and Rehabilitation in China*"
- ◆ Prof. A. Arya and Dr. T.N. Gupta, India: "*Vulnerability Atlas of India*"

Content: This session discussed recent technological advances aimed at reducing the vulnerability of human settlements in disaster-prone areas. Emphasis was given on the situation of developing countries, where the magnitude of the problems relating to human settlements prevents from achieving significant risk reduction activities for large portions of the population.

Regarding protection from extreme winds during hurricanes, floods resulting from heavy rains, and earthquakes, the measures proposed for vulnerability reduction ranged 1) from relocation of human settlements in extreme levels of risk to temporary evacuation related to effective warning systems, and 2) from construction of large infrastructure work to give protection from floods to rather simple improvements of existing houses to increase their safety. Problems arise when it comes to the feasibility of implementation of these measures. Poor human settlements have a great variety of needs related to their daily life, and normally no high priority is given to measures related to risk reduction for extreme and rare events. Solutions are especially difficult and complex when they require infrastructure works as these related to flood protection.

Conclusions and Recommendations:

- ◆ In case of earthquakes, there is a need to thoroughly evaluate different building techniques by monitoring their performance under future earthquakes.
- ◆ Implementing non traditional technological solutions may prove difficult if not stated and solved at the community level by involving the concerned population both in the decision and the implementation process.
- ◆ As in poor human settlements the tendency is to give low priority to measures related to risk reduction for extreme and rare events, opportunities must be taken from post disaster situations where people have greater awareness of problems, and solutions applied for damaged housing can be more easily extended to other subtended but undamaged dwelling.
- ◆ Vulnerability reduction measures require generally long-term projects and can only be fully implemented when situations of extreme poverty are corrected.
- ◆ Comprehensive long-term plans for risk reduction must be envisaged, including warning and evacuation programs for settlements where the level of risk cannot be brought to acceptable levels in the short time.

EARLY WARNING SYSTEMS: AN INTEGRATED PROCESS

Task Manager: GeoForschungs Zentrum (GFZ), Potsdam, represented by Prof. J. Zschau, Director, Division of Solid Earth Physics and Disaster Research

Moderator: Mr. P. Platte, Representative of the Division of Humanitarian Assistance, Federal Foreign Office, Federal Republic of Germany, Bonn, Germany

Rapporteur: Mr. J. C. Scott, President of the Center for Public Service Communications, Arlington, VA, USA

- Speakers:**
- ◆ Mr. P. Platte: *"Introduction and International Political Context of Improved Early Warning for Natural and Similar Disasters which have an Adverse Effect on the Environment"*
 - ◆ Dr. J. W. Zillman, President of the World Meteorological Organization and Director General, National Meteorological Service, Melbourne, Australia: *"The Fundamental Role of Early Warning in an Integrated System of National Disaster and Risk Management"*
 - ◆ Prof. B. Lee, Head of Department, Department of Civil Engineering, University of Portsmouth, U.K. and Chair of UK IDNDR Flagship Project on Early Warning. *"Experience from the U.K. Flagship Project Relating to Technology Transfer and the Relationships Between Engineering and Disaster Risk Reduction Capabilities of Early Warning"*
 - ◆ Mr. K. Kishore, Programme Officer, Asian Disaster Preparedness Center (ADPC), Thailand: *"Field Level and Local Realities and the Effective Applications of Early Warning: Guiding Principles of Effective Early Warning"*
 - ◆ Mr. J.C. Scott: *"The Concluding IDNDR Early Warning Programme Report and Future Action Plan for Effective Early Warning"*

Content: This session conveyed the important issues that have emerged during the IDNDR's global programme initiative of early warning considered as a basis by which global practices may become better coordinated and more effective. During the Decade, the focus on early warning has shifted from alerting and forecasting activity with a strong emphasis on technology transfer towards organizational relationships, human factors and international networking built up over a period of time, with an ongoing commitment and the enhanced role of public participation at local levels. Essentially, early warning is about the effective and informed communication among people of various disciplines, who work together on a global scale to understand an approach to hazards and the feasibility of protecting their common resources and economic assets within a community.

