8 Science and technology

A resilient planet needs robust science for disaster risk reduction. It is clear from any review of the disaster risk landscape that progress can be made in saving lives, jobs and critical infrastructure, but only by integrating science into both policy-making and best practice for disaster management. An international science advisory mechanism is urgently required to lead the process of this integration.

Lead author: Virginia Murray

The role of science in disaster risk reduction[148]

- **For DRR, scientific capacities must be interpreted broadly to include all relevant matters of a scientific and technical nature, to include the natural, environmental, social, economic, health and engineering sectors. Similarly, the term 'technical' includes relevant matters of technology, engineering practice and implementation.**
- **Scientific and technical work often requires the participation of practitioners and other intermediaries in addition to scholars and scientists.**

Science needs to inform policy and practice for DRR[149]

- **Currently 107 national scientific academies/institutions exist, but it is unclear if and to what extent they contribute towards informing policy-makers on disaster risk reduction or management.**
- **A recent review revealed that only 11 countries have a government chief scientific advisor; scientists in these roles are positioned to inform and support decision-makers.[150]**

Using science for DRR: Examples of Evidence[151]

MAPPING HAZARDS AND DISASTER RISKS IN CHINA

Over the past 30 years China has promoted and implemented DRR measures using scientific evidence communicated through an atlas. Published in 1992, and updated and improved in 2003, the *Atlas of Natural Disaster System of China* and the *Atlas of Natural Disaster Risk of China*, published in 2010, have increased the emphasis on evidence-based risk assessment and regional variations, significantly increasing regional capacity in disaster prevention and risk mitigation. This work is believed to be a contributing factor to the general decrease in annual deaths and the reduction in relative economic losses seen in the past two decades.

WATCHING THE RAINS TO BUILD RESILIENCE IN THE AFRICAN SAHEL

In 2011, user-friendly Rainwatch products were provided directly to the Office of the President and the Direction de la Météorologie Nationale du Niger (DMN), to help them assess the monsoon. The DMN provides climate information to the Ministry of Agriculture, which then combines it with in-field phenological data to assess the growing season. This information is used by the Council of Ministers to issue early warnings to the people of Niger.

TSUNAMI WARNING AND MITIGATION FOR THE INDIAN OCEAN

The Indian Ocean Tsunami Warning and Mitigation System now provides warnings to all Indian Ocean countries, reaching millions of people who had no warnings in 2004.

BUILDING RESILIENCE TO EARTHQUAKES IN CHILE

An earthquake with a magnitude of 8.8 struck central Chile on 27 February 2010. Around 300 people lost their lives due to collapsed buildings, but well-enforced, science-based seismic building codes are believed to have been a major reason for the relatively low number of casualties. It is estimated that only about 1% of the total building stock in the affected area was damaged, demonstrating that integration of science into building practice can and does save lives and livelihoods.

PREVENTING CONGENITAL RUBELLA SYNDROME

Rubella has been eliminated in the Americas; this means less than one case per 100,000 births. Experiences here have been turned into guidance to support elimination of the disease in other regions of the world. Lessons identified include: high-level commitment and partnerships are essential; political commitment must be linked with technical strategies; proven surveillance tools must be used; outstanding performances by individual countries should be recognised; and ongoing training should be provided for surveillance staff. The number of World Health Organization (WHO) member states using rubella vaccine in their national immunisation programmes is continuing to grow, increasing from 83 out of 190 member states (44%) in 1996 to 130 out of 194 (67%) in 2009.

ASSESSING VULNERABILITY TO IMPROVE RISK REDUCTION

In the United States, the Social Vulnerability Index (SOVI) has helped to improve long-term recovery efforts from Hurricane Sandy in 2012. The Federal Emergency Management Agency (FEMA) integrated a social vulnerability index into its planning and decision support metrics to assess the likely capacity of affected communities to respond and recover from the hurricane. This has allowed more targeted allocation of resources for recovery.

