



World Conference on Disaster Reduction

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Thematic Discussion Paper Cluster 2.

RISK IDENTIFICATION, ASSESSMENT, MONITORING AND EARLY WARNING

Discussion papers have been prepared for the five thematic clusters of the WCDR. The papers have been developed by the Lead Agencies for each cluster with the support of the Inter-Agency Task Force for Disaster Reduction (IATF) and the ISDR secretariat.

The objective of these papers is to orient and guide the discussions in the five clusters toward the goals of the Conference. The papers provide a vehicle for coordinating the interests of the key stakeholders and will form the basis for the subsequent summarising of the thematic clusters.

Session organizers and participants in the thematic discussion are invited to draw on the papers to ensure the output of the sessions and panels at Hyogo-Kobe provide the technical assessment and guidance to complement and support the at the intergovernmental level and to advance the International Strategy for Disaster Reduction (ISDR).

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1. Introduction

Statistics over the last 50 years show a significant increase in the frequency of disasters, the number of people affected, and economic losses. The reasons for these trends are manifold: environmental change, population growth and migration, poverty and social conflicts, mismanagement of natural resources (such as deforestation and land degradation), lack of awareness or experience, to mention a few. All these factors lead to both higher exposure and vulnerability, which often remain undetected until a disaster strikes. The recent UNDP report, *Reducing Disaster Risk: a Challenge for Development* points out that developing countries remain disproportionately affected by natural disasters.

Risk identification, assessment, monitoring and early warning are key features of disaster reduction.

- Risk represents the core problem – the probability of a disaster to occur;
- Risk identification and assessment combines analysis of natural processes of hazards, and social processes related to vulnerabilities and coping capacities of human communities;
- Monitoring helps keep track of these two subsets of risk features, yet hazard monitoring is more advanced than vulnerability monitoring;
- Early warning helps turn information generated by monitoring into social response to impending hazards. It provides the primary avenue to reduce the impacts of impending events. For instance, application of early warning to hurricane, in the Caribbean and the Americas, has often proven to help reduce disaster impacts – at least in terms of fatalities.

If the above measures are not in place or if warnings are not communicated in time, the negative impact of natural phenomena will have a maximum negative impact on the exposed communities. When early warnings do not reach the population at risk or are communicated in a way that those at risk do not understand the warning or do not know how to react, disasters such as hurricane Mitch and more recently the December 2004 tsunami in the Indian Ocean give evidence of the urgent need to improve risk assessment, monitoring, and early warning. This confronts disaster-prone countries and the international community with a long-term challenge.

In order to address this challenge, the institutional frameworks for risk management and early warning devised over the last 15 years by the international community through the UN System have included the following:

- International Decade for Disaster Reduction (IDNDR), spanning 1990-1999
- International Strategy for Disaster Reduction (ISDR) initiated in 2000 and supported by the Inter-Agency Task Force on Disaster Reduction (IATF-DR)
- World Conference on Natural Disaster Reduction, Yokohama, in 1994, that led to the landmark Yokohama Strategy and Plan of Action for a Safer World
- World Conference on Disaster Reduction in 2005 mandated by the UN General Assembly

In addition, the global development agenda, most notably the United Nations Conference on Environment and Development, Rio de Janeiro, 1992, the Millennium Development Goals (2000) and the World Summit on Sustainable Development, Johannesburg (2002), has promoted improved linkages between disaster risk reduction and development policies.

The Early Warning Conference, in Potsdam, 1998 and the Second International Early Warning Conference, Bonn, 2003 (EWC-II) have set directions for early warning systems, including their need for a sound basis of risk knowledge. At the EWC-II an International Early Warning Programme (IEWP) was adopted and the Platform for the Promotion of Early Warning (PPEW) established in 2004 in Bonn to promote the implementation of the programme. In the aftermath of the 2004 South Asian tsunami it has become evident that more efforts are needed to implement the recommendations of EWC-II, that Early Warning is one of the most effective instruments of disaster reduction to save lives and property. Other initiatives, such as the World Water Assessment Programme (WWAP) and the World Water Forum series, have provided strong guidance on freshwater risks as well. These international efforts have underlined that disaster reduction is a matter of public policy, and that multidisciplinary and inter-sectoral approaches are needed to address in a consistent way the environmental and social processes leading to risks.

