INFORMATION ON DISASTER RISK MANAGEMENT

CASE STUDY OF FIVE COUNTRIES

Summary report

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The views expressed in this document are those of the authors and do not necessarily reflect the views of the sponsor organisations.

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PROLOGUE

Reducing the risk of destructive natural phenomena increasingly looms as a strategic line of developmental action. Since 2000, the Economic Commission for Latin America and the Caribbean (ECLAC) along with the Inter-American Development Bank (IDB) have stressed that proper disaster prevention, reduction and response are a facet of regional development and as such demand a systematic and coherent approach to lowering the risk of disaster consequences. ECLAC views the inclusion of such policies as indispensable to comprehensive development, meaning one that is sustainable, equitable and provides improved productivity and competitiveness while also promoting social cohesion throughout the countries of the region.

Latin America and the Caribbean are marked by a high degree of exposure to natural phenomena that have considerable destructive potential and which in the past two decades have taken the form of events with catastrophic social and economic consequences for governments and populations alike on both a social and economic plane. This geographic location combined with pronounced features of economic physical, environmental and politico-institutional vulnerability have all been tragically reflected in the frequency with which tremendously disastrous events occur. At the same time the region continues to suffer a range of limitations that stand in the way of an effective risk management. A conditioning factor for these obstacles is the lack of information available to those throughout the various phases of the management process when they are making decisions and formulating the proper projects.

There is growing evidence, data and experience that substantiate the need to adopt pro-active risk-mitigation strategies in light of the major benefits they afford and the extent which they allow for a more sustained course of development. Nevertheless, there has yet to be a generalized sharing of information regarding each country's experiences or the adoption of specific indicators.

In the framework of a cooperative programme between IDB and ECLAC, a project on disaster risk information was conducted on the basis of the case studies of five countries seen as representative of the region owing to their sizes, relative degree of development, and geographic locations. It is our hope that the results of that endeavour will contribute to a better understanding of risk, its specific management in the region and the handling of information related to such issues as well as in formulating proposals for creating a more systematic handling of information that can make it more effectively available for decision making. This report contains the general conclusions of these investigations and sheds light on the institutional structures and disaster risk management that exist in the countries studied. By providing a chronological account of the evolution of institutions responsible for emergency and civil defence processes and for risk management as part of planning and development policies the study constitutes a valuable record of national experiences and explains how the countries studied have made changes in recent decades to the institutions in charge of disaster and risk management as well as their information systems. Based on the experiences that have been documented regarding the responses to disasters, some conclusions are drawn that have region-wide implications and recommendations directed at decision makers are formulated.

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EXECUTIVE SUMMARY

A. OBJECTIVE AND SOPE OF THE PROGRAM

There is a generalized opinion throughout Latin America and the Caribbean that a serious obstacle to an effective disaster risk management is the lack of information available to those in charge of making decisions all along the various stages of the management process.

In order to rectify this weakness, the Inter-American Development Bank (IDB) and the Economic Commission for Latin America and the Caribbean (ECLAC) jointly developed a Natural Disaster Management Information Programme. The project was oriented toward determining information regarding risk and the methodologies for analysing data needed by risk-management decision makers, those generating the information and the agencies that promote a quality management process.

The project was based on case studies in five countries that are representative of the various sub-regions of Latin America and the Caribbean that are exposed to various threats: Colombia, Chile, Jamaica, Mexico and Nicaragua. These studies focused on evaluating the risk management situation of each of these countries and on the information that is available for such purposes.

In order to establish a common basis from which to conduct the case studies we prepared a *Basic Methodological Document* and five *Specific Methodologies* for obtaining the necessary information and evaluation of management strategies.[1]

B. STUDY CONCLUSIONS

Generation and use of information

The past 15 years witnessed improvements in the available information on natural threats, the monitoring of hazardous phenomena —especially of a hydro-meteorological nature— and the public alert systems in the countries studied.

However, the information is not always available, or is overlooked when formulating policy, designing instruments for confronting vulnerability —especially involving critical infrastructure—, or dealing with risk reduction. There is a general lack of information on the possible impact of the mitigation and risk-reduction measures that could be implemented.

Urban zoning laws and land-use regulations exist, but there are no mechanisms for monitoring the extent of compliance with such norms.

The progress achieved on the level of threat and risk information must be extended from the macro scale (national, regional) to a local one where the conditions

1 The methodologies and reports of the case studies can be found at the project website, http://www3.cepal.org.mx/iadb-eclac-project.

that most greatly influence risk are to be found. While the public receives information on natural threats and how to respond in an emergency, little has been done to date to provide the public about how to lower vulnerability in their own environment.

Institutional structure and operational risk management

The number of disaster victims has tended to fall in a sign of increasing efficiency in emergency preparation and response even as losses have grown in magnitude and cost in an indication that the vulnerability of goods has not been lowered and that sufficient risk transference measures have yet to be adopted._

The analysis allows us to conclude that the efficiency of the management system depends more on the extent of the country's political development and the general efficiency of the government apparatus than directly on the formal structure of the risk management system. Institutional weakness is related to a lack of clarity about how shared responsibilities are to be delineated between the various levels and agencies of government, a lack of personnel training at those agencies and institutions, and paucity of coordination inter-sectorial and between the local and national levels of government.

While disaster management responsibility is increasingly being transferred to local governments, the efficacy of such management varies and in some instances is quite limited. Local governments and agencies generally lack the economic, technical and structural resources needed for an effective risk management.

On the level of financial management, government calamity funds, when they exist, lack sufficient resources for coping with the magnitude of the disasters to which they are destined to respond, and they suffer from unstable funding. In many instances funding is largely limited to emergency response or the reconstruction of public sector goods. Few countries assign funding to prevention and mitigation activities, with the exceptions of Mexico and Colombia constituting a valuable experience that needs to be shared throughout the region.

RECOMMENDATIONS FOR DECISION MAKERS

Generating and using information

It is necessary to generalise, cross-reference and uniform risk studies across sectors and government levels. Both prevention and response measures must be based on a correct risk identification and analysis. There is a considerable lack of knowledge about how to design such studies. In order to sustain progress in these areas it is useful to define model terms of reference for local, regional and national studies, as well as indicators for validating study results.

Consultation and participation processes

We recommend establishing consultation mechanisms between information generators and users in order to define the basic information needs and the manner in which it is to be used. These mechanisms could be concretized through agreements on the inter-connectivity of the information in various environments, and by avoiding informational duplication and incompatibility.

Vulnerability of critical infrastructure

The considerable disaster vulnerability of public goods is to a large extent the result of weaknesses in infrastructure maintenance and rehabilitation. It is necessary to conduct disaster vulnerability studies and implant rehabilitation programs with which to reduce risk to critical infrastructure, especially hospitals.

Institutional structure and risk management

The national experiences studied show the importance of the risk-management system wielding institutional might and weighing heavily in national policymaking. Only in this way will risk management acquire the attributes necessary to coordinate the actions of the sectors involved and establish the mechanisms for the correct application of and compliance with relevant norms. It is also necessary to face up to the existing chronic deficit of, and excessive turnover among personnel trained and experienced in matters of risk management.

PROPOSAL OF ADDITIONAL STUDIES ON THIS TOPIC

- Standardization of information on risk and its components.
- Improved methodology for risk and risk-management indicators.
- Improved methodology for extreme-event scenarios.
- Generation and distribution of techniques for reducing vulnerability in low-resource communities.
- Cost-benefit studies that help to decide what proportion of catastrophic risk to infrastructure should be transferred to the insurance market and what part should be assumed by the government.

I. DISASTER IMPACT ON REGIONAL DEVELOPMENT AND THE SCOPE OF THE ECLAC-IDB DISASTER MANAGEMENT PROJECT

Natural disasters in Latin America and the Caribbean inflict human and economic losses on an enormous scale. Estimates made by the Economic Commission for Latin America and the Caribbean (ECLAC) indicate that in the past three decades more than 150 million inhabitants of the region have been affected by disasters that have led to the deaths of more than 108,000 people and produced 12 million direct victims. The amount of accumulated damage from just the largest disasters is calculated at more than 50 billion 1998 dollars.

The extent to which the poor disproportionately suffer devastation is evident in the direction of causality: because one is poor, one is vulnerable. Statistics compiled by the United Nations over the past 30 years show that the risk of death from disasters is four times greater in poor countries than it is in countries with high per capita income.[2]

The high number of victims and growing extent of economic losses from natural disasters in the region have led international development agencies, and most of the institutions and specialists focused on disaster prevention to encourage countries to shift their focus from one centred on emergency response to one emphasizing prevention for reducing the consequences of hazardous phenomena. A basic prerequisite for succeeding with such an approach is to have widespread access to reliable information on the risks to which human settlements are exposed, a country's socioeconomic infrastructure, and the measures capable of reducing the leading sources of vulnerability.

We have discovered that a dire obstacle to correct disaster risk management is the lack of information on risks and risk mitigation measures available to those in charge of making decisions throughout the various stages of the management process. In order to rectify this weakness, the Inter-American Development Bank (IDB) and the Economic Commission for Latin America and the Caribbean (ECLAC) have joined forces to conduct a project regarding a **Information and Indicators Programme for Disaster Risk Management.** Project Component 1, called the **Disaster Management Information Programme,** was geared toward determining information regarding risk and the methodologies for analysing such data needed by risk-management decision makers at all levels of the management process. Component 2, the Disaster Risk Management Indicators Programme was aimed at defining a series of indicators for gauging the principal factors that determine a country's disaster risk. The results of this component have been published in a general report and a series of accompanying documents.[3]

2 International Federation of Red Cross and Red Crescent Societies World Disaster Reports, several years.

3 http://idea.unalmzl.edu.co.

The first component of this report is primarily based on **case studies** we conducted in Colombia, Chile, Jamaica, Mexico and Nicaragua. These five countries, which vary in the scale of their economies and extent of development, as well as in the degree to which they are subject to various types of threats[4], were chosen in order to draw from a broad spectrum among the various sub-regions of Latin America and the Caribbean of disaster-related risks and the policies needed to manage them. The studies centred on evaluating a country's risk-management situation as well as the information available for such purposes on three fundamental levels: **risk analysis, risk management and financial disaster risk management.**

In order to establish a common basis from which to conduct the case studies we prepared a **Basic Methodological Document** which defines the analytical framework for evaluating the quality, quantity and use of information needed for suitable risk management. In addition we prepared five **Specific Methodologies** for obtaining the necessary information and evaluation of management strategies. The case studies employed methodologies for evaluating the performance of the system of risk management in the face of **extreme event scenarios**, and for measuring the evolution of that performance using **risk and performance indicators** developed in Component 2 of the programme.