While early warning includes the technological aspects of hazard monitoring, forecasting and telecommunications as well as the scientific aspects of climatology, volcanology and seismology, it also involves elements that frequently do not get the attention they deserve, such as:

- ◆ **Context:** focusing attention on continuously changing vulnerabilities, considered spatially and temporally, across all sectors
- ◆ **Risk scenarios:** focusing attention across professional sectors, on consequence analysis and issues that are location specific, time specific, sector-specific and community-specific.

- ◆ **Appropriate actions targeted to specific vulnerable groups** to mitigate loss and damage that have been based on procedures pre-defined and established by local authorities or communities.

Conclusions and Recommendations:

- ◆ There is a crucial need to implement an “early warning concept of the second generation” that must be multi-disciplinary and inter-sectoral, comprising sociological, economical, political, organizational and scientific wisdom.

Warning systems:

- ◆ to realize their full potential, warning systems must be properly embedded in integrated and coordinated national natural disaster reduction programs.
- ◆ In order to avoid conflicting advice and dangerous public confusion in potentially life-threatening situations, there must be only one official source of warning information to the community at large
- ◆ detailed studies are needed on the cost-benefit characteristics of warning systems of different levels of sophistication to enable governments to optimally balance their use of the resources available for natural disaster reduction.
- ◆ regular public education in the interpretation and use of warning information is essential.
- ◆ the design and operation of warning systems must be based unambiguously on the commitment to cooperation and information exchange and the concept of partnership in the overall public interest

The Flagship Programme of the UK National IDNDR Committee “Forecast and Warning”:

- ◆ good geophysical forecasts must be translated into fully useful warnings that will be received, understood and acted upon in time by populations under threat.
- ◆ Effective early warning includes. maintaining relationships, developing redundancy, maintaining lifelines, legal framework with links to the political center and to national disaster plans, public awareness of hazards and warnings, and recognizing the gaps existing between the public awareness of hazard warnings and the predictive capacities of scientists.

Guiding principles of effective early warning:

- ◆ Risk scenarios should take into account social, economic and cultural aspects of vulnerability and should involve local stakeholders as well as employ local knowledge in understanding vulnerability and hazard patterns.

IDNDR Early Warning Programme Action Plan for the Future:

- ◆ the future program for natural and related risk reduction (the successor arrangement to the IDNDR) should establish a high level working group on early warning. Based on the combined global and multi-sectoral experience and drawing upon the conclusions of the International Conference on Early Warning Systems for the Reduction of Natural Disasters held in Potsdam, Germany in September 1998. The high level working group should focus broadly on technical as well as public policy issues. Its objective would be to institutionalize guiding principles of early warning at local community, national, regional and international levels and ensure that the momentum for a coordinated approach to improving early warning generated during the past decade carries into the 21st century.

URBAN MEGA DISASTERS

Task Manager: Chinese National Committee for IDNDR (CNCIDNDR)
Moderator: Dr. Y. He, Deputy Director-General of the China Seismological Bureau, China
Rapporteur: Mr. D. Hollister, Asian Disaster Preparedness Center (ADPC), Bangkok, Thailand

Speakers:

- ◆ Mr. K. Nakashima, Secretariat of the Headquarters for Reconstruction of Hanshin-Awaji Area, Japan: "*Reconstruction from the Great Hanshin-Awaji Earthquake*"
- ◆ Dr. H. Yepes, Director, Geophysics Institute, Quito, Ecuador: "*Quito: Managing Earthquake Damage Scenarios and Volcanic Alerts*"
- ◆ Mr. D. Hollister: "*Disaster Reduction in Asian Cities- The Experience of the ADPC*"
- ◆ Dr. Y. He: "*Preparedness and Reduction of Urban Earthquake Disaster*"

Panel Discussion

Moderator: Dr. P. Mouroux, Bureau de Recherches Géologiques et Minières (BRGM), France

Panelists:

- ◆ Mr. S. Mustow, UK IDNDR Coordination Committee
- ◆ Dr. K. Priyadi, Institute of Technology of Bandung (ITB), Project Manager of the Indonesian Urban Disaster Mitigation Project and the RADIUS case study in Bandung, Indonesia
- ◆ Dr. H. Yepes

Content: This session discussed the measures as well as the government and public functions to reduce the risk of urban mega disasters. While big cities are growing rapidly worldwide, so is the risk of mega disasters. As the big cities usually play an important role economically and politically, internally as well as internationally, disasters could cause serious damage to the country and the world as a whole.