Rapid improvements in scientific knowledge and technological capacities have provided more accessible and effective tools for risk assessment. In certain regions and for certain hazards, early warning has made progress as well. Even though considerable progress has been achieved regarding hazard assessment, risk and vulnerability assessment are still lagging. As recent events in South Asia have shown, these efforts have to be extended to other hazards and parts of the world. The human side of risk is less amenable to technologically based solutions. Some frameworks and methodologies have been developed to capture the concept of vulnerability. The important role of involving stakeholders in the design, implementation and assessment of risk management policies, has also been acknowledged.

The progress in developing national platforms for disaster reduction has often been triggered by disaster events, as is also the case with the planned regional tsunami warning system for the Indian Ocean after the December 2004 tsunami. Continued support is needed to strengthen both national-level structures as well as regional and international cooperation in order to effectively address national and transboundary issues.

Addressing risk and early warning requires political support, policy and institutional backing, finance, professional competence, and community involvement. Advocacy and demonstration projects, as well as cost-benefit analysis are needed to show decision-makers and donors that prevention pays off. This message must be clear enough to obtain the public and political commitment needed to effectively mitigate and manage risks.

Current trends in environmental change and socioeconomic development are leading to increased potential losses, social and political instability, and human insecurity. Therefore, it is critical to continue systematically assessing and mitigating disaster risks. This requires that we continue to identify the main driving forces that lead to the unwanted increase of risk and exposure.

Coupled with these efforts, measures are needed to strengthen the technical, institutional and social capacities of affected societies and authorities to cope with the impacts of disasters. These efforts should span national and community-based approaches, including the design and monitoring of risks. Likewise, different types of early warning systems as well as risk and vulnerability indicators have to be developed at community level as well as at national and international levels.

2. Findings of the Yokohama Review

The Yokohama Strategy and Plan of Action for a Safer World, which emerged as the primary output of the World Conference on Natural Disaster Reduction, held in Yokohama, 23-27 May 1994, sets out comprehensive “guidelines for natural disaster prevention, preparedness and mitigation”. In response to growing concerns about progress on disaster risk reduction, the United Nations General Assembly in 2002 called for a review of progress on the Yokohama Strategy, seeking the conclusion of the review in time for consideration at the World Conference on Disaster Reduction in Japan in January 2005.

The review will be tabled at the conference in document A/CONF.206/L.1. The following points concerning risk and early warning issues may be drawn from this document.

- Since the Yokohama Strategy was adopted in 1994, the worldwide impact of disasters has been increasing. Causes for such an increase are manifold: ongoing trend of urbanization or migration in general, development of highly exposed areas for settlement, environmental degradation, etc.
- Disaster prevention, mitigation, preparedness and relief are four elements that contribute to and gain from the implementation of sustainable development policies. Disaster response alone is not sufficient, as it yields only temporary results at very high cost
- Stakeholder involvement has been identified in the Yokohama Strategy as an asset for successful design and implementation of awareness raising and disaster mitigation strategies
- A positive trend has emerged in respect of the number of casualties caused by natural disasters

The growing understanding of disasters and the associated paramount objective to improve human security is leading to a paradigm shift that places the human being at the center of attention. Scientific progress is reflected in an increasing number of approaches to explain and quantify complex parameters such as risk and vulnerability, in more holistic ways.

Change and progress is also achieved on the institutional level: several institutions and organizations have been or are being created to operate on a trans-sectoral and inter-disciplinary level (e.g. UNU-EHS, PPEW, IFI/P, UNESCO-CHARM, with UN/ISDR as facilitator). Their mandate readily reflects the paradigm shift mentioned above. A similar development can be observed in the crosscutting topics of numerous conferences and workshops that are being held under the theme of integrated disaster management and implementation oriented approaches (EWC 98, EWC II '03, Water and Disasters Workshop, ICLR Canada 2004).