In order to define the scope of the case studies, and later their results, we conducted **National Workshops** in each of the five countries with the participation of local decision makers and specialists. Lastly, a **Regional Workshop** was held to review and treat the project conclusions with national counterparts and members of the Scientific Advisory Committee. The reports on these activities are available at the project's website[5]:

This report contains the basic elements proposed for the **Final Programme Report** which is also available on line. The principal issues it covers include the following:

a) The bases for defining the information necessary for an efficient disaster risk management and for evaluating its proper usage in each country's strategy.

b) A comparison of the current situation of the five countries studied regarding: the availability and usage of the information regarding risk; the structures of disaster management systems and their performance in both the ex ante and ex post phases of recent disasters; the structure of their systems for financial disaster risk management primarily with an eye toward determining who assumes disaster costs and the consequences for the country's development.

c) The conclusions derived from this study and the recommendations for improving the risk management of the countries in the region.

This document is aimed at those who generate and use risk management information in the countries of the region, as well as the bodies or agencies that work to improve the quality of that management.

4 In previous documents and in most of the National Case Studies the term "hazard" is used as this is the word most commonly used in scientific circles.

5 See http://www3.cepal.org.mx/iadb-eclac-project.

II. BASES FOR ANALYSING DISASTER RISK INFORMATION

1. INFORMATION FOR RISK EVALUATION AND REDUCTION

a) Problems of risk information

Determining risk for purposes of managing it is a laborious and complicated task due to the manner in which risk factors are interrelated, and the complexity of the physical and social systems involved as well as the processes that lead to losses. Even after overcoming these issues, it is necessary to establish lines of communication between risk determination specialists and competent officials to assure that the risk-analysis transcends the national, regional or provincial level.

b) Information for risk evaluation[6]

The principal objective of a study of **hazard or threat** in a place of interest is to become familiar with the phenomenon that poses it by identifying and measuring its intensity and zone of influence (see Table 1 of Appendix 2.) A detailed estimate of the hazard must deal with the **local effects** of topographical, subsoil or climatic conditions capable of increasing or decreasing the intensity, frequency or area of influence of the phenomena.

The evaluation of **physical vulnerability** can be conducted from a qualitative focus using indexes, or a quantitative one employing vulnerability functions. **Social vulnerability** refers to the sum of circumstances that affect population groups, limiting their ability to cope for themselves. Table 2 of the Appendix 2 offers useful information for estimating vulnerabilities.

Risk evaluation is a process that consists of determining the nature and extension of risk in order to measure its societal consequences.

The analysis of **extreme scenarios** consists of determining a critical event in which extreme demands are placed on the system of risk and disaster management, estimating a country's economic loss and the system performance of risk management when such a catastrophic event occurs. Table 3 of the Appendix lists the information that might be needed for making such an analysis.[7]

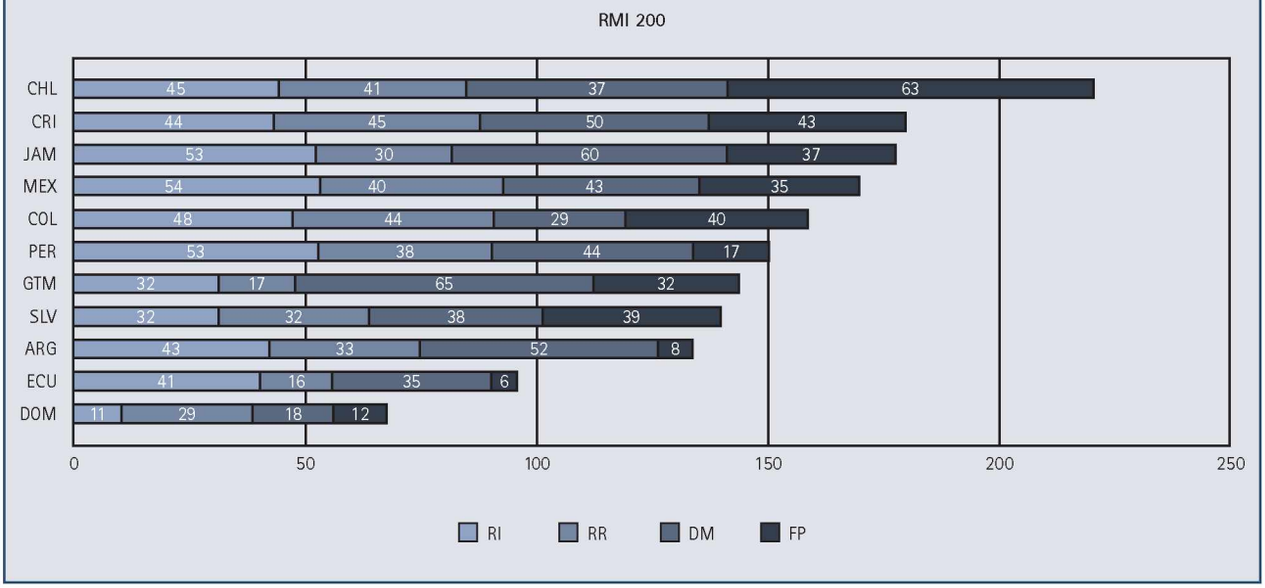
In Component 2 of this project we develop a methodology for determining four **risk indexes** to be applied to the countries of Latin America and the Caribbean.[8] Two of these were employed for comparative purposes in this

6 See Documento Metodológico Básico at *http://www3.cepal.org.mx/iadb-eclac-project/05.html*.

7 See "Metodología de Evaluación de Escenario Extremo" http://www3.cepal.org.mx/iadb-eclac-project/.

8 Cardona, Omar Dario. 2005. Indicators of Disaster Risk and Risk Management. Programme for Latin America and the Caribbean. IDB, Special Report of the Sustainable Development Department. Washington D.C. http://idea.unalmzl.edu.co.

Figure 1. RISK MANAGEMENT INDEX (RMI) AND ITS COMPONENTS



study: the **Disaster Deficit Index (DDI),** which relates expected losses from possible catastrophic events to the country's financial ability to cope with the situation, and the **Risk Management Index (RMI),** which is built on the sum of four indicators that gauge four aspects of strategy: Risk Identification (RI), Risk Reduction (RR), Disaster Management (DM), and Financial Protection (FP). The results that appear in Figure 1 show that Chile, Costa Rica and Jamaica rate highest among the 12 countries studied on the RMI while the Dominican Republic and Ecuador are lowest on the scale.

c) ECLAC methodology for analysing economic losses

ECLAC has developed a methodology for evaluating the socio-economic impact of disasters that is being applied with increasing frequency in Latin America and the Caribbean. This methodology is laid out in a manual that we have updated on several occasions since it was first published in the decade of the 1980s.[9]

The methodology is used to evaluate **direct damage,** which consists of the harm that has immobilized, destroyed or damaged assets and inventories and which is usually confined to the immediate period surrounding the disaster. An assessment is also made of **indirect damage** that basically refers to production losses (see Table 4 of Appendix 2). More specifically, this involves the flows of goods and services that cease to be produced or provided during a period beginning from the moment a disaster occurs and possibly extending into the rehabilitation and reconstruction process which, as we have previously indicated, conventionally has been defined as having a maximum time horizon of five years although the greatest losses occur during the first two.

To complement the basic methodology and for purposes of the current study we have developed an **abbreviated damage evaluation survey methodology**[10] to be applied to frequent events that are not extreme in magnitude. The survey was developed based on the experience of Mexico, and involves a prior effort to identify the affected area and its socio-economics, as well as contacts with government officials in the affected area. It requires less field and lab work than the

9 The most recent version of this manual can be found at the ECLAC website under the title "Handbook for estimating the socio-economic and environmental effects of disasters".

10 See "Metodología abreviada de evaluación de daños", Daniel Bitrán, http://www3.cepal.org.mx/iadb-eclac-project/05.html.

general methodology so the more limited costs should make it possible to broaden the catalogue of evaluated events as well as to produce more reliable statistics on disaster damage from the countries in the region.

Another methodology we develop in this study is the **retrospective evaluation of the socioeconomic impact of disasters**[11] that can be applied after an event in order to complete a country's catalogues of damage from severe events. Accumulated and average-annual loss totals make it possible to determine which are the most vulnerable regions, the incidence of the various phenomena, and the financial needs of their rehabilitation and reconstruction processes. To a considerable extent, quantifications refer only to the damage or destruction of assets. Indirect effects or losses in the production of goods and services are much more difficult to estimate because the records through which they are usually calculated generally refer exclusively to losses of life and of physical infrastructure.

2. INFORMATION FOR DISASTER MANAGEMENT[12]

The operational handling of a national risk management strategy should include a range of activities that are needed in the pre-disaster or prevention phase as well as in the **post-disaster**, or attention and reconstruction phases. For each phase a country must keep on hand the information decision makers need for executing the various stages of risk management as well as that required by the potentially affected population, and for the media.

Among **pre-disaster activities**[13] the following have been identified as the most important for assembling the information necessary for proper risk management:

Prevention. In this stage general risk information is needed as is the identification of the most vulnerable areas and the least favourable scenarios that might arise.

Preparation. This consists of the activities and measurements taken ahead of time to assure an effective response when a disaster hits, including early alerts. It requires the existence of observation, forecasting and public alert systems, hazard measurement networks, and fluid communications mechanisms that can reach the most remote communities.

Emergency planning. This should be based on a sufficient volume of information to allow for prior and timely access to: contingency plans based on event scenarios with varying degrees of hazard; preparations and resources set aside to attend to emergencies; evacuation plans and shelters; the existence of funds budgeted for emergency attention; efficient information systems regarding the evolution of the phenomenon and its consequences. It is necessary to be ready to launch informational campaigns directed at the general public, and especially for those in high risk situations.

Mitigation. The design of **structural mitigation measures** demands vulnerability studies of strategic installations and vital lines of communication and transportation or plans for their implementation. Special attention must be paid to risk mitigation programmes involving non-engineered construction so that the necessary programmes are established for providing individual or artisan builders the technologies appropriate to their environment and experience.

Non structural mitigation measures include land use and management regulations, building codes and related enforcement measures, and zoning that takes into account risk-related hazards. Also of importance is the existence of land use regulations and land management policies for the areas with the greatest vulnerability as well as building standards that contemplate safety precautions in anticipation of exceptional natural phenomena such as earthquakes and wind.

The main information needs of **post-disaster actions**[14] are as follows:

Emergency response. The necessary information is described in the emergency preparation phase.

11 See "Evaluación Retrospectiva del Impacto Socioeconómico de los Disastres y consideraciones metodológicas para llevarla a cabo," Daniel Bitrán, http://www3.cepal.org.mx/iadb-eclac-project/05.html.

12 See "Documento metodológico básico para los estudios nacionales de caso" at: http://www3.cepal.org.mx/iadb-eclac-project/05.html.

13 The definitions of pre-disaster activities can be found in the Glossary at the end of this document.

14 A more detailed definition of post-disaster activities can be found in the Glossary at the end of this document.

Rehabilitation. Actions aimed at repairing installations, infrastructure and assets in general demand the existence of quick evaluation systems that set priorities for the various rehabilitation tasks such as re-establishing essential public services and productive activities.

Reconstruction. When a disaster occurs, the authorities must design a reconstruction strategy with action priorities based on existing needs and available resources, and which properly take into account mitigation factors. During this phase comprehensive civil works projects must be designed, a process that demands a series of prior studies.

