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03 Reducing Disaster Risks through Science: Issues and Actions

Report of the ISDR Scientific and Technical Committee[1]

ISDR
International Strategy for Disaster Reduction

Disasters, disaster risk reduction, and the role of science

1. Increasing attention is being given to the rising impacts of disasters and to ways to reduce the exposure and vulnerability of communities and assets to natural hazards. In 2008, 321 disasters killed 235,816 people, affected 211 million others and cost a total of US$181 billion[2]. Economic losses from disasters in some countries have been greater than their national GDP. Losses with potentially catastrophic implications for the global economy include the possibility of a major earthquake in Tokyo (which seismologists assess could occur at any time within the next 150 years) with an estimated cost of US$ 1.2 trillion. However, although natural hazards will always occur, their impacts on society can be significantly reduced through the application of sound, evidence-based investments in disaster risk reduction.

2. Recognising the importance of scientific and technical information for disaster risk reduction, the UNISDR established a Scientific and Technical Committee to address policy matters of a scientific and technical nature, where science is considered in its widest sense to include the natural, environmental, social, economic, health and engineering sciences, and the term 'technical' includes relevant matters of technology, engineering practice and implementation[3]. The Committee decided at its second meeting on 30-31 October 2008 to prepare a short report for presentation at the Second Session of the Global Platform for Disaster Risk Reduction, in Geneva, 16-19 June 2009, in order to highlight the use of scientific and technical knowledge as an essential foundation for disaster risk reduction, and to make recommendations on key issues and priorities. This includes ways that specialist scientific and technical information can be more effectively adopted and put into practice. The present report is drawn from a longer report that will be released separately.

Practical applications of natural and social sciences to reduce vulnerability

3. Disasters are a concern for almost all countries and are growing in terms of people affected and economic losses. The number, scale and cost of disasters are increasing mainly as a consequence of growing populations, environmental degradation, unplanned settlements, expanding and ageing infrastructure, growing assets at risk, and more complex societies. By 2050 it is expected that the number of megacities in the world, many of which are located in exposed coastal zones or river plains, will have increased by a third. A changing climate will

increase the risks for many regions. Risk and resilience are affected by the appropriateness of building design, urban planning and infrastructures for local circumstances.

4. Natural hazards strike hardest on the poor[4]. Disparities in vulnerability to natural hazards arise from wide gaps in access to resources and capacities for risk reduction associated with poverty and socio-cultural stratification. Addressing these factors and their damaging roles in development will require good foundations of social and economic knowledge and information, and the development of relevant scientific and technical capacities especially in developing countries. Related objectives to develop societal resilience are similarly dependent on sound scientific and technical knowledge.

5. The integration of science into policy development and implementation and practical problem solving can make major contributions to disaster risk reduction. Many examples exist—success stories but also failures—that reveal the importance of science and technology to disaster risk reduction.

6. For example, following a major cyclone in 1977 that resulted in about 20,000 deaths on the east coast of India, an early warning system was established, complete with meteorological radars and emergency plans. When the same area was hit by cyclones of similar strength in 1996 and 2005, the death tolls were just 100 and 27 respectively. On the opposite side of the world, operational real-time satellite remote sensing systems are being used to provide rapid assessments and potentially crucial information for disaster prevention for Fuego volcano, Guatemala.

7. Over many decades, seismology, engineering sciences and building administration have progressively developed design codes and standards to improve the earthquake resistance of buildings and infrastructures. Where these have been vigorously implemented in new buildings and through retro-fitting schemes for existing buildings, for example in earthquake-prone Japan and California, USA, the loss of lives and damages due to earthquakes have been very significantly reduced. Accompanying risk assessments and public education programmes have contributed to high levels of awareness and preparedness of the population.

8. Throughout the world, millions of people living near rivers benefit very greatly from flood forecasting and evacuation systems and other risk management practices, and from the sustainable management of rivers and the use of flood plains. This is a major scientific and technical achievement that draws on the systematic integration of knowledge from meteorology, hydrology, agriculture, forestry, water and natural resources management, engineering and land-use planning.