The findings of the review underline that the changing “risk landscape” requires a continuous updating of data and related analytical tools. In this context a development of instruments for risk monitoring is called for, which means an extension of risk assessment. There is a widespread recognition of the inadequacy or absence of common approaches to this monitoring and how to maintain national and international data sets related to hazards, risks, vulnerabilities and disaster impacts. Similarly, more standardized data collection and analysis methods, indicators and presentation of information are needed to address transboundary risk management challenges.

People-centered early warning is widely accepted as a crucial component of disaster risk reduction and when it is in place the worst, the loss of human lives, can be largely avoided. In addition, the

continued developments of observation and forecasting technologies through growing scientific understanding and modeling capabilities for climatic events, global change, and other geophysical conditions coupled with improved communications technologies, have led to progressive improvement in the technological basis for early warning since 1994. Conclusions demonstrated that there is a need for wider integration of early warning into public policies and that the social components and policy development of early warning systems had not kept pace with the technological capabilities to detect, monitor and forecast hazards. Efforts can be made to improve early warning systems and ensure their greater effectiveness such as supporting growth in capacities and enhancing links between policy makers, technical specialists and the public.

The rapidly increasing number of disasters and their economic losses pose a threat to sustainable development. The positive message that is delivered by disaster statistics is the decrease in fatalities due to natural disasters. But even after considering the progress which has been made since Yokohama, the international community must realize that the development of disaster reduction could not keep pace with the development of risk.

3. Risk and vulnerability assessment

3.1 Risk assessment

Ongoing efforts to understand and assess risk and vulnerability are leading to more holistic and integrated concepts.

It is understood that risk and vulnerability have many dimensions such as social, economic, and environmental. This has to be reflected in the approaches to assess and monitor risk and vulnerability. Risk and vulnerability are dynamic features that change over time and, hence, require continuous monitoring. The assessment of risk and vulnerability requires a conceptual framework to identify and quantify their various components. This alone is a complicated task, as there is at present no clear consensus on how such a framework could, or should be conceived and developed. There is a lack of standard definition and procedures to assess risk and vulnerability.

Hazard and risk mapping can provide tools for decision makers in many regions and cities but these tools are still not available in all hazard prone regions. Several hazard-specific indicators have also been developed, such as hazard maps for floods, earthquakes, landslides, volcanic eruptions. Mapping of social vulnerabilities remains a challenge.

Other attempts at evaluating risks include:

- At the global scale: UNDP has developed a framework to assess relative vulnerability of countries with respect to different hazards: floods, tropical cyclones, earthquakes and drought. The World Bank and Columbia University have elaborated another index referred to as “Hot Spots”, which looks at risks associated with various types of hazards. The European Commission Humanitarian Office (ECHO) started to develop a similar index trying to integrate existing coping capacities as well.
- At the regional/continental scale: The Inter American Development Bank (IADB) and the University of Colombia have developed a multi-hazard, integrated risk index for some countries in the American continent.

- At the national and sub national levels: the Climate Vulnerability Index, designed by the Center for Ecology and Hydrology (Wallingford, UK), that help assess the relative exposure of regions and cities to floods and water scarcity; the Risk Index designed by the Public Works Research Institute (Tsukuba, Japan), that helps assess the cost-effectiveness of public policies for flood mitigation; other examples can be found in different regions of the world, for instance in Latin America.

Standardized methodologies including indicators and indices are needed to quantify and monitor the various aspects of risk, vulnerability at both local and national levels. However, the quality of risk and vulnerability assessment very much depends on reliable data and there is an urgent need to improve amount, quality, and accessibility of data. Information on all aspects of risk and vulnerability has to be gathered on the regional, national and local level. The shift from hazard-centred to more integrated approaches generates a need for data on the social and cultural aspects of risk, vulnerability, coping capacity and resilience. Issues related to data are discussed in the following section.

3.2 Data

Data production, collection, distribution, and management remain a key challenge to successful risk and vulnerability assessment. For instance problems arise when dealing with extreme events having a long recurrence interval, where data is scarce, or data sets incomplete, or inhomogeneous. This is especially the case in developing countries, because of technical, financial or social factors. In the developed parts of the world on the other hand complex administrative structures sometimes hinder the access to the data. Socio-economic data are also lacking, and proxy indices are not always satisfactory options. Earth observation and remote sensing technologies are gaining a more prominent role in disaster reduction and decision making because by satellites, information can be gathered virtually anywhere on earth.