3. INFORMATION FOR FINANCIAL DISASTER RISK MANAGEMENT[15]

The sources of information for documenting the financial handling of disasters are scattered and generally suffer from a considerable lack of oversight of post-disaster activities. The hardest data to come by is often that of insurance claim recovery.

Decision makers must turn to multiple sources of information —to which access is often limited— for implementing the necessary policies. The information in question includes public accounts that are sufficiently detailed as to make it possible to discern the volume of funds applied and the redirecting of programmes, external financing and the probable re-channelling of loans as well as the extent of insurance coverage and claim recovery once a disaster has occurred.

a) Financing pre and post-disaster actions

It is useful to deal separately with the financing of prevention-related risk reduction actions and of the emergency, rehabilitation and reconstruction phases. In both instances there tends to be a combination, in varying proportions, of situations in which:

i) The central government assumes a high degree of risk either through calamity funds or by drawing down resources from other programmes.

ii) International cooperation becomes the main funding source both in terms of loans and donations.

iii) The private sector largely assumes the consequences.

Pre-disaster actions include the assigning of resources for:

i) Research and activities aimed at improving risk awareness (hazard, vulnerability and risk maps);

ii) Prevention actions including public awareness and advance-alert systems;

iii) Vulnerability studies, particularly of strategic installations;

iv) Mitigation works;

v) Activities related to emergency-response preparations and rehabilitation; and

vi) Those allotted for setting up early detection and warning systems.

The effectiveness of public emergency or governmental calamity funds will depend on the scale of those resources (in relation to the risks they are designed to cover), how fluid procedures are for distributing the funds, the sectors it covers, and the possible priority awarded to the sectors of society most vulnerable to disasters.

Calamity funds have largely been designed to attend to the emergency and in some instances, the reconstruction of public infrastructure. The ECLAC methodology for assessing disaster impact makes it possible to provide access to information regarding the cost of the necessary investments during the rehabilitation phase and for the reconstruction of damaged property.

When it comes to external financing, it is important to distinguish between non refundable resources —mainly donations— and those that must be repaid: contingency credits from international funding agencies, the reorientation of existing loans or new loans. Such resources include IDB and the World Bank facilities and mechanisms, the reorientation of previously approved loans and the reformulation of active lines of credit to meet reconstruction needs, and the rejection of new

15 For greater detail refer to Documento metodológico básico para los estudios nacionales de caso at: http://www3.cepal.org.mx/iadb-eclac-project/05.html.

loan requests[16]. The agency in charge of risk management can obtain information on such issues from the files of the country's Central Bank.

b) Risk transference

Insurance and reinsurance coverage for catastrophic risks has achieved only a limited degree of penetration in the region, due largely to the high cost of premiums and the minimal extent of institutional and legal development for their implementation. It is useful to identify the penetration, cost and efficacy of these policies within the public and private sectors. This exercise makes it possible to evaluate the prospects for this means of catastrophic risk transference assuming a greater role in the region.

Seismic risk policies have become increasingly available in the region. Some countries have adopted a legal requirement that public infrastructure be covered by insurance, although it is less frequently enforced on a local level. There is considerably less coverage available for hydro-meteorological risks, except where policies are available for crop damage. Such policies are inflated by high administrative costs that only large agribusiness firms can cover. In developed countries such insurance schemes tend to be subsidized. Flood insurance is also scarce in the region because assets located along rivers and canals frequently suffer flood damage, thereby leading to very onerous premiums. Catastrophic risk policies in the region are generally limited to a country's most modern sectors, raising the need for the public sector to assume greater responsibilities in financing disaster results among the least advantaged segments of the population.

There are a number of information sources for documenting such issues. Information on public disbursements o reallocations can be found in public accounts while data on external cooperation is generally to be found in the records of the main institution charged with handling risk. Data on insurance payments is the hardest to come by. Official agencies that determine the norms under which insurance firms operate in the country are the ones that tend to manage such information.

16 The Inter-American Development Bank and the World Bank offer countries special contingency facilities for such instances as do some sub-regional development banks (for example, the BCIE, CDB and CAF).

4. GENERATING INFORMATION FOR RISK MANAGEMENT

Providing decision makers with access to the necessary quantity and quality of information needed for the various management phases demands a major effort to generate and compile information, their translation into useful products and transfer to the user.

In the most developed countries much of the necessary techno-scientific information is generated by academic research centres or by specialized state institutions. The least developed countries lack the means to generate all of the necessary information, and often try to rely on information produced in other countries or in studies financed and executed by international bodies or donors. In all such instances it is best that one or more local groups assemble the information and prepare useful products for decision makers at all levels. In some countries such as Mexico, Nicaragua and El Salvador this work is conducted by specific centres and in others by each specific sector. Small countries can turn to regional institutions that coordinate the studies for generating the necessary the information and channel international technical support. CEPREDENAC and CDERA are successful examples of such regional centres.

Whichever the form, it is the responsibility of the management system to generate the conditions needed to provide the necessary information, an undertaking that involves considerable economic and human resources. International technical cooperation has greatly contributed to such efforts in the countries of the region, where the most difficult and taxing endeavours have proven to be managing the specialized technical centres as well as monitoring and warning systems. It is often the case that once the international aid that contributed to the creation and initial operation of such centres and systems is withdrawn, they are abandoned within a few short years owing to the resulting shortfall in necessary resources.

When evaluating a country's risk management strategy it is important to determine who assumes the cost of generating and distributing the information needed for risk management.

III. COMPARISON OF RISK MANAGEMENT IN THE COUNTRIES STUDIED[17]

This chapter provides a comparative analysis of the state of risk-management related information, as well as the principal aspects of the structure of the management system. This analysis is based on the five national case studies. A tabular listing of each country's characteristics appears in tables in Appendix 2, and the body text makes comparative comments.

In order to provide an understanding of each country's situation we begin with a description of the fundamental features of each one's socio-economic profile and later describe relative disaster impact.

1. SOCIO-ECONOMIC CHARACTERISTICS AND DISASTER IMPACT

The five countries chosen for this study display considerably varied degrees of economic and human development (see Table 5 of Appendix 2). Their societies are exposed to various types of hazards owing to their geographic location, physical characteristics and the uneven vulnerability levels arising out of distribution inequalities and differing degrees of risk management penetration.

The urbanization process has been most accelerated in Chile, where city dwellers now account for 86.6% of the population, well above the 77.6% regional average. Somewhat more than three fourths of the populations of Colombia and Mexico are urban, while Jamaica has the lowest degree of urbanization among the countries studied (52.2%), followed very closely by Nicaragua.

Mexico ranks first in terms of per capita income with a 2004 annual average of 6,522 dollars, followed by Chile (5,903 dollars). Both of these countries are well above the regional average (3,756 dollars), while Nicaragua ranks last at 836.50 dollars. Colombia and Jamaica also rank below average with the latter country closest to the regional median.

The rankings of countries on the human development indexes published by the United Nations Development Programme (UNDP) generally coincide with per capita income levels. The only exception is Mexico, which has a lower HDI reading than Chile although it has higher per capita income.

a) Disaster impact

On average in recent years, natural disasters in Latin America and the Caribbean have affected four million people including approximately 5,000 deaths, and 4.00 billion dollars in losses.[18] The trend toward an expand-

17 The documentation from the case studies can be found at *http://www3.cepal.org.mx/iadb-eclac-project/05.html.*

18 "Evaluation of the Inter-American Development Bank's Operational Policy on Natural and Unexpected Disasters", DRM, World Institute of Disaster Risk Management, September 2003.

ing scale of disaster appears to be related primarily to demographic growth and an urbanization process that has produced high-density populations in at-risk areas, as well as a process of development that has increased the value of assets in such locales. Climate change appears to be another contributing factor and one whose impact will probably contribute to increasingly severe disasters in the future.

While the scope of losses has tended to grow, recent evaluations suggest that the same cannot be said about the number of those killed or injured in disasters. The proportional drop in the number of human victims reflects the increasingly positive effect of improved warning, evacuation and rescue systems, but such progress has yet be replicated on the level of endeavours aimed at lowering the physical vulnerability of assets at risk and of risk transfer mechanisms.

Trends in the number of disaster victims vary from country to country. Colombia continues to record high numbers of disaster victims but that disparity apparently reflects a greater propensity than in other countries to tally the victims of lesser disasters. Nicaragua registers a very high per capita rate of disaster-related deaths that easily surpasses the regional average.

Disaster-related losses per inhabitant vary from a low of an annual average 4 dollars in Colombia to a high of 26 dollars in Nicaragua. For the three other countries in our sample, the average ranges between 11 dollars and 12 dollars per person per year. That per capita gap is evident in that such losses account for less than one per cent of GDP per inhabitant in four of the countries but grow to 3.2% in Nicaragua.

2. INFORMATION FOR RISK EVALUATION[19]

The handling of statistical information regarding catastrophes is generally up to state institutions that are also in charge of publishing information about, and inventories of severe natural events, as well as hazard, vulnerability and risk studies. Table 6 of Appendix 2 lists some of the agencies that oversee such tasks.

Decision makers have access to numerous catalogues of past events as well as low-resolution national maps. Information on a local scale is much more limited. Table 7 of Appendix 2 offers examples of some hazard, vulnerability and risk studies produced in the countries analysed along with the names of the authors and target audience of such reports.

All of these countries have made considerable headway in improving the availability of information on disaster risk, especially with regard to hazards. Very encouragingly, the microzonification of seismic regions appears to have become common practice in major cities. It is important to carry through with these efforts so that this type of progress translates into regulations at the state and municipal levels such as those we have witnessed in Cali, Mexico City and Acapulco.

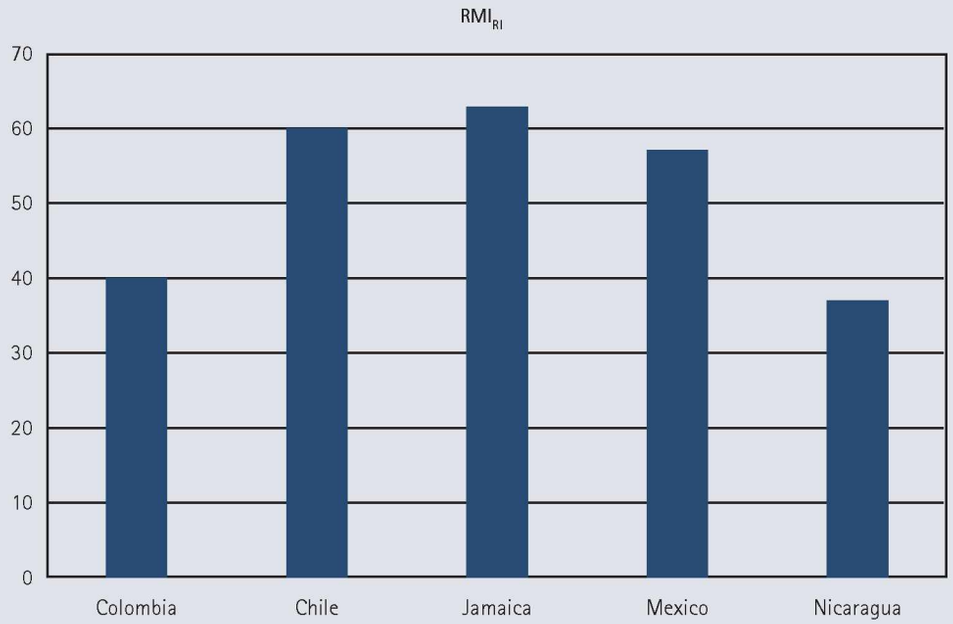
Vulnerability studies are generally less common and of a lesser quality than studies that focus on hazards. Many vulnerability studies are exclusively academic in nature. There are few risk studies in the region and the ones that are conducted are limited by the quality of the information available and the complexity of the phenomena involved. Table 8 offers a comparison of the availability and quality of risk information in the countries analysed.