Experiences of **Japanese urban communities** in the response, rehabilitation and recovery process showed that planning and construction must be more disaster resistant (i.e. more open space, lower densities, wider streets, more resistant construction of infrastructure, buildings and shelter). As a result, the emergency response plan procedures and methods of need assessment as well as decision making were revised to be more comprehensive and faster.

In **Quito, Ecuador**, starting a real integrated program of volcano and landslide vulnerability reduction without raising first public awareness on risks proved difficult. Raising public awareness can be done efficiently by establishing disaster scenarios which also help identifying physical as well as social and economic vulnerability reduction actions.

The **ADPC Asian Urban Disaster Mitigation's Program (AUDMP)** is one possible model program for initiating vulnerability reduction actions in Asian cities. The AUDMP implements programs to raise public awareness on vulnerability reduction, build on existing national and local capacities and identify simple and affordable vulnerability reduction techniques with a view to transfer the ownership of these programs to national and local networks, thus promoting networking at national and community levels.

-⁴Progress made during the decade in **China** in establishing a practical and action oriented policy as well as a legal framework resulted in a nationwide program of earthquake vulnerability reduction in many Chinese cities. The success of the program is based on the strong political will of the government to fund and implement vulnerability reduction programs in the cities of China. It is worth noting that half of all deaths worldwide due to earthquakes have occurred in China.

Conclusions and Recommendations:

- ◆ Mitigation and planning of response to urban mega disasters is a complex and difficult inter-disciplinary process which should:
 - integrate cross institutional approach with focus on what happens to a city in a disaster and what can be done about it
 - be built on strong political will and public demand
 - recognize that city-managers are usually overwhelmed with normal daily pressures, priorities, and needs
 - obtain the support of local, national, regional and international networks as well as advocacy groups
 - be based on a mutual understanding and collaboration among community, business, municipal officials, and scientific/engineering sector
 - be integrated into the normal development process
 - apply simple, cost effective solutions that are appropriate to the context and needs of the community.

- ◆ The process that leads to vulnerability reduction in cities include the following basic steps:
 1. identify the problem (hazard and vulnerability assessment)
 2. identify, analyze, prioritize and select solutions (mitigation measures)
 3. take action (implement the vulnerability reduction program)
 4. Ready-Fire-Aim (act immediately in concrete terms)

APPLYING TECHNOLOGY FOR SHARING INFORMATION

- Task Manager:** Canadian IDNDR Coordination Committee represented by Prof. P. S. Anderson, Director of the Telematics Research Lab, Associate Director of the Centre for Policy Research on Science and Technology, Associate Prof. at the School of Communication, Simon Fraser University, Canada, and Member of the United Nations Scientific and Technical Committee (STC) on Natural Disaster Reduction
- Moderator:** Mr. C. Littleton, President of the Quixote Consultancies of Australia and Member of the United Nations STC on Natural Disaster Reduction
- Rapporteur:** Prof. P. S. Anderson
- Speakers:**
- ◆ Prof. P.S. Anderson: *"The role of Internet in Disaster Reduction"*
 - ◆ Mr. Wang Ang-Sheng, Chinese Academy of Sciences: *"Technology Applications in Disaster Reduction in China"*
 - ◆ Ms H. Molin-Valdes, Head of the IDNDR Office in Costa Rica: *"CRID Experience in Latin America"*
 - ◆ Mr. J. Devine, Senior Advisor, United States Geological Survey (USGS), USA and Mrs. E. Padovani, Senior Scientist USGS, USA: *"Advances in Disaster Information Delivery and Hazard Awareness"*

Content: From the role of Internet in disaster reduction to the use of integrated information management systems for vulnerability reduction; this session explored the future trends in information sharing and management and their applications in the specific domain of disaster prevention.