Our incomplete understanding of natural and social processes sometimes does not allow producing reliable statistics and models for decision-making, planning and action. These factors can result in high uncertainty, irrelevant model results, incorrect warnings, wrong hazard mapping (e.g. for planning purposes in urban areas) and eventually lead to higher potential risk. In addition, lack of data becomes highly problematic when it comes to designing (and updating) policy-relevant indicators on hazards, vulnerabilities and risk.

Historical lessons learned from past disasters, once systematized into assessment tools, also help evaluate vulnerability. However, disasters are complex and not well-defined phenomena with easily measured dimensions or well-established data collection methods. Even when estimates are available, there may be pressures to either minimize or exaggerate the numbers. In some cases the data on numbers of people killed or otherwise affected may be no more than rough guesses. This is especially true for large events like famines or tsunamis, in countries where demographic data are limited, and for past events. Experts recognize that more systematical efforts at data gathering over the last three decades have improved data collection and precision but this has also undoubtedly contributed to rising trends in the number of reported events and affected people.

There is a pressing need for a more systematic approach on disaster data collection. In particular, an internationally endorsed data collection protocol is needed for use by countries and international authorities. Existing disaster archives might be combined or extended into world data centre for disasters. This would ease historical data mining and quality upgrading of existing data sets.

3.3 Emerging risks

In addition to the commonly identified natural risks, so-called emerging risks add to the complexity of the disaster landscape. These risks might not be new as such, but rather emerging in or ranking higher on the technical or political agenda. In some cases, these risks are generated by human communities being increasingly exposed to pre-existing hazards, for instance because of migration in hazard prone areas.

In other cases, risks emerge because human activities are modifying the environment and thus the hazards. Deforestation, soil degradation and atmospheric pollution (brown clouds), land subsidence (over pumping of aquifer) are cases in point. Poorly planned development contributes to an increase of risks. Additional emerging risks include: complex risks and emergencies, soil and water contamination, terrorism and biological hazards, etc. In addition, global change is presumed to have an impact on the frequency and severity of disasters in several regions of the world.

Small scale risks deserve additional attention, especially in developing countries where small but frequent events severely compromise sustainability of livelihoods. Securing the gains of development requires increased commitment of decision-makers and the donor community in mitigation programmes.

3.4 Risk Monitoring

The above mentioned facts show that risk is not a constant factor, but changing over time. Risk assessment providing a static, momentary picture of risk at a certain time and place must be improved by instruments which allow a monitoring of the dynamics of risk. Ideally these instruments will provide information for a predictive understanding of risk, thus providing the necessary tool to design disaster management plans for the years to come.

4. Early warning

The improvement of accuracy and timeliness of the warnings must be addressed as well as the design and communication of the warning message in order to enhance the effectiveness of early warning. Early warning must not limit itself to producing a scientific occurrence probability of a certain event. The ultimate goal of early warning is the reduction of impact of disasters and hence its success is measured on the basis of reduced casualties and losses.

Accurate and timely warnings will only have an impact on disaster reduction if they are conveyed to the people at risk in an understandable way accounting for age, gender, social, cultural and livelihood characteristics of the targeted audience and also include guidance on how to act upon the warning. Public participation in the design of the warning message and the planning of the warning procedure will lead to a better understanding and an increase in awareness. Together with the warning, guidance has to be provided on how to react while taking into account the social and cultural context. The incorporation of traditional knowledge forms an important part of early warning.

For an effective early warning system an institutional and policy framework is needed under which it can operate. Communication chains and action plans have to be defined so that the warning will

not only reach the targeted audience but will also result in appropriate action following to the warning. The importance of early warning and its implementation needs to be recognized on the governmental level and supported by the appropriate policy and legal framework. A clear assignment of responsibilities to decision makers in the early warning process would be beneficial to its effectiveness and sustainability.

Regional and international collaboration and cross-border information sharing should also be fostered at the political level. In many cases, early warning systems have been set up only once large disasters have taken place. This has for instance been the case in Central America after hurricane Mitch. Such a process also took place in the Pacific after tsunamis had occurred. And even though the Indian Ocean was known to be exposed to tsunamis, no early warning system had been initiated until the tragic events of December 2004.