Figure 2 shows the RMI_{RI}, 39th generated through Component 2 of this programme[20] for measuring the five countries' capacity for satisfying the risk information requirements of both decision makers and the general public. Such index readings are generally positive and reveal how they have improved over time. One should keep in mind, however, that the relative results between countries are not entirely congruent with the qualitative and quantitative evaluations consultants made of available risk information in the case studies. The use of subjective indicators that depend on the judgement of the evaluator in obtaining RMIs appears to be the main factor underpinning this discrepancy.

19 The consultants conducted studies in keeping with the terms of reference and basic methodological document for national case studies that can be found at http://www3.cepal.org.mx/iadb-eclac-project/05.html.

20 Disaster Risk and Management Indicators Program: IADB-ECLACC-IDEA, Manizales, Colombia, April 2004. http://idea.unalmzl.edu.co.

Figure 2 COMPARISON OF RMI_{RI}



a) Comparison of extreme scenarios with regard to risk information

For each country case study [21] an analysis was made of extreme event scenarios. We will now comment on the principal results of those exercises and the extent to which the risk information employed is applicable and useful. Table 9 in Appendix 2 lists the principal sources of information reported. We should add that the knowledge and criteria of local consultants played a very important role when it came time to determine factors or fill in gaps in the information in order to arrive at the desired results.

The choice of critical scenario was based primarily on an analysis of the records of historical events and knowledge of the natural phenomena that threaten the population centres where much of the countries' population and infrastructure are concentrated. As a rule, no effort was made to determine the probability of occurrence or the frequency of reoccurrence and hypothetical scenarios.

Seismic events were deemed critical events as they had produced severe disasters in all five countries. The seismic events proposed for the studies were seen as affecting the countries' capital cities except in Chile. Hurricanes have led to considerable losses in the recent history of Jamaica, Mexico and Nicaragua so they were designated critical events for those three countries. Floods were included as a critical event only in Colombia.

Hazard information, especially of a seismic nature, was found to be properly presented, scaled and available.

The greatest weaknesses are apparent on the level of information regarding physical vulnerability to hurricanes. In Jamaica and Nicaragua it was necessary to draw on the criteria and experience of the consultants to determine the extent of such vulnerability. Vulnerability to seismic events was determined based on existing studies.

The estimates on amounts and numbers of people exposed to risk that appear in the case studies were based on reliable information to which access was free except

21 Consultants conducted their analysis using the framework defined in the document "Análisis de escenarios de eventos extremos para la evaluación del sistema de gestión de riesgo" (2006) at http://www3.cepal.org.mx/iadb-eclac-project/05.html.

in some instance in Chile. The chief problem reported during this phase of the analysis was a paucity of detail in the available information for purposes of estimating losses. For example, there was a lack of data regarding construction materials and a tendency to underestimate the cadastral appraisals of infrastructure. Nicaragua reportedly suffered from a lack of economic indicators for the regions affected by the postulated event.

There were also reports of a lack of information for calculating the number of people affected by other collateral effects of the disaster (climate effects, lack of medical attention, fires, containment actions and post disaster psychological trauma).

3. INFORMATION FOR DISASTER MANAGEMENT

This section discusses the extent to which those responsible for the various areas of risk management enjoy access to the information they require for making decisions and taking action, and to the way in which such people effectively make use of such information. The section also deals with what access the potentially affected population has to the information it needs in order to limit risk as well as the manner in which the public perceives the magnitude and characteristics of the risks to which it is exposed.

Each country's situation is summarized in Table 10 of Appendix 2, and we will now make some comparative observations.

a) Making information accessible to decision makers

In all of the countries studied there was a strong level of assimilation of basic information on hazards, but not with regard to vulnerability and general risk.

There is a lack of information from the sort of local risk studies that are needed for drawing up contingency plans and mitigation programmes although progress has been made in the microzonification of risk in major cities, especially in Colombia and Mexico.

In Chile specialized information is managed by specific agencies and is not readily shared across sectors either for interested parties or others. This limitation, however, does not appear to have affected the country's capacity to manage the disasters that have occurred to date.

Decision makers generally lack sufficient information regarding vulnerability reduction and mitigation measures.

Official norms for the realization of mitigation works, and for urban planning and zoning in general are often inadequate or out of date. The most significant problem, however, consists of the extremely low level of compliance with such norms except in Chile.

b) Distributing information and the public's risk perceptions

In all of the countries studied campaigns have been conducted for informing the public about risks and preparation measures. These initiatives have achieved varying degrees of penetration, but surveys show that the public remains poorly informed about these problems.

Informational campaigns have focused on the most frequent events such as earthquakes in Chile and hurricanes in Jamaica. Awareness exists as to the risk posed by less frequent events with the potential to generate large-scale disasters such as earthquakes in Jamaica and floods in Chile.

Some case studies suggest that the population at risk proved reticent to respond to evacuation instructions and appeals to move to shelters even in relation to the most frequent events including those that had recently led to disasters. Jamaica is a case in point.

There have been significant improvements in warning systems and evacuation plans. Thanks in part to improved forecasting, notable progress has been made in establishing warning systems for both volcanoes and hurricanes.

c) Information on damage

Most countries studied have yet to adopt a systematic approach —and one using a standardized methodology— for conducting the disaster-loss evaluations needed immediately after an event for planning rehabilitation activities and later for reconstruction as well as for statistical purposes.

Mexico is the country among those studied that has gone the farthest in systematizing its process for evaluating losses and in employing the ECLAC methodology. In Chile such appraisals are made separately in each

sector and there is little in the way of integrating those results. Colombia is the only country that has tried to make an evaluation of losses from minor disasters.

4. INFORMATION FOR FINANCIAL DISASTER RISK MANAGEMENT

The availability of information for financial disaster risk management varied greatly from country to country within the five-country sample. In some the information was difficult to access while in others there were charges to see such materials. In all but two instances, assessments of the financial cost of disaster impact were discontinuous, partial, or based on methodologies that were not entirely comparable. It proved to be even more difficult to document the course and cost of reconstruction processes for which there was rarely any follow-up. Despite such obstacles, it was possible to extract sufficient information and to obtain a differentiated panorama of the way in which disaster risk was financed in each case.

a) Ex ante financial disaster risk management

Financing prevention, mitigation and preparation activities

The governments of both Colombia and Chile assign resources or conduct funding re-allocations for risk recognition and for studies or prevention actions and mitigation. Over the past decade Chile budgeted for catastrophe prevention programmes only 5% as much as was earmarked for dealing with emergency situations. In contrast, Mexico has a Fund for the Prevention of Natural Disasters (FOPREDEN) aimed at providing resources for prevention measures. Requests for funds may be made only by state governments of federal ministries or agencies. There are no specific funds for risk reduction in Jamaica. Nicaragua has worked out mechanisms for developing prevention and mitigation projects with the World Bank. A vulnerability reduction project is currently being implemented as part of a national strategy that includes establishing an institutional framework, regulating building codes and acquiring risk reduction technologies. The project is being funded with a 13,500,000 dollars (thirteen million, five hundred thousand dollar) loan and is coordinated by the Executive Secretariat of the National System for Disaster Prevention, Mitigation and Assistance (SINAPRED). The country also has a Social Investment Fund for Emergencies (FISE) for risk mitigation projects at a local level.

Calamity funds

The situation in the five countries studied varies from that of Mexico, where the central government assumes a high percentage of risk, Chile where the private sector copes with the losses while the government deals with financing emergency expenses or re-allots funds originally assigned to other programs, and that of Nicaragua in which international cooperation has become the principal source of financing although the government continues to assume its responsibilities. The other two countries studied are marked by a combination of these options. The extent to which risk transfer measures have penetrated also varies from country to country.

Four of the five countries have a disaster fund with Chile being the only exception. Mexico's FONDEN has accumulated more than ten years of experience; part of the fund is for emergency response but most goes toward reconstruction. Colombia's National Calamity Fund (Fondo Nacional de Calamidades or FNC) has seen its share of the national budget reduced; unlike in other countries, Colombia has assigned a significant percentage of its calamity fund (more than 60% in some years) to prevention activities. Jamaica's calamity fund has experienced inconsistent funding, thereby limiting its effectiveness. Nicaragua's fund has proven to be woefully inadequate and has been limited to extending assistance to those affected by future disasters. In these last two countries disaster response has been principally based on funding from abroad and the redirecting of funds from other government programmes.

Whenever a natural phenomenon occurs in Chile that merits the government declaring a state of emergency, a very agile procedure allows funds to be quickly redirected from other programmes to emergency response. In addition there are standing budget allotments for the emergency response units of a number of government ministries. These mechanisms have worked satisfactorily when such emergencies have occurred.

b) Ex post financial management

Financing the emergency, rehabilitation and reconstruction phases

Reconstruction activities in Colombia have practically been absent from the National Disaster Fund. The government set up other funds such as FOREC for the recovery and reconstruction phases that have been used for major disasters. In Chile, each ministry makes a damage report, draws up an estimate of the resources necessary for attending to the emergency and rehabilitation, and reassign the available funds accordingly. The funding for the reconstruction phase can only be obtained starting one year after the phenomenon occurred. Jamaica and Nicaragua receive foreign financial assistance in the form of loans for retrofitting infrastructure affected by major events. In Mexico, FONDEN assigns resources for rehabilitation and reconstruction to the states and to all federal departments or agencies; the states are required to provide 30% of the total project cost while federal agencies must provide 50%). Lastly, in Nicaragua financing for post-impact activities is assumed by the government by reassigning resources from the regular budget and redirecting credits and funds from international cooperation programmes. The international community has covered less than 60% of the aid the country has requested for the rehabilitation and reconstruction phases of recent disasters.

c) The countries' financial capacity for dealing with extreme events

The study in Colombia concluded that the potential direct effects in Bogotá and the surrounding area from a 500-year earthquake would total somewhat more than 15 billion dollars. The municipalities and regional departments lack the capacity to absorb the impact of such an event and recover. The study of one of the two extreme scenarios posed in Chile, based on the country's experience with an actual earthquake, concluded that most resources would come from the national budget. The Jamaica study failed to arrive at an estimate of probable losses or any assessment of the ability of the financial system of risk management to cope with the extreme scenarios contemplated in the project.