9. Conversely, the Indian Ocean tsunami of 26 December 2004 provides a stark reminder of the catastrophic consequences that can ensue when scientific and technical findings are not transferred into policies and actions. Seismologists understood the seismic risks of the region and oceanographers had promoted the need for a tsunami warning system, but no integrated warning system had been implemented. Likewise, the hazard assessment recommending no building near Montserrat’s Soufriere volcano was ignored, leading to over US$ 100 million of infrastructure damage during a subsequent eruption. In the United Kingdom, the severe damage and health problems that followed the 2007 floods revealed that warning

communications were not sufficiently clear, timely or coordinated, and people, local government and support services were unprepared.

Selected topics - climate change, early warning, health and societal resilience

10. Rather than attempt to cover all of the dimensions of concern to disaster risk reduction—which cover diverse geographical and environmental settings, time frames, hazard types, different communities, sectors, and institutional issues—the ISDR Scientific and Technical Committee has decided for this report to focus on four key selected topics, namely climate change, early warning systems, public health, and socio-economic resilience. These are topics of current policy concern for which immediate science-based actions are needed and possible. Other important topics, such as seismic risk prevention and reduction and the role of ecosystems in risk reduction and management, will be examined in future reports.

11. The basic facts of climate change are now well established, which itself represents an outstanding achievement for science and for policy-relevant international scientific cooperation. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)[5] projects increases in intensity or frequency for several types of extreme weather conditions, such as heat waves, droughts, storms, tropical cyclones and heavy rainfall, and their impacts will be compounded by other projected effects, such as sea level rise and reduced water supplies that will reduce the capacities of communities to cope with extreme events.

12. There is an urgent need to systematically link disaster risk reduction and climate change adaptation policies. This connection is recognised in the UNFCCC Bali Action Plan, which is guiding the preparations for a new agreement on climate change at the end of 2009 in Copenhagen. Another significant step is the decision by the IPCC to prepare an IPCC Special Report on "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation"[6], following a proposal jointly developed over 2008 and 2009 by UNISDR and Norway. This will provide a sound scientific basis for action to reduce the growing risks of disasters and to support UNFCCC policymaking and practical adaptation to climate change.

13. When properly implemented and adhered to, warning systems are a high-payoff activity to reduce disaster impacts and save lives, and for this reason, virtually all governments systematically invest in science-based early warning capacities, particularly through national weather services. Large populations are often evacuated from risk areas in response to timely warnings, for example in response to tropical cyclone alerts. Integrated all-hazard early warning systems that address time scales of minutes through to decades will be an important feature of climate change adaptation plans.

14. The natural sciences have generated a good understanding of the causes and behaviour of most natural hazards and together with the engineering sciences have enabled the development of effective surveillance and prediction systems. The health sciences have made similar achievements for health-related hazards and impacts. The social sciences have created a growing body of understanding of human resilience, the factors that influence people's attitude to risk and behaviour during a crisis, as well as the effectiveness of warning messages, channels for distributing messages, and mechanisms for eliciting public response.

15. There is a growing evidence base upon which we can improve our understanding of the health impacts associated with disasters, which are now recognised to extend well beyond the immediate crisis phase. What is now needed is continued support for multi-disciplinary research in this field coupled with efforts to translate knowledge into more effective policy and to bridge the gaps between environmental, humanitarian, development and governmental actors. Health sector responses to disasters need to be extended to take into account the whole breadth and longer timeframe of potential health impacts, including and beyond preparedness and recovery, in order to mitigate the total health, societal and economic burden of disasters.

16. Social and economic understanding is critical for building resilience and reducing disaster risks. Social science research provides significant insights into the conditions and processes that create inequity in exposure and vulnerability and that lead to the establishment of the unsafe conditions that characterize vulnerable communities. Such analysis can help us understand the complex factors involved, for example, in why people in some cities expose themselves to landslides by building houses in steep ravines, or settle on the slopes of still-active volcanoes. Other key issues to consider are the nature of individual risk perception, the influence of institutional, social and economic conditions, and the limitations imposed by poverty, lack of experience, short-term goal focus and weak governance.