Over the last decade, the availability of information on natural hazards and disasters has increased enormously. This has occurred through new studies of the phenomena, an explosive expansion of global channels of communication and, perhaps most significantly, through the widespread of new information technologies, including CD-ROM, spatial technologies and the Internet. In the evolution of computer networking and its application in disaster reduction, the emergence of the Internet has empowered organizations to collaborate across disciplines, jurisdictions and geographical regions.

In China, strides are being made through the application of information technology in interdisciplinary collection and coordination of scientific and social-economic data with a view to establish a national synthetic database that can support real-time disaster impact assessment.

The significance and importance of effective dissemination of collected information in disaster reduction activities within Latin America and the Caribbean is exemplified by the development of the Centro Regional de Informacion Sobre Desastres (CRID). This Center consolidates information for all organizations in the region, using a multi-sectoral approach. It also works with other libraries and centers to broaden regional participation and encourage ongoing assessment. CRID uses a variety of information technologies to collect and distribute information including CD-ROM based virtual libraries and the Internet.

In the field of disaster information collection, integration and delivery, most significant is the advances being made in the way disaster information can be integrated and delivered to users through changes and extensions to open Global Disaster Information (GDI) specifications. As a result, interoperable geospatial products and other information consumables can be shared across the disaster reduction community. Efforts are currently underway to initiate a Global Disaster Information Network. Potential benefits from such an initiative were illustrated in a presentation of how the integration of digital maps, aerial photography, satellite imagery and other data was used to map impacts and assist in reconstruction efforts in Central America following Hurricane Mitch.

Conclusions and Recommendations:

There is a need to:

- ◆ Promote use of networking technology to ensure more effective and efficient delivery of customized disaster information to the right people at the right time and in the right form.
- ◆ Recognize that no single information technology will be appropriate for everyone.
- ◆ Promote geoprocessing, geodata, telecommunications interoperability, robustness and scalability as key elements of emergency management information infrastructures.
- ◆ Improve effectiveness of exchange of hazard-related information through international clearing houses and meta databases.

TOWARDS EARTHQUAKE SAFE CITIES: HOW TO REDUCE EARTHQUAKE DAMAGES

Task Manager: UN Centre for Regional Development (UNCRD)
Moderator: Prof. M. Kobayashi, Manager, Disaster Management Planning, UNCRD
Rapporteur: Dr. R. Shaw, RADIUS expert, International Consulting Division, OYO Corporation, Japan

Speakers:

- ◆ Dr. T. Katayama, Member of the United Nations Scientific and Technical Committee (STC) on Natural Disaster Reduction and Director General of the National Research Institute for Earth Science and Disaster Prevention, Japan: "International Cooperation in Disaster Mitigation: An Earthquake Engineer's Review on IDNDR"
- ◆ Mr. M. B. Karki, Secretary, Ministry of Science and Technology, Nepal: "Nepal's Experience with Earthquake Risk Management"
- ◆ Mr. K. Okazaki, IDNDR Secretariat: "The RADIUS Initiative: A practical approach to reduce urban seismic risk"
- ◆ Lic. J. M. Gastelum, Secretary General of Tijuana Municipality, Mexico: "The RADIUS case study in Tijuana, Mexico"
- ◆ Dr. M. Belazougui, Director of Centre National de Recherche Appliquée en Génie Parasismique (CGS), Algeria, Member of the STC: "Seismic Risk Assessment and Management in Urban Areas: The Addis Ababa (RADIUS Case Study) Example"

Panel Discussion

Panelists:

- ◆ Dr. R. Shaw
- ◆ Dr. J. Ryrin, RADIUS Regional Advisor, Director of the Center for Earthquake Research Australia (CERA), Australia