For the massive total losses that would be expected in Mexico's cities most affected by the hypothetical event —an earthquake that registers 8.2 on the Richter scale— the Disaster Deficit Index (DDI), which is the ratio of direct losses provoked by the phenomenon and the country's economic resilience, produced a 1.82-point reading. In Nicaragua the DDI for the extreme scenario posed was 2.28.[22] These readings suggest that Mexico's existing disaster funds would be insufficient to deal with losses and replacing the affected capital stock and that Nicaragua would lack the financial capacity to cope with a major tragedy, thereby increasing the country's dependence on international cooperation.

Although a common methodology is employed, cross-country DDI comparisons should be taken with certain reserves as it is impossible to guarantee that the extreme events postulated when calculating the DDI would have the same degree of probability in each country. This problem largely reflects the differences in risk information available for each country.

d) Risk transference

Penetration of catastrophic insurance is relatively low in four of the five countries studied but plays an important role in Chile. In all instances earthquake insurance is much more common than policies related to hydrometeorological phenomena. In Colombia, Mexico and Nicaragua public property must be insured, but much of Colombia's public infrastructure is not covered. The law in Mexico does not yet apply at the municipal level and in Nicaragua only incipient progress has been made in acquiring such coverage, but the government has launched campaigns along with the insurance industry to promote a culture of insurance among all segments of the population. Everything that has been insured in Nicaragua is covered by reinsurance. The Nicaraguan Insurance and Reinsurance Institute (INISER) is an autonomous state agency that is authorized to issue all manner of life and property policies, and has played a major role in relation to natural disasters and catastrophes.

22 A common methodology was employed, one should keep in mind the limitations of making cross-country DDI comparisons as it is impossible to guarantee that the extreme events postulated when calculating the DDI would have the same degree of probability in each country. This problem largely reflects the differences in risk information available for each country.

Chile lacks a policy of requiring insurance coverage on public infrastructure, but the concessionaries tend to take out insurance because they are legally obligated to assure ongoing public access to such services. The only government assets that are covered in Jamaica are seaports and airports, but new contracts point to a trend toward more expanded coverage. The tourism infrastructure of both Jamaica and Mexico is insured.

Various factors explain the relative scarcity of insurance coverage in all of the countries studied. A considerable percentage of these countries' economies are informal or in the hands of small-sized enterprises. The local insurance industry is underdeveloped, tends to face very high costs in acquiring external coverage and charges very high premiums. Inflation in Colombia erodes replacement values. Lastly, the public is poorly informed about the advantages of catastrophic insurance especially in the case of housing.

Mexico is the only one of the five countries that has introduced a catastrophe bond (for up to 450 million dollars) providing coverage for seismic events with a reading above 7.5 on the Richter scale as a way of attending to emergencies in those regions most susceptible to telluric movement.

The governments of Colombia and Mexico have devised subsidized insurance policies to protect the farm sector against crop damage arising out of meteorological contingencies. Those of Colombia also cover farm infrastructure losses. In contrast, Chile's booming agricultural export industry lacks any state-promoted insurance, leaving each farmer or enterprise to individually negotiate terms of coverage with insurance firms.

Table 11 of the Appendix lists the five countries' most representative aspects of financial management.

5. INSTITUTIONAL STRUCTURE

The five countries implement their main disaster management tasks in significantly different ways, thereby making comparisons particularly challenging. Table 12 of the Appendix summarizes the most notable characteristics of each of the five countries' institutional structure.

Chile is the country with the least structured disaster management system, leaving each ministry the responsibility for all phases of risk management. Responsibility even for the country's principal vital systems is left in the hands of the private interests holding the concessions to that infrastructure.

The management system's legal structure is most complete in Mexico and Nicaragua although not all of the agencies totally comply with the functions that they are legally obligated to perform. Budget restrictions greatly limit the scope of SINAPRED activities in Nicaragua.

In all five countries the responsibility for disaster risk management is increasingly left up to local governments, which frequently lack the economic, technical and structural resources required to effectively conduct the necessary actions, a deficiency that is particularly acute in the case of the smallest and weakest municipalities. Colombia has achieved the most significant degree of decentralization and has registered the most significant success in this regard in some of the country's largest cities. Jamaica appears to have the most efficient local management.

In almost all of the countries there exists a formal or real separation between the system for attending to emergencies and the one in charge of reconstruction-prevention. Mexico is probably the country that has best integrated both endeavours although the system suffers from a certain lack of coordination between the sectors in charge of these tasks.

There seems to be little correlation between management and its formal structure as it would appear to be more dependent on the country's degree of political development and the extent to which local or national governments function effectively.

One problem that appears to a lesser or greater degree in all of the countries studied is a paucity of experienced personnel working on an ongoing basis in disaster related tasks as there remains a generalized problem of high turnover in such posts.

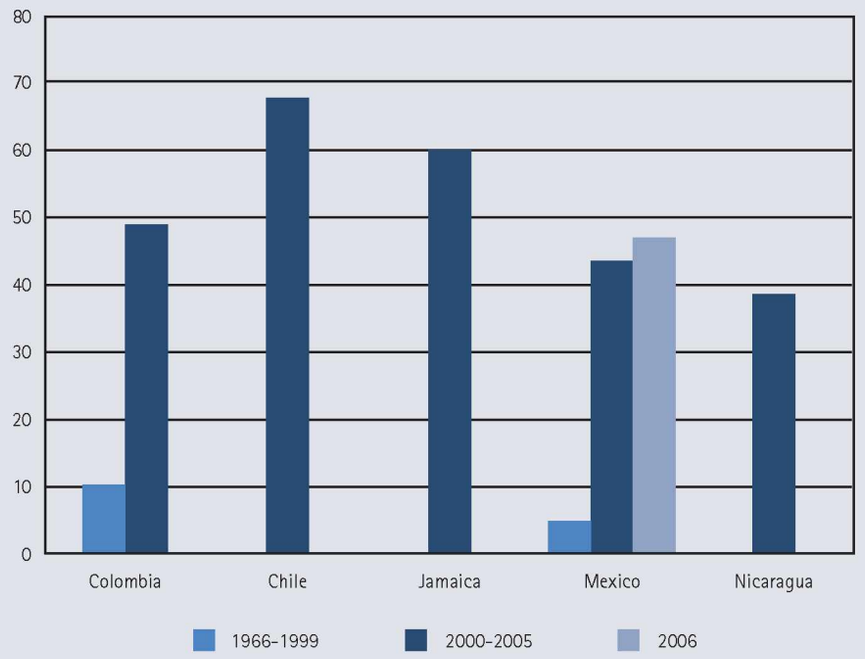
a) Disaster management index[23]

Here we comment on the Disaster Management Index (DMI) discussed in part 2 of the programme,[24] with emphasis on the factors that determined the assigned index reading and the changes observed between the

23 This index gauges risk management on the level of disaster response and recovery. These tasks are part of the broader disaster risk management that is the subject of this study.

24 http://idea.unalmzl.edu.co.

Figure 3 DISASTER MANAGEMENT INDEX COMPARISON



various dates when evaluations were conducted. Figure 3 summarizes the results for the five countries.

The substantial improvement that **Colombia** achieved in this regard between 1986 and 2003 is testimony to the importance the issue has acquired and the effectiveness of the emergency response and reconstruction mechanisms.

For 2000 **Chile** rated a DMI of 67, the highest of all five countries, in recognition of the country's superior performance in managing major earthquakes in past years.

Jamaica's DMI reading for 2000 of 60 was based on both response and recovery capacity as well as in the extent to which the public was prepared to face disasters.

Improved efficiencies in emergency and recovery have been the most significant factors helping to improve **Mexico's** DMI. Factors that have most notably limited index improvement are a lack of compliance with urban zoning and building norms and of reconstruction-related mitigation measures.

Nicaragua's evaluation of the case study produced a 38-point reading for 2006 that reflects the extent to which management capacity is dependent on foreign aid.

The differences in the five countries' DMI do not appear to reflect the assessments made by the consultants in the national case studies, something that seemingly underpins a basic weakness in the methodology which requires many subjective judgements in the assigning of basic parameter values.

b) System performance amid extreme events

While case study results are conditioned by the gravity of the event under consideration, its probability of occurrence and the scale of the affected area, it is useful to mention the principal weaknesses and strengths that were detected in each of the countries' risk management.

Should **Colombia** experience a very severe earthquake affecting Bogotá, rescue, fire fighting and hospital care capacity would be severely overwhelmed. Recovery and reconstruction programmes are still weak and do not guarantee the necessary speed and efficiency of response.

The scenarios studied for **Chile** correspond to the most severe earthquakes on record. To date there has been good emergency management in such events but poor performance on the level of reconstruction. The study concluded that improved organization and the reduction in building vulnerability would allow for a more favourable outcome.

In the category 5 hurricane projected for **Jamaica,** many basic disaster management services would be strongly affected particularly in transportation, hospital attention and the distribution of food and assistance. Doubts exist as to whether the public would massively obey evacuation orders and whether planned shelters would be in shape to supply the necessary attention.

The analysis of the scenario of a major earthquake off the coast of the southern state of Guerrero that was postulated for **Mexico** projected such a scale of economic losses and of human victims that disaster management capacity would be overwhelmed on the level of hospital capacity, rescue and recovery of basic services, especially in Acapulco and Mexico City.

The scenario for **Nicaragua**, involving an earthquake similar to that of December 1972, the extent of damage in Managua would be extremely high due to a low degree of building maintenance and the use of structurally deficient systems particularly in housing. Rescue problems similar to those of 1972 would arise owing to a lack of public safety, fires and, above all, a lack of hospital attention.

IV. CONCLUSIONS

1. DISASTER RISK AND MANAGEMENT SYSTEMS IN THE COUNTRIES STUDIED

The five countries chosen for this study display considerably varied degrees of economic and human development, levels of hazard exposure and vulnerability owing to distributional inequalities and differences in the effectiveness of risk management.

In most of these countries and others in the region the scope of losses has tended to grow while recent evaluations point to a trend toward a reduction in the number of victims. This drop reflects improvements in energy preparation and response, but the same success has yet to be replicated in reducing the vulnerability of assets at risk and of risk transfer mechanisms.

Trends in the number of disaster victims vary from country to country. Colombia continues to record high numbers of disaster victims but that disparity apparently reflects a greater propensity than in other countries to tally the victims of lesser disasters. Nicaragua registers a very high per capita rate of disaster-related deaths that easily surpasses the regional average.

Annual average disaster-related losses per inhabitant vary from a low of 4 dollars in Colombia to a high of 26 dollars in Nicaragua. For the three other countries in our sample, the average ranges between 11 dollars and 12 dollars. That per capita gap is evident in that such losses account for less than 1 per cent of GDP per inhabitant in four of the countries but grow to 3.2% in Nicaragua.

Indicators that the case studies applied for rating risk management performance show that while all of the countries substantially improved their ratings between the decade of the 1980s and the year 2000, they remain lower than desired and in three countries remain below 50 points on a 100-point scale.

Loss statistics confirm that disaster effects would be capable of halting national economic development in small countries but would have a comparatively smaller impact on the national economies of large countries as only a small percentage of their national territory would likely be affected even when the local economic and social impact were extremely severe.