FLOOD EARLY WARNING IN BANGLADESH

Since 2004, Bangladesh's Flood Forecasting and Warning Centre (FFWC) has been using its model to produce daily flood forecasts for 7–10 days ahead. Bangladesh experienced three major floods in 2007 and 2008: each was forecast successfully 10 days in advance and action was taken to mitigate their effects. Communities moved to evacuation points in advance, nets protected fisheries, crops were harvested early, households were warned to store food and drink and mechanised boats were readied in case of evacuation.

EARTHQUAKE EARLY WARNING FOR JAPANESE BULLET TRAINS

On the afternoon of 11 March 2011, a seismometer on Kinkazan Island on the northeast coast of Japan detected seismic P-waves and sent an automatic stop signal to the Shinkansen network's electric power transmission system, triggering emergency brakes on 27 bullet trains. Ten seconds after the warning signal went out, a massive 8.9 magnitude earthquake hit mainland Japan. Although the Great East Japan Earthquake and the tsunami that followed it caused immense destruction and loss of life, none of the 19 trains running through the affected area was derailed and no casualties were sustained on them.

FLOOD RISK REDUCTION IN THE NETHERLANDS

The 'Room for the River' plan in Nijmegen, the Netherlands, has turned the threat of river flooding into an opportunity to create a whole new waterfront and an urban island in the River Waal. This was a difficult decision to make as relocation of a dyke would result in the demolition of 50 houses and a number of businesses; however, this was seen as the best and safest option to protect Nijmegen from floods now and in the future.

SUMMARY OF RECOMMENDATIONS

Science needs to be thoroughly integrated into the post-2015 framework for DRR. In particular:

- The scientific community must demonstrate that science can inform policy and practice. Evidence must be shown of the added value of a science-based approach to DRR.
- A problem-solving approach to research should be encouraged, one that integrates science into all hazards and disciplines.
- Knowledge should be promoted as a key feature of action, with key activities underpinned by evidence.
- An international science advisory mechanism for DRR needs to be created.

An agenda to establish and promote an international science advisory mechanism for DRR in the post-2015 framework is needed to:

- champion and reinforce existing and future programmes and initiatives for integrated research and the scientific assessment of disaster risk
- strengthen the evidence base to effectively reduce disaster risk and enhance resilience, using scientific information and evidence to support implementation.

The mechanism should draw on existing programmes, initiatives and resources and should introduce new elements where appropriate. These could include, but not necessarily be limited to:

- producing periodic reports on current and future disaster risks and on the status of efforts to manage such risks
- monitoring progress towards internationally agreed targets for reducing disaster losses
- providing guidance on terminology, methodologies and standards for risk assessments, risk modelling, taxonomies and the use of data
- convening stakeholders to identify and address demands for scientific research, information and evidence
- Enhancing the communication of complex scientific information and evidence to support the decision-making of policy-makers and other stakeholders.

How science and technology are featured in the HFA

The General Assembly in its resolution 44/236 of 22 December 1989 (www.un.org/documents/ga/res/44/a44r236.htm) stated:

'The Secretary-General is requested to establish, with due regard to equitable geographical representation and covering the diversity of disaster mitigation issues, a scientific and technical committee on the International Decade for Natural Disaster Reduction, consisting of 20–25 scientific and technical experts selected in consultation with their governments on the basis of their personal capacities and qualifications, including experts from the organs, organisations and bodies of the United Nations system.

The role of the committee shall be to develop overall programmes to be taken into account in bilateral and multilateral cooperation for the decade, paying attention to priorities and gaps in technical knowledge identified at the national level, in particular by national committees, as well as to assess and evaluate the activities carried out in the course of the decade and to make recommendations on the overall programmes in an annual report to the Secretary-General.'