Achieving a more effective interplay of science, technology and policy

17. The Scientific and Technical Committee considers that much greater effort is needed to achieve more effective interplay of science, technology and policy in support of disaster risk reduction. This requires attention to three key areas: (i) better mechanisms for integrating science and technology into policy processes; (ii) greater interaction and collaboration among the scientific and technical disciplines including at international level; and (iii) systematic efforts to build relevant scientific and technical capacities.

18. In respect to the first of these, disaster risk reduction requires strategic planning and implementation as well as technical and scientific expertise. It sits at the interface of policy-making, engineering and scientific research, and requires a close and continuous exchange among these fields in order to provide effective and durable solutions.

19. Secondly, diverse expertise from different fields of science is needed in order to produce well-suited solutions to risk-related problems. The science community has to learn to find better and faster ways to interact and to communicate substantial findings to policy makers and to support the development and implementation of solutions for emerging problems. This is not just a matter of developing trans-disciplinary processes among the natural sciences and engineering but also of fully incorporating the insights and methodology of social sciences and humanities into problem-solving approaches. Applied research, such as in the health and engineering sciences, provides a sound grounding in tried-and-tested best practice to practical solutions for prevention, preparedness and response. International collaboration is essential to maximise the benefits of science.

20. Thirdly, technical capacities for the provision of information and services may be unavailable or not adequately developed, constraining the prospects for sustainable development. There is

an ongoing need for investment in research of both basic and applied types. The role and expertise of scientific institutions in developing countries are often not well recognised or supported, either within national priority setting or by international agencies. Yet it is these institutions, such as universities, geophysical, agricultural and health institutes and meteorological services that nurture and develop the essential bases of local knowledge for disaster risk reduction, and that can be the most effective advisers and communicators with leaders and local communities.

Recommendations

21. Following the considerations above, and as detailed more fully in the associated full report, the Scientific and Technical Committee makes the following recommendations.

(i) Promote knowledge into action

Greater priority should be put on sharing and disseminating scientific information and translating it into practical methods that can readily be integrated into policies, regulations and implementation plans concerning disaster risk reduction. Education on all levels, comprehensive knowledge management, and greater involvement of science in public awareness-raising and education campaigns should be strengthened. Specific innovations should be developed to facilitate the incorporation of science inputs in policymaking.

(ii) Use a problem-solving approach that integrates all hazards and disciplines

A holistic, all-hazards, risk-based, problem-solving approach should be used to address the multi-factorial nature of disaster risk and disaster risk reduction and to achieve improved solutions and better-optimised use of resources. This requires the collaboration of all stakeholders, including suitable representatives of governmental institutions, scientific and technical specialists and members of the communities at risk. Knowledge sharing and collaboration between disciplines and sectors should be made a central feature of the approach, in order to guide scientific research, to make knowledge available for faster implementation, to bridge the various gaps between risks, disciplines, and the stake-holders, and to support education and training, and information and media communication.

(iii) Support systematic science programmes

Systematic programmes of scientific research, observations and capacity building should be supported at national, regional and international levels to address current problems and emerging risks such as are identified in this report. The international Integrated Research on Disaster Risk (IRDR) Programme[7], which is co-sponsored by ICSU, ISSC, and UNISDR, provides a new and important framework for global collaboration. The ISDR Scientific and Technical Committee should provide strategic guidance on research needs for disaster risk reduction and oversight of progress.

(iv) Guide good practice in scientific and technical aspects of disaster risk reduction

The ISDR Scientific and Technical Committee should be strengthened to serve as a neutral, credible international resource to support practitioners at all levels, from local through national to international levels, by overseeing the collection, vetting and publicising of information on good practices carried out on the basis of sound science and up-to-date scientific and technological knowledge, as well as on those inadequate practices or concepts

that may be hindering progress. The Committee should further develop its recommendations for follow-up on the areas of concern highlighted in the present report, including on the themes of disaster risk reduction and climate change adaptation, preparedness and early warning systems, health impacts of disasters, and the association of disaster risk and socio-economic factors.