There are major differences in the structures that each country has implanted for the handling of risk. Chile is the country with the least structured disaster management system, leaving each ministry the responsibility for the various phases of risk management. Even the responsibility for the country's principal vital systems is left in the hands of the private concessionaires for those systems.

There seems to be little correlation between management and its formal structure as it would appear to be more dependent on the country's degree of political

development and the extent to which local or national governments function effectively.

In almost all of the countries there exists a formal or real separation between the system for attending to emergencies and the one in charge of reconstruction-prevention. Mexico is probably the country that has best integrated both tasks although the system suffers from a certain lack of coordination between the sectors in charge of these tasks.

In most countries responsibility for disaster risk management is increasingly entrusted to local governments, which frequently lack the necessary economic, technical and structural resources for effectively taking the necessary action, a critical weakness especially in the case of the smallest and weakest municipalities.

One problem that appears to a lesser or greater degree in all of the countries studied is a paucity of experienced personnel working on an ongoing basis in disaster related tasks as there remains a generalized problem of high turnover in such posts.

2. INFORMATION FOR THE ANALYSIS AND REDUCTION OF RISK

All five countries have made considerable progress in the availability of disaster risk information, especially as regards hazards.

Experts in the region report technical and methodological handicaps for conducting risk studies that can be attributed to the lack of a framework of reference and especially a lack of standardized methodologies for gauging and expressing the various risk components. Despite such weaknesses, there is optimism that the situation will improve and a few complete and consistent risk studies have already been produced.

There is a general perception that risk information is often left at a purely academic level, failing to translate into standards, regulations or development plans.

Even while adhering to a common methodological framework, the studies of extreme events in the countries analysed revealed differences especially with regard to the probability of an event occurring, a disparity that largely reflected differences in the information available for such purposes. In almost all cases, the scenarios imply consequences outside of various aspects of management capacity including financial wherewithal. The studies also revealed weakness in the determination and spatial distribution of vulnerabilities, especially in the case of hurricanes.

The differences between the risk management indexes RMI_{IR} and appreciations arising out of the case studies should be a topic for further discussion.

3. INFORMATION FOR DISASTER MANAGEMENT

There has been a good level of acceptance of information on the part of decision makers and users in general, although they generally clamour for instruments that are both simpler and provide more precise and detailed risk-detection information.

The information generated from the managing of risk has concentrated on hazards. Decision makers lack sufficient information regarding vulnerability, exposure and risk in general. Furthermore, the distribution and availability of information on vulnerability and general mitigation reduction measures are limited.

The norms applied to the building of mitigation works, urban planning and land use nationwide are frequently inexistent or outdated, but the greatest problem is that when such planning exists in many instances compliance is minimal and the authorities lack efficient mechanisms for enforcing such rules.

There has been a notable improvement in the monitoring of hazardous phenomena and in public warning systems, especially in relation to major meteorological events. However, such systems have generally yet to develop the capability of anticipating local effects involving a major amplification of intensity and considerably elevated risk conditions for the general population.

There have been significant improvements in keeping the public informed, but in terms of risk awareness results have been disproportionate to the effort made. The communications media has proven highly useful to informational campaigns.

The self-protection information provided to the public focuses on how one should act in the preparation and emergency phases. Efforts geared toward convincing those at risk to take steps aimed at lowering vulner-

ability in their surroundings have generally enjoyed only limited success.

4. INFORMATION ON FINANCIAL DISASTER RISK MANAGEMENT

Where calamity funds exist, their financing has been very irregular and at levels that fall well short of what would be needed to help sectors cope with disaster impact.

These funds are frequently used, especially in states and municipalities, for rebuilding public sector property which the law requires be insured.

It is not always possible to easily and quickly disburse fund resources by sector or region.

An agile system of budget reassignment can compensate for a lack of a Disaster Fund as long as such a re-channelling of funds does not adversely affect high-priority national development programmes, and there is an understanding that whenever a catastrophe occurs responding to it becomes a national priority.

None of the countries studied have the financial capacity to cope with an extreme event.

Some countries fail to enforce rules that require insurance protection for public infrastructure. This problem is particularly acute with regard to public assets at the local level.

There is a general absence of reliable or up-dated inventories of public sector property.

There is a medium amount of catastrophic insurance coverage for earthquakes, but not for other types of natural phenomena.

Sources of information for documenting the financial management of disasters are scattered and generally suffer from considerable gaps. There is an especially pronounced lack of oversight for post-disaster actions. Data on insurance recovery is usually the hardest to come by.

The existence of a central fund is often not reflected at the state, provincial or municipal level even in the case of small countries. In addition, matching-fund requirements are usually imposed as a condition for such local entities to access the federal fund.

There is a scarcity of resources allotted for ex ante disbursement for disaster prevention and mitigation programmes. When funds are budgeted for such purposes they only account for a fraction of those allotted for emergency response.

V. RECOMMENDATIONS

1. FOR RISK-MANAGEMENT DECISION MAKERS IN THE COUNTRIES OF THE REGION

a) Regarding risk management strategies

DIAGNOSIS	RECOMMENDATION
Risk reduction should form part of developmental rather than emergency agendas.	• Adopt 'Hyogo Framework for Action' guidelines for promoting a culture of prevention and reducing disaster risk with an eye toward sustainable human development. • Promote: a) the strengthening of local capacities, b) the participation of all sectors, c) the use of resources endogenous to the countries, territories and communities involved. • Base disaster-risk reduction on the reality of the communities, taking into account the environment, the natural habitat and the people as the principal resources for achieving processes.
An efficient risk management system requires the participation of practically all sectors and levels of government. Participation can be achieved through a wide variety of organizational plans including those that imply tight government-public coordination and those that afford civil sectors almost total independence.	• Coordinated interaction between institutions, financial mechanisms, norms and policies must be achieved in order to arrive at an efficient operation with a holistic approach incorporating central and local government agencies, the general public, and business. • A key ingredient in an efficient management is to establish clearly defined lines of authority for each actor, as well as jointly agreed-upon, coordinated action plans.
The public risk (disaster) management system sometimes lacks the necessary hierarchy within the institutional organigram needed to assure that this issue becomes a national priority and that the measures and actions that are adopted are quickly and efficiently implemented.	• Management-system agencies must be granted the authority needed to coordinate the actions of the various sectors involved.
The management system, especially at a local level, frequently lacks personnel with the necessary training and experience for handling the various tasks involved in risk management.	• The management system must be armed with career professionals and avoid the common problem of constant turnover among technical personnel assigned to fundamental tasks.

b) Regarding information for risk analysis and reduction

DIAGNOSIS	RECOMMENDATION
Decision makers lack access to some information regarding risk issues and aspects of mitigation measures. The information that is available is not always prepared in the terms that decision makers require.	• The various phases of risk management, whether related to prevention or response, should be based on identifying and analysing risk. • It is useful to set up working groups between those generating and those using information with which to define product scope and content and for orientation on the best way to employ them. Vulnerability studies of critical infrastructure are fundamentally needed as the basis for implementing risk-reduction based rehabilitation programmes.
There is a frequent lack of funds necessary for the production, up-dating and distribution of information, especially in the case of resources for monitoring networks.	• Specific sources of financing must be established for the production and distribution of information needed for risk management, as well as rules and mechanisms for partially recovering such costs.
The information generated by differing groups of specialists is frequently incompatible, leading to confusion among decision makers. There have been positive experiences with integrating risk information in national or regional centres, but positive information flows have also been achieved in the absence of such centres.	• Proper terms of reference must be defined conducting national, regional and local risk studies for validating study results before they are employed in management activities. • Coordination agreements between information generators must be established as a way to avoid informational dispersion, duplication and incompatibility.

c) Regarding risk management

DIAGNOSIS	RECOMMENDATION
Most countries of the region have developed a proper body of laws to back their institutional structure for handling disasters, but the standards related to risk reduction, especially the laws and plans on land management and building standards, have not always been fully developed or updated. Of even greater concern is the frequency with which such codes and standards are ignored.	• It is important to establish proper procedures to assure standards dealing with land management and building safety are correctly applied and enforced. It is essential to establish permanent vulnerability-reduction campaigns for both formal buildings self-built constructions. One key ingredient is making available information on appropriate technologies written for poorly skilled people.
Hydro-meteorological disaster risk is on the rise in the poorest communities because of factors such as human settlements being located in high-risk areas, the extent of environmental destruction and a lack of adequate infrastructure	• Programmes are needed for the building, improvement and maintenance of protection works against flooding and landslides in communities. • Attention must be paid to minor-disaster risks, which require detailed studies of local hazard and vulnerability conditions.
Structures that are critical to emergency response such as roads and other means of communication and hospitals are not always in conditions that would help assure that they would be in working order following a disaster.	It is important to launch maintenance and rehabilitation programmes for vital systems with the proper technical and financial support. Of particular importance is the execution of hospital rehabilitation programmes for guaranteeing that such facilities are up and running during disasters.

d) Regarding financial disaster risk management

Calamity funds

DIAGNOSIS	RECOMMENDATION
Calamity funds have proven to be very unstable and their resources are disproportionate to the historical needs associated with disaster impact.	• Assure steady resource flows and define the extent of the funds based on experience and the sectors to which the fund is expected to prioritise support.
The money from such funds is not always readily available.	• A balance should be maintained between the speed with which such funds are to be made available and the necessary rigor with which they must be applied.
A significant portion of the disaster funds are applied toward rebuilding public sector infrastructure, which legally or for practical reasons should be covered by insurance.	• Assign fewer resources from disaster funds to the rebuilding of public works and prioritize their use in attending to damage in the least protected segments such as non farm, informal sectors.
Often the central fund is not organized on the state, provincial or municipal level and access to the federal fund is frequently restricted to those who can assure matching funds.	• Assure that central disaster funds are replicated at a municipal or provincial level. Establish matching-fund requirements that are realistically within the realm of possibility of such local entities.

Ex-post financing
Relative importance of prevention actions

DIAGNOSIS	RECOMMENDATION
Very little funding is earmarked ex ante for disaster prevention and mitigation programmes. When resources are budgeted for such purposes, they account for a small fraction of the funds assigned for dealing with emergencies.	• Expand the funds available for prevention and mitigation activities. • Provide additional support for infrastructure maintenance programmes, especially for critical installations such as hospitals as their weaknesses have made exceedingly more expensive or complicated to assure such infrastructure. • Encourage progress on vulnerability studies, particularly on strategic installations for which there are convincing reasons to allot adequate resources for prevention and mitigation work. • Promote the financing of cost-benefit studies for mitigation projects on basic installations.