However, in the HFA 2005–2015 this committee was not continued in the same way and was more generally required to support the development and sustainability of the infrastructure and scientific, technological, technical and institutional capacities needed to research, observe, analyse, map and where possible forecast natural and related hazards, vulnerabilities and disaster impacts.[152]

As a consequence of this concern, UNISDR set up the Scientific and Technical Advisory Group (STAG) to provide substantive technical advice and support in the formulation and implementation of activities carried out by the broad International Strategy for Disaster Risk Reduction (UNISDR) community. It was formed in 2012, succeeding the Scientific and Technical Committee (STC) which started work in 2008. The members of the STAG are drawn from across the globe and from different scientific disciplines.[153]

How science and technology are featured in statements and consultations on the successor to the HFA

Chair's Summary

'It is expected that the HFA2 will recognize the need to govern disaster risk reduction and resilience through clear responsibilities, strong coordination, enabled local action, appropriate financial instruments and **a clear recognition of a central role for science**' (p. 4).

Mid-Term Review

'Recognising the importance of scientific and technical information for disaster risk reduction UNISDR established a **Scientific and Technical Committee in 2008** 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. In its report – *Reducing Disaster Risks through Science – issues and actions*, to the Global Platform 2009, the committee concentrated on addressing: climate change; changing institutional and public behaviour to early warnings; incorporating knowledge of the wide health impacts of disasters; improving resilience to disasters through social and economic understanding. The Scientific and Technical Committee made the following recommendations: promote knowledge into action; use a problem-solving approach that integrates all hazards and disciplines; Support systematic science programmes; guide good practice in scientific and technical aspects of disaster risk reduction' (p. 35).

'A new instrument would find new opportunities: the economic case for greater investment in disaster risk reduction is getting stronger, and **scientific innovation and technological progress** will open up better and more cost-effective means to tackle disaster risk' (p. 65).

Elements Paper

'The availability of open source and open access science-based risk information and knowledge is instrumental to cost-benefit analysis, transparent transactions, accountability, and the development of partnerships across public, private and other stakeholders' (p. 7).

In order to make progress towards the expected outcome and strategic goals, public policies on risk management need to be underpinned by appropriate governance frameworks that incorporate actions not only by national and local governments but also by civil society, the private sector, the science and academic sector and others. Such a governance approach would reflect the increasing prevalence of innovative and networked partnerships and alliances between different sectors, as effective means to address development challenges. Similarly, the public policies will need to be underpinned by mechanisms for information and knowledge generation and management in order to ensure that relevant information and knowledge on risk and on risk management alternatives is available to policy and decision makers at different levels, from individuals and households to international organisations (p. 7).

The consultations have called for a strong participation by civil society, science, local authorities, local communities, media, business, and others in the development and implementation of the post-2015 framework for disaster risk reduction. Moreover, the implementation of the HFA has been enriched, enhanced and accelerated (p. 10).

RECOMMENDED READING

Scientific enterprise is important not just for supporting mitigation, preparedness and response measures but also for the development of policy at the highest levels:
Southgate, R.J., Roth, C., Schneider, J., Shi, P., Onishi, T., Wenger, D., Amman, W., Ogallo, L., Beddington, J., Murray, V. (2013) *Using Science for Disaster Risk Reduction*. Report of the UNISDR Scientific and Technical Advisory Group.

Climate change, changing institutional and public behaviour to early warnings, incorporating knowledge of the wide health impacts of disasters and improving resilience through social and economic understanding:
UNISDR (2009) *Reducing Disaster Risks, through Science: Issues and Actions. The full report of the ISDR Scientific and Technical Committee 2009*. Science and Technical Committee report on *Reducing Disaster Risks through Science: Issues and Actions* for the second session of the Global Platform for Disaster Risk Reduction in Geneva on 16 June 2009.

Social as well as physical dimensions of weather- and climate-related disasters, considering opportunities for managing risks at local to international scales:

IPCC (2012b) *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX). A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK, and New York.

IPCC (2014) *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK and New York, USA: Cambridge University Press (http://ipcc-wg2.gov/AR5/report/final-drafts/)

Providing advice to decision-makers on how science can inform the difficult choices and priorities in DRR:
Foresight (2012) *Reducing Risks of Future Disasters: Priorities for Decision Makers*. Final Project Report. London: Government Office for Science.