Content: It is now recognized that a relatively low-seismic zone is facing high risk depending on the vulnerability of its structures. In developing countries, their exposure to risk of developing countries is gradually increasing due to the rapid growth of their population. This risk can be mitigated by a closer cooperation among the governments, local communities, businesses, NGOs and international organizations. Natural disaster mitigation is an essential part of the sustainable development and requires availability of funds. Infrastructure development and disaster management should match new demands as developing countries become more closely integrated into the global economy. In this respect, there is a need for small and realistic projects to undertake effective measures towards disaster reduction activities, such as the IDNDR RADIUS Initiative, the International Association for Earthquake Engineering (IAEE) and the World Seismic Safety Initiative (WSSI), all related to cities at risk. These type of initiatives could be reproduced in many other cities in the 21 century.

In Nepal, a project on earthquake risk management has been launched, with special emphasis on awareness raising. A significant aspect of this project is the establishment of an Earthquake Safety Day as a yearly event for raising awareness among all stakeholders. The HMG of Nepal is deeply committed to continue these efforts.

The RADIUS initiative is one of the IDNDR projects in the field of earthquake risk mitigation and is funded mainly by the Government of Japan. Nine cities worldwide have been selected as case studies, while more than 70 others are participating in information exchange programs. RADIUS case studies are built around three stages of earthquake risk management :

- 1) assessment (which leads to a scenario),
- 2) planning (which leads to the action plan or disaster plan), and
- 3) implementation (which leads to real actions).

For instance, The RADIUS project for the case study city of Tijuana was implemented by collecting data for the preparation of a damage scenario involving an earthquake estimated at M'6.5. Seismic awareness raising in the community was also an important aspect of the project, which is still in progress so as similar initiatives in cities in Africa, Europe, Middle-east and Asia. The success of the RADIUS initiatives requires that case study cities

- 1) share experience with other cities,
- 2) ensure community based participation at grass-root levels,
- 3) sustain efforts in disaster management, and
- 4) incorporate these efforts in future development planning.

The methodology applied by the RADIUS project is unique and could be of great benefit to other disaster prone cities in the world: small or mega cities, in developing countries or developed countries, threatened by earthquake or other disasters. The RADIUS project proved to be an excellent tool for an integrated international cooperation.

Conclusions and Recommendations:

- ♦ RADIUS type initiatives should be continued beyond the decade, as it can be applied to other types of disasters. Accumulated knowledge should be disseminated at national and regional level. Efforts provided should be institutionalized at local level in order to ensure sustainability.
- ♦ The success of this type of initiatives depends on the support of bilateral and international funding agencies through demonstration projects, case studies and pilot projects. An integrated international cooperation is highly desirable.
- ♦ Further initiatives are needed on the participation of people at the grass-root level to ensure capacity building within local communities.

GEOLOGICAL HAZARD ASSESSMENT - How Science Tries to stop Hazards from becoming Disasters

- Task Manager:** International Council for Science (ICSU)
Moderator/ Rapporteur: Prof. H. Th. Verstappen, Chairman ICSU-SC/IDNDR, International Institute for Aerospace Technology and Earth Sciences (ITC), Netherlands
- Speakers:**
- ◆ Prof. D. Giardini, Geophysical Institute ETH Zurich, Switzerland: *"The Global Seismic Hazard Assessment Programme /GSHAP"*
 - ◆ Prof. H. Kienholz, Department of Geography, University of Bern, Switzerland: *"Mountain Hazards: Tools for Risk Management"*
 - ◆ Mr. K. Hoshina, Director, SABO Technical Center, Japan: *"Countermeasures Against Volcanic Disaster of the On Mt. Unzen-Fugendake"*
- Content:** Hazard assessment is the first step to reduce the impact of natural disasters. This session discussed methodologies for seismic, mountain, and volcanic hazard assessment, taking into consideration how science can prevent hazards from becoming disasters.