Catastrophic insurance

DIAGNOSIS	RECOMMENDATION
Catastrophic insurance is moderately available in the case of earthquake coverage, but not so for other types of natural phenomena.	• Promote the development of insurance for hydro-meteorological phenomena. • Given the difficulties local governments have in raising enough funds for catastrophic insurance, the central government could assume a percentage of the premiums in order to make it possible to acquire such policies. • Setting aside a percentage of calamity funds for such policies would be a very good investment.
In some countries laws requiring that public infrastructure be insured are ignored, especially in the case of provincial or municipal buildings.	• Work to assure that public infrastructure must be insured so as to reduce the financial impact of disasters.
There is a general lack of reliable and up-dated inventories of public sector property.	• Support funding for up-dating inventories of public sector property and infrastructure that they can be reliably insured.
Catastrophic insurance is very expensive in the region, in part due to the frequency of disasters but also due to specific practices in the selling of insurance	• The public sector should try to achieve economies of scale in assuring its real estate. Premiums can prove excessively high when each government agency separately takes out insurance on their infrastructure. • Island nations or countries with a limited degree of financial development should study the possibility of joining forces with other governments in the region with the idea of taking out insurance on a regional level, thereby diversifying risk and lowering the weight of the global reinsurance market on the region.

Historical series on disaster socio-economic impact

DIAGNOSIS	RECOMMENDATION
Only a few countries in the region have banks of continuous and real-term data on the socio-economic impact of disasters.	• Promote the creation of evaluation bodies within the risk-management institutional structure. • Solid data banks on the socio-economic impact of disasters broken down by type of disaster and without regional overlap are indispensable for the design of proper financial policy.

Disaster of extreme proportions

DIAGNOSIS	RECOMMENDATION
None of the countries studied had the financial capacity to cope with events of extreme proportions	• Study the possibility of establishing a resource pool for catastrophic insurance with the regional or sub-regional financial organizations or institutions that allow one of the member countries to cope with an eventual extreme disaster.

2. RECOMMENDATIONS TO INTERNATIONAL DEVELOPMENT AGENCIES

The international financial or donor institutions should adopt measures and projects for improving the availability and quality of the information needed for risk management and in this way help to reduce the negative impact of disasters. Such measures include:

- Effectively determining whether development projects have properly considered disaster safety, and when necessary adopted measures necessary for risk mitigation.
- Improving the efficiency of coordination mechanisms between the relevant technical support programmes of the various international development agencies in order to avoid duplication and obtain compatible results that contribute to the national strategy.
- Promoting the development and publication of methodologies and techniques for creating risk information systems that properly assess hazards and vulnerabilities. Promote regional or sub-regional workshops on this topic in the countries that have made the most headway, such as Colombia and Mexico, so that they are able to share their experiences.
- Contributing to the standardization or normalization of terms used in risk management, thereby facilitating comparisons between countries.
- Developing methodologies for evaluating progress in prevention measures as part of a country's risk management policy.
- Giving technical support to countries in order that they may, in the most favourable terms, expand catastrophic risk transferences through insurance and reinsurance.
- Making known ECLAC and other damage valuation methodologies, but always employ common criteria so that results can be compared and combined.
- Financing vulnerability studies and rehabilitation criteria for critical installations.
- Promoting the use of cost-benefit studies for mitigation investments, and the development of related methodologies.
- Financing mitigation works in the countries with relatively less development.
- Providing help, especially to the least developed countries, for assuring that the results of many related studies are put into practice including the support needed to sustain for various years the systems that have been developed (monitoring networks, warning systems, information systems).

3. PROPOSAL FOR ADDITIONAL PROGRAMMES ON THIS SUBJECT

The diagnosis made in this programme on the level of risk management information needs in the countries of the region reveal some methodological differences that could be overcome with additional studies promoted by the same international development agencies. The main projects in this regard would include:

- Standardize risk information and its components. This would not involve imposing unified methodologies and products, but rather agreeing on common criteria for producing information needed in relation to the various types and scales of disaster phenomena, as well to the socio-economic conditions in affected zones.
- Improve risk indicator and management methodologies. This demands simplifying the processes for obtaining the various indexes while at the same time achieving more reliable results. The main objective in applying the methodology should be to measure index variations over time and encourage index progress while correcting management deficiencies.
- Improve the methodology for extreme event scenarios. Scenarios constitute a useful tool for detecting disaster-management needs and deficiencies. The main challenges of the current methodology primarily involve the volume and complexity of the required information. It is useful to think of simplified procedures for local scenarios that base contingency plans on more detailed contingency plans and methods for events with a broad area of influence with

which to evaluate national or regional strategies for the financial management and operational handling of disasters.

- Produce and make widely known vulnerability reduction techniques for low-resource communities. The development of appropriate technologies should be associated with broader programmes that tend to promote the socio-economic development of communities.
- Conduct cost-benefit studies that help to decide which part of catastrophic infrastructure risk should be transferred to the insurance market and which should be assumed by the government.

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APPENDIX I

GLOSSARY

Critical scenarios. A disaster scenario is the possibility that an event of great intensity and area of influence unfavourably affects a specific region or human settlement. A critical scenario is one of greater damages or losses in a region. Critical scenarios are identified based on the distribution of exposed goods, vulnerabilities and hazards in the region under analysis. Given that some factors that determine the scenario vary by the seasons or hours, it is necessary to anticipate the moment at which the most adverse conditions will coalesce.

Disaster. An event that severely affects a society, community or project's functioning and inflicts considerable or generalized human, material, economic or environmental destruction that exceeds the capability of a society, community or project city to respond using its own resources.

Disaster Management. The operational handling of risk management strategies. This category extends from a variety of activities that must be conducted during the pre-disaster phase as well as those related to the post-disaster or attention and reconstruction phases. These include prevention, litigation and preparation in order to reduce the effects of future disasters, emergency response, rehabilitation and reconstruction to lower the effects of past disasters, avoiding a return to a state of vulnerability.

Emergency planning. The efficient handling of a crisis produced by a natural phenomenon is based on effective planning for the emergency. The principal aspects consist of contingency plans for scenarios; preparation and resources for attending to emergencies; evacuation plans and shelters, the role of the armed forces and non governmental organizations; budgeting for emergencies. Other *pre-disaster* strategic orientations involve assuring the presence of alternative routes, redundancies in the healthcare system and the provision of clean water, among other alternatives.

Emergency relief/response. The provision, attention to or management of an emergency situation includes plans, structures and systems for coordinating the actions of the government with those of non governmental organizations, groups of volunteers, civil organizations and international aid for responding to emergencies in the broadest sense.

Financial management of risk. This consists of all of a country's policies for channelling financial resources for reducing risks and impact prior to when a disaster occurs, the resources needed dealing with emergency response, rehabilitation and reconstruction once the event occurs, and the application of mechanisms that tend to reduce the financial effects on a country through risk transference.

Hazard. The degree to which a place or human settlement is threatened by natural phenomena or other types of events over a specific period of time. Hazards can be classified by their origin: natural, technological and social. The complexity and interrelation of the phenomena that may pose such threats lead to nuances in deciding the manner hazards should be designated and classified.

Mitigation. Structural and non structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation[25] and technological hazards such as:

Non structural mitigation measures. Non-engineered measures that reduce vulnerability to hazards: land-use planning and regulations; building codes and their enforcement; zoning according to degree of hazards; reforestation of costal areas and hill/mountainsides; government educational and training efforts, and public involvement in mitigation works.

Prevention and Mitigation Works. The pre-disaster part of a national strategy must include hydraulic works for the prevention of flooding and drought: canals for diverting water flows, other fluvial defences, contention walls and similar constructions that serve to avoid or at least mitigate the effects of flooding. It should also include vulnerability studies of strategic installations and vital lines or plans to implement them.

Physical vulnerability. System propensity to suffer damage and losses owing to interaction with potentially hazardous external and internal processes. This is a relative property depending on the characteristics of each system and its susceptibility to the type of threat to which the system is exposed.

Preparedness. Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations. This involves the existence of observation, forecasting, public-warning systems and networks for measuring hydro-meteorological, geological and anthropogenic hazards and fluid communications systems that reach the most remote communities.

25 *Living with Risk, a global review of disaster reduction initiatives*, International Strategy for Disaster Reduction (UN/ISDR), Geneva, July 2004.

Prevention. A combination of activities to provide outright avoidance of the adverse impact of hazards and means to minimize related environmental, technological and biological disasters. Depending on social and technical feasibility and cost/benefit considerations, investing in preventive measures is justified in areas frequently affected by disasters when it is combined with public awareness and education campaigns on disaster risk reduction that help to reshape attitudes and behaviour so as to promote a "culture of prevention".[26] In addition to actions of a physical nature, prevention includes actions for raising awareness as well as the organization, education and preparation of civil society about disaster prevention and response.

Risk. The results arising out of the interaction of hazard, vulnerability and exposure. This interaction makes for the possibility of harmful consequences or expected losses (economic, physical, social and environmental) amid certain sectors of society. A risk exists when a possibility of such losses arises as a result of all three factors coalescing. If one of these factors is missing, risk is nil.

Risk management. "The systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to *lessen the impacts of natural hazards and related environmental and technological disasters* [our emphasis],[27] according to the united Nations International Strategy for Disaster Reduction, which is regarded as the best approach.[28]

Risk perception. Peoples' perceptions of the risk they run. The objective of a risk perception study is to delineate the sectors of society based on their degree of risk perception and eventually to compensate for any weaknesses in perception with useful information regarding past events in the living memory of community members. The methodology for these studies may be based on polling techniques and surveys.

Social vulnerability. Propensity of human communities to suffer damage from a specific hazard depending on a series of socioeconomic, psychological and cultural

26 Ibid.

27 Ibid

28 Ibid.

factors. Social vulnerability to natural phenomena is greatest among the poorest people in developing countries owing to a lack of information and resources with which to take the appropriate measures.[29] Within this group, children, women and the elderly are seen as being the most vulnerable.[30]

Value or Exposure. The dimension and cost of a region's goods that might be susceptible to losses from a threat. Such exposure extends to infrastructure, the populace, economy and production. As with hazards and vulnerability, determining the value of exposure becomes more complicated depending on the size and diversity of a region.

29 During the June 2001 earthquake in Arequipa, Peru, the 16 people who were pulled out to sea when the first wave receded could have saved themselves if they had been familiar with how tsunamis work.

30 Statistical data from the Kobe earthquake shows that most of those who died belonged to these age groups.

APPENDIX II

COMPARISON TABLES

TABLE 1. INFORMATION REQUIRED FOR EVALUATING SOME HAZARDS IN THE REGION

Seismic activity	Tsunami	Wind	Precipitation	Volcanic eruption	Storm waves	Landslides
Historical seismicity, seismic catalogues	Records of floods, high water levels for past events.	Studies on the frequency and intensity of hurricanes, histograms.	Historical information: maps of flooding from past events.	Catalogues, records of areas affected by past events.	Historical information and records of water levels.	Historical data for the area or other sites with similar conditions.
Tectonic and geological studies. Models of rates of magnitude exceedance.	Land surveys: costal bathymetric charts, curve maps of costal areas	Cyclogenic area. Hurricane generation, trajectory and probability studies.	Records from pluviometric stations and of both maximum annual and average daily rainfall.	Geological studies and estimated dates of occurrence.	Costal bathymetric studies.	Study of physical and geological characteristics.
Risk reduction laws specific to, or suitable for the region being analysed; rates of exceedence of maximum accelerations.	Seismic and tectonic information for the surrounding area. Studies of propagation velocity and arrival times of waves reaching the coast.	Topography of costal areas. Relief and topographical maps for affected zones.	Hydrograms of avenues, determination of areas susceptible to flooding. Topography, level curves, relief of drainage works.	Classification of volcanoes, volcanic explosivity indexes.	Cyclone generation studies.	Modelling of possible landslide formation, behaviour, velocity and distance covered.
Acceleration amplification and transfer functions, spectral coefficients.	Identifying and studying natural or man-made defences for the mitigation of tsunami effects.	Data from meteorological observation stations. Distribution models of extreme values.	Suitable runoff and filtering models for the zone under analysis, studies of solid permeability	Wind direction and velocity (only in the case of hazard from volcanic ash).	Theoretical studies and storm-related high-tide models.	Frequency/intensity studies for triggering events (torrential rains, earthquakes, etc.)