References

(Further detailed references are provided in the full report of the ISDR-STC, published sep

[1] The membership of the Scientific and Technical Committee (STC) comprises the following representatives of United Nations and international scientific organizations and independent experts. Dr. Walter Erdelen (Chair of the STC), Assistant Director General, Natural Sciences, France, representing UNESCO. Dr. Howard Moore, Senior Advisor, ICSU Secretariat, representing ICSU. Dr. Juan Carlos Villagrán de León, Head, Risk Management Section, UNU–EHS, Germany, representing UNU. Dr. Samir Ben Yahmed, Director, Health Action in Crises, Switzerland, representing WHO. Dr. Geoff Love, Director Weather and Disaster Risk Reduction Services Department, Switzerland, representing WMO. Dr. Walter Ammann, Chairman, International Disaster Reduction Center, Switzerland. Professor Ilan Chabay, Göteborg University and Chambers, Sweden. Dr. Mohamed Farghaly, Director General, Arab Academy for Science, Technology and Maritime Transport of the League of Arab States, Egypt. Professor Gordon McBean, Institute for Catastrophic Loss Reduction, The University of Western Ontario, Canada, representing the IRDR. Professor Mohsen Ghafory-Ashtiany, International Institute of Earthquake Engineering and Seismology (IIEES), Iran. Professor Harsh Gupta, National Geophysical Research Institute (NGRI), India. Professor Virginia Murray, Consultant Medical Toxicologist, Health Protection Agency, United Kingdom. Professor Laban A. Ogallo, Director, IGAD Climate Prediction and Applications Centre (ICPAC), Kenya. Dr. Kaoru Takara, Vice Director, Disaster Prevention Research Institute (DPRI), Kyoto University, Japan. Professor Dennis Wenger, National Science Foundation, United States. The UNEP representative remains to be nominated. Dr. Reid Basher, UNISDR, supports the Committee.

[2] See http://www.unisdr.org/eng/media-room/press-release/2009/pr-2009-01-disaster-figures-2008.pdf. Disaster statistics and summaries are available from (i) Centre for Research on the Epidemiology of Disasters (CRED), at website http://www.cred.be, (ii) Munich Reinsurance, at website http://www.munichre.com/en/ts/geo_risks/natcatservice/default.aspx, and (iii) UNISDR, at website http://www.unisdr.org/disaster-statistics/introduction.htm (All accessed on 14 May 2009.)

[3] ISDR-STC (2008). Scientific and Technical Committee, International Strategy for Disaster Reduction, Report of the Second Meeting, Geneva, 30 - 31 October 2008. 10pp.

[4] 2009 Global assessment report on disaster risk reduction: risk and poverty in a changing climate, UNISDR, Geneva, 207 pp. Summary at: http://www.preventionweb.net/english/professional/news/v.php?id=9425. Full report at http://www.preventionweb.net/english/hyogo/gar/report/index.php?id=9413&pid:36&pil:1. http://www.preventionweb.net/english/hyogo/gar/?pid:3&pil:1 (accessed 18 May 2009).

[5] IPCC (2007a). Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA.

[6] IPCC, 2009. *IPCC To Prepare Report on Extreme Events and Disasters*, Press statement by the Intergovernmental Panel on Climate Change, 23rd April 2009, On website at http://www.ipcc.ch/pdf/press-releases/ipcc_pr_antalya_april_2009.pdf. (Accessed 9 May 2009).

[7] International Council for Science (2008) A Science Plan for Integrated Research on Disaster Risk: Addressing the challenge of natural and human-induced environmental hazards. On website at http://www.icsu.org/Gestion/img/ICSU_DOC_DOWNLOAD/2121_DD_FILE_Hazard_report.pdf (Accessed on 4 April 2009).