The Global Seismic Hazard Assessment Program (GSHAP) was launched in 1992 by the International Lithosphere Program (ILP) with the support of the International Council of Scientific Unions (ICSU), and endorsed as a demonstration program by the UN IDNDR. The GSHAP was implemented during the 1992 - 1998 period, with the support of and in coordination with other initiatives from various entities (ILP, ICSU, UNESCO, IASPEI, the European Council and European Community, NATO and INTAS). The GSHAP promotes a regionally coordinated and homogeneous approach to seismic hazard evaluation with the view to mitigate risk associated with the recurrence of earthquakes. It aims at improving national and regional assessments of seismic hazards for the use of national decision makers as well as engineers in order to allow more effective land use planning, building design and construction work in terms of disaster prevention. The GSHAP strategy has consisted in establishing a mosaic of key multi-national test-areas under the coordination of selected regional centers. In each region, multi-disciplinary working-groups have contributed to the assessment of probable seismic hazard (earthquake catalogues, seismotectonics, strong ground motion attenuation). These regional activities extended to whole continents resulted in the production of the Global Map of Seismic Hazard presented for the first time at the Programme Forum. This map counts 100 main contributors and more than 400 globally. Its publication along with the results of completed regional activities is under way. Regional reports, GSHAP yearly reports, summaries and maps of seismicity, source zones and seismic hazards can be found on the GSHAP home page <http://seismo.ethz.ch/GSHAP/>.

Many **mountain disaster** losses are the predictable result from interactions between the physical environment, including hazardous events, and the human structures. A modern strategy to cope with mountain hazards should foreseen comprehensive risk management and follow systemic approaches in the planning and realization of concepts. It is a general understanding that risk management includes two main categories:

- 1) Prevention strategies, and
- 2) Event management.

A major precondition for a comprehensive mountain risk prevention is to undertake in-depth risk analyses for the modeling of "mountain risk systems". These systems will indicate the appropriate timing for possible interventions according to the following measures:

- 1) Preventive intervention to the hazardous processes
- 2) Preventive intervention to the vulnerable elements (e.g. hazard zoning)
- 3) Integrate results of measures 1) and 2) in early warning and prevention systems
- 4) Monitor the above for efficiency purpose
- 5) Provision of suitable tools for education

Mt. Unzen-Fugendake resumed volcanic activity after an interval of almost 100 years. Pyroclastic flows and debris flows occurred repeatedly causing more than 40 victims, dead or missing. Disaster prevention projects are presently being conducted by the Unzen Restoration Project Office, Ministry of Construction. The occurrence of a pyroclastic flow cannot be predicted and its detection is ensured at the earliest possible stage by remote-controlled monitoring cameras. Debris flows, on the contrary, can be predicted to some extent by observing rainfall patterns causing debris flows through the use of radar rain/gauges. The Shimabara City Office undertook the creation of a hazard map of volcanic disasters due to lava flows, pyroclastic flows and debris flows. This map proved useful for the safeguard of lives and property in the area. The Unzen Restoration Project Office is currently carrying out the construction of sediment control dams as well as training against debris flows and other debris related disasters. New techniques of RCC and CSG methods were adopted and developed during construction including the introduction of remote controlled execution of constructions for test fields where it is extremely dangerous to work.

Conclusions and Recommendations:

- ◆ Specific elements of geological hazard assessment should include.
- ◆ Global assessment and coordination
- ◆ Dynamics of extreme events and their impact on society
- ◆ The engineering responses to disaster reduction challenge

CONCLUSIONS ON SCIENCE AND TECHNOLOGICAL CONCERNS BY : Prof. M. Erdik, Special Rapporteur for the day

Within the context of risk reduction, science and technology are essential tools for achieving sustainable development while providing protection of lives and property. Science and Technology have also a major role to play in natural disaster risk assessment (hazard, vulnerability and loss).