TABLE 2. INFORMATION FOR VULNERABILITY EVALUATION	
PHYSICAL VULNERABILITY	VULNERABILITY SOCIAL
Degree of development of and compliance with building codes.	Distribution of the population by urban and rural, sex, age groups, geography and historical growth.
Characteristics of buildings and critical infrastructure such as quality and types of construction, age and state of conservation.	Spatial distribution of the principal human settlements and their growth rate over time. Location of hazardous installations or activities.
Information on type and severity of damage from past natural events.	Social infrastructure, including for educational, historical and cultural assets, recreation and sports facilities, housing and healthcare installations.
Mathematical models of existing vulnerability or structural fragility for the place analysis and the hazard in point.	Farm, industrial and commercial (including tourism) production, its spatial distribution over a period of a year (when seasonal).
Existence of structural rehabilitation and maintenance programmes.	Infrastructure of transportation and telecommunications services, supply of potable water and evacuation of residual water and solids, and energy (hydrocarbons and electricity), identifying sources and spatial location.
Area planted and type of crop, existence of water reserves.	Development indicators —such as the Human Development Index developed by the UNDP— and its spatial distribution in the country under study.
Spatial distribution of infrastructure by type of structure. Damage maps from past events.	Existence and application of educational programmes and those for lowering the adverse affects of extreme natural events such as seismic and tsunami warning systems.

TABLE 3. INFORMATION THAT COULD BE NECESSARY FOR EXTREME SCENARIO STUDIES

Historical information of the phenomenon and statistics

- Statistics on the number of dead and injured.
- Statistics on losses and damages.
- People displaced by events with characteristics similar to those posed in the scenario.

Hazard Studies

- Probability studies of a phenomenon: incidence rates, exceedance rates.
- Effects of the path, trajectory.
- Amplification due to site effects.
- National zonification maps.
- Microzonification of cities.
- Possibility of secondary effects: fires, explosions of flammable material.

Vulnerability studies

- Vulnerability indicators.
- Vulnerability tasks for the area and for the hazard analysed.
- Existence and maintenance of disaster mitigation programmes for the public.
- Warnings systems, emergency drills, and evacuation drills, etc.

Exposure

- Land surveys.
- Land registries, processed satellite photography.
- Value of construction by square meter for the various types of structures.
- Population distribution by area, age group, social condition, sex, religion, etc.

Critical Infrastructure

- Locations, capacity and state of vital and critical structures (hospitals, healthcare and emergency care centres, shelters, fire and police stations, schools, theatres, dams, water lines, lighting, power stations, oil and gas pipelines, refineries, roads, bridges, urban transportation).

TABLE 4. ECLAC-MANUAL CRITERIA

Direct damage

- Damage suffered by immobilized, destroyed or damaged assets, and those in inventories (both finished goods, goods in process, raw materials, and replacement parts).
- Total or partial destruction of buildings, installations, machinery, equipment, means of transport and warehousing, furnishings, and damage to crops, irrigation systems, and reservoirs.
- Production losses on crops that were ready for harvesting

Indirect damage

- Flows of goods and services that cease to be produced or provided during the period beginning from the time of the disaster and potentially extending throughout the rehabilitation and reconstruction process.
- The disaster-related increases in expenditures or costs needed to produce goods or provide services, and the income reduction arising out of the impossibility or difficulty of such provisioning (which at the same time will be manifest in macroeconomic effects).

Macroeconomic Effects

- Economic growth (overall and by sector) in the trade balance both in terms of the projected changes in exports, tourism and services, as well as their counterparts in imports and external service payments.
- Extent of indebtedness, monetary reserves, public finance and gross investment.
- It is often useful to estimate the impact of secondary effects on prices, employment and household income.

TABLE 5. FUNDAMENTAL FEATURES OF THE DEVELOPMENT LEVELS REACHED BY SELECT COUNTRIES						
	Colombia	Chile	Jamaica	Mexico	Nicaragua	Regional Average (LatAm & Caribbean)
Total population (2005) (Thousands of people)	46 039	16 267	2 651	106 147	5 483	562 046
Population growth (2000-2005 annual average)	1.7	1.1	0.5	1.4	2.0	1.4
Percent of urban inhabitants (As per cent of total)	76.6	86.6	52.2	76.5	56.9	77.6
Illiteracy rate[a] (as per cent of total population)	7.1	3.5	11.3	7.4	31.9	9.5
Per capita income in 2004 (Dollars)	2 136.4	5 903.0	3 343.9	6 521.9	836.5	3 755.7
Human development index 2004[b]	0.790	0.859	0.724	0.821	0.698	0.795
Ranking among 176 countries surveyed	70	38	104	53	112	
Electric power coverage (2004) (as per cent of total population)	95.3	98.5	n.a.	97.2	72.4	Na
Potable water coverage (2004) (as per cent of total population)	85.9	92.0	93.0[c]	88.1	61.5	Na
Drainage coverage (2004) (as per cent of total population)	73.6	80.4	80.0[d]	71.1	62.9	Na

Sources: ECLAC, Statistical yearbook for Latin America and the Caribbean, 2005; Human Development Report UNDP, 2006

a Percentage of population 15 years and older.

b This is a combined index that contemplates GDP per inhabitant, life expectancy at birth, illiteracy rates, education enrolment at all levels, a month other indicators.

c 2002.

d 2002.

TABLE 6. SOME SOURCES OF STATISTICAL INFORMATION AND THE MONITORING OF SEVERE NATURAL EVENTS

Colombia	Chile	Jamaica	Mexico	Nicaragua
• Colombian Institute of Geology and Mining (Ingeominas) • Institute of Hydrological, Meteorological and Environmental Studies, IDEAM • Network of meteorological stations in Manizales operated by the Institute for Environmental Studies, IDEA.	• Meteorological Data Base of the National Water Service • South Andean Volcanological Observatory (OVDAS) • Seismology Service of the Universidad de Chile • RENADIC (accelerographical network)	• Office of Disaster Preparedness and Emergency Management • National Hurricane Centre (NHC)	• National Disaster Prevention Centre, CENAPRED. • Mexican Water Technology Institute, IMTA • National Meteorological Services • Regional Disaster Information Centre (CRID) • National Seismology Service, CIRES • Scientific Research and Superior Education Centre of Ensenada, CICESE • Mexican Geological Service • Mexican insurance companies	• National Disaster Prevention System, SINAPRED • Nicaraguan Institute of Territorial Studies, INETER

TABLE 7. EXAMPLES OF RISK, HAZARD AND VULNERABILITY STUDIES IN THE REGION

Colombia	Chile	Jamaica	Mexico	Nicaragua
Seismic hazard map published by the Seismic Engineering Association with the participation of Ingeominas and the Universidad de los Andes	To-scale geological hazard maps of the National Geological and Mining Services	Storm high-tide estimates conducted by the Caribbean Institute for Meteorology and Hydrology	Geographic Information System for Identifying Risks, developed by the SEDESOL	Isoacceleration maps for various return-time periods prepared by SE-SINAPRED.
Intensity curves, maximum intensity tables, daily and monthly precipitation maps, nationwide maps on areas subject to flooding prepared by the IDEAM	Preparation of Tsunami Flooding Maps for regions I and V prepared by the Navy's Hydrographic and Oceanografic Service (SHOA)	Flood mapping through the Water Resource Authority (WRA) of the island's 8 largest rivers for return periods of 5, 10, 25,50 and 100 years (trunk project)	Hazard maps (mainly seismic) generated at the National Engineering Institute and the Geo-physical Institute of the UNAM, the Mexican Institute of Water Technology, Petróleos Mexicanos	Incomplete seismic microzonification of the cities of Managua and León
Maps produced by Ingeominas that chart the threat of landslides and define those areas with the greatest relative and qualitative threat of slides.	Amplification or liquation calculations of by the Universidad de Chile and the Pontificia Universidad Católica de Chile for private firms.	Maps marking areas susceptible to slides prepared by the Government Department of Mining and Geology and the Disaster Studies Unit of the University of the West Indies	Microzonification of the Federal District and Acapulco that form part of regulatory frameworks.	Seismic vulnerability studies of Managua provided by the vulnerability services of the Universidad Nacional de Ingeniería (UNI) and MOVIMONDO
Risk indicators for IDB-ECLAC performed by the Universidad de Manizales as part of the pilot project.	Seismic vulnerability conducted in 28 hospitals throughout the country as part of a joint endeavour between the Mathematics and Physical Sciences Faculties of the Universidad de Chile.	The ODPEM conducts non structural vulnerability studies for the private sector as part of a strategy to promote preparation and planning in that sector.	CENAPRED Risk Atlas offers high-quality, nationwide risk information, but is incomplete and lacks the resolution necessary for local or municipal decision making.	The joint "Natural disaster vulnerability reduction", project between SINAPRED and the INETER. Determines economic and human losses for various return-time lapses.

TABLE 8. RISK INFORMATION IN THE COUNTRIES ANALYSED

	Colombia	Chile	Jamaica	Mexico	Nicaragua
Quality and quantity of risk, hazard and vulnerability studies	Numerous high-quality hazard and microzonification studies exist of major cities. Vulnerability studies contain a considerable volume of approximated information	Most of these risk studies are generated in universities by a select few people who embody the knowledge and scientific trajectory on these topics.	Hazard studies sometimes lack suitable continuity. The generation of new information is limited by the non existence of a budget allotment for vulnerability reduction.	Risk (principally seismic) study projects are focused on the main cities. CENAPRED's risk atlas provides nationwide, risk information of a good quality.	The country has one of the most ambitious risk studies in the region.
Purpose and usefulness of existing studies	The detail and scale of studies on hazards and microzonification are suitable for regulatory purposes.	Studies are generally prompted by the occurrence of extreme events.	There are studies that proved useful for implementing housing-relocation programmes in the Askenish community.	Seismic microzonification studies for the two cities with the greatest hazard (Acapulco and Mexico City) have been included in building codes.	The proposal for a new national building code includes recent information on seismic hazards.
Connectivity and correlation of information produced	No common methodological frameworks exist for national, regional and local risk studies.	Local information is not always correctly systematized. There are some isolated studies of local effects from seismic events in some of the main cities.	Information is not always complete and many times map detail is inadequate.	The risk atlas provides a common methodological framework for conducting studies.	Social vulnerability studies