Examples of early warning systems include:

- At the international level: The Pacific Tsunami Warning System; Tropical cyclones warning systems operated by NOAA and WMO; FEWSNET Famine Early Warning System;
- At the national level: many systems for floods, volcanic eruptions, high winds, droughts, etc.
- At community level: many systems exist, mostly focussing on floods, and a few on volcanic eruptions.

However, given the fact that exposed areas in need of early warning systems are mostly known, there is a need for a more proactive approach to implement such systems in the future.

5. Capacity building for risk assessment and early warning

In order to maintain and improve risk and vulnerability assessment as well as early warning the following measures are needed:

- Analysis and interlinking of existing structures and capacities
- infrastructure to gather, store and exchange data has to be enhanced
- development of methodologies and their exchange on an international level
- mobilization of additional finances, manpower, technology
- Institutional analysis with regard to hierarchical structures and responsibilities to act quickly and efficiently
- Strengthening of the technical and policy basis for the design and implementation of people-centred early warning systems
- Improvement of institutional structures to ensure efficient risk assessment, monitoring, early warning, and unrestricted information flow
- education, training and awareness-raising at all levels (scientists, decision makers, local population)
- partnerships to transfer knowledge and skills at both the institutional and individual levels
- a permanent feedback of lessons learned, identified shortfalls and gaps into existing structures to improve the systems and the early warning chain
- Implementation of the International Early Warning Programme as called for at the EWC II, 2003

- translation of complex information into understandable messages, adapted to specific audiences and contexts.

In addition, a strong policy framework is called for that shifts emphasis from disaster relief to preparedness and prevention. Capacity building in the broadest sense should include the awareness raising of both political decision makers and the public at risk. Only an educated society can comprehend hazards and risks and is more likely to invest into institutional infrastructure, early warning, and associated capacities. Several countries started to offer interdisciplinary educational programmes on risk assessment, disaster mitigation and early warning. Educational institutions with experience in those areas should network with other institutions and thereby share their experience.

New information technologies have been increasingly relied upon for early warning, but mostly in developed countries. Modern technology should be used in a way which is appropriate for the environment of their use. The optimal balance between technological sophistication and reliability of the systems in the given environment is the basis for the effective functioning of the early warning system. Options for extending these tools in developing countries should be explored.

6. Conclusion

The World Conference on Disaster Reduction, and in particular its thematic clusters, offers a precious opportunity to exchange information, knowledge, and experiences on an international level across all sectors and fields involved in disaster reduction. The Thematic Cluster 2 focuses on "Risk Identification, Assessment, Monitoring and Early Warning". The outcomes of the thematic sessions/WCDR should provide better guidance for future development of risk assessment and at the same time should lay the foundation for future co-operations and joint initiatives under participation of partners from all disciplines, geographic regions paying special attention to the most vulnerable. Linking ongoing initiatives will enhance synergy and increase efficiency as well as the spatial coverage of monitoring and early warning.

Better information leads to better decisions and better planning. Systematized monitoring and data sharing through networks will put decision makers in a situation to make better, informed, more timely decisions. However, the monitoring has to be linked to policy and decision making in order make it a sustainable process.

The important role of Early Warning for disaster reduction has been widely recognized. An efficient early warning system has to communicate the warning message in a timely and appropriate way in order to get the right social response. Nevertheless, early warning systems are still missing in many places of the world, as recently shown in the tragic December 2004 tsunami in South Asia. Efforts should be made to implement such systems as quickly as possible.

At the root of disasters lies the vulnerability of human society which, in its complexity, reaches across many different fields and sectors. The complexity calls for a systemic approach to addressing vulnerability and risk. But first vulnerability has to be defined, assessed and monitored in order to establish a basis for vulnerability reduction. A number of indicator methodologies have been developed for that purpose. Refinements of existing methodologies, and development of new approaches, are needed to better quantify risks and vulnerability. A careful test phase should then be implemented in co-operation with their potential users, e.g. policy and decision makers to establish the feasibility and reliability of those indicators as decision support tools.