Aware of the importance of the place of science and technology in future actions in the field of disaster reduction, the IDNDR recommends to:

- ♦ Foster scientific and technical endeavors;
- ♦ Disseminate technical information and;
- ♦ Devise guidelines to apply scientific knowledge towards the assessment and mitigation of natural disasters

Several papers presented under the overall theme "Science and Technological concerns" discussed techniques and applications on geologic, hydrologic and meteorologic hazards assessments. The international demonstration project "Global seismic Hazard Assessment Project" has standardized approaches to seismic hazard assessment and resulted in global probabilistic seismic hazard maps. The regions of the world prone to natural hazards are now delineated. Nevertheless, research should continue to advance our understanding of the physical phenomena associated with natural hazards and improve our predictive skills. Developments in space technologies, satellite imagery and computation power will provide assistance in this respect. In the coming decades, multiple hazards hitting complex urban environments will present new challenges for assessment and mitigation. Such hazards can occur simultaneously or in sequence to create cumulative and synergistic impacts.

Assessments of elements at risk including physic, social and economic vulnerabilities to various hazards, were the subject of a series of presentations. These assessments ranged from community to regional levels. Special mention should be made of a significant study on the delineation and quantification of vulnerabilities in India. Realistic risk assessments in the future should consider environmental vulnerability as an important factor, given that several natural hazards pose a threat to environment and ecosystems.

Loss assessment studies have been covered under the headings "Risk Simulation" and "Damage/Loss Scenario". The advances made so far in computer and Geographic Information System (GIS) technologies allow the development of virtual simulations of damaged caused by earthquake, flooding, meteorological changes, forest fire etc. Such simulations will with no doubts be in the near future an integral part of public awareness raising and political sensitization on risk mitigation.

As repeatedly shown during the Programme Forum presentations on science and technological concerns, an integrated, inter-sectoral and inter-disciplinary approach to risk mitigation is essential: all scientific and technical tools and efforts have to be integrated in social, economic and environmental actions for risk reduction within the context of sustainable development. An important role of science and technology in risk reduction lies also in the identification and application of structural measures for the modification of natural hazards (if and when possible) and the reduction of vulnerability. Although significant progress have already been made, structural engineers can still learn a great deal from physical damages after exposure to natural hazards. There is a need for focused researches to be carried out on the improvement of the content, application and enforcement of hazard resistant building codes.

During the decade as well as in this Programme Forum, themes such as risks associated with population concentrations, early warning and information technology have emerged as specific

scientific and technological issues to be considered in the risk reduction agenda of the future:

- ♦ **Risks associated with population concentrations** exposed to natural hazards are and will remain an important problem of risk management. At least three thematic sessions were dedicated to urban earthquake risk and earthquake-safe cities with examples of Japanese, Mexican and Chinese experiences and applications. An important project undertaken by the IDNDR Secretariat, the RADIUS Project, has conducted urban earthquake risk assessment studies and identified appropriate risk mitigation strategies for nine cities throughout the world. It is expected that in the coming years such urban risk strategies will be in place for all major urban areas exposed to earthquake and other hazards. A new project on twin cities prone to earthquake have already been formulated under the Earthquakes and Megacities Initiative with the view to encourage joint action in earthquake risk mitigation research and applications.
- ♦ **Early warning** is a process of scientific analysis for technical forecasting of a natural hazard. The Potsdam Early Warning Conference has called for the need to expand the use of technologies related to observation, analysis and communication for early warning purpose. For early warning can only be effective if science and technology are being taken into account as much as networking, organizational and social aspects. Although there is still room for improvements, early warning is successfully applied for most atmospheric and oceanographic hazards. Further developments are however necessary to achieve the same for earthquakes, flash floods and volcanic hazards.
- ♦ In addition to a specific thematic session, a substantial number of presentations discussed the issue of the application of the **information technology** in risk mitigation and disaster management, using keywords such as "Database", "GIS", "Satellite Imagery" and "Information Culture". Information technology stands to be the important tool of the future for risk assessment and risk management. The communication of information on natural hazards, risks and mitigation through the Internet has considerably increased our capability to reduce risks. What is needed now is to make the software and hardware pertaining to the information technology more users friendly in order to reach a larger audience. Current trends show that real time information will be of paramount importance for hazard detection and loss prevention. To this end information acquisition, processing and communication have to be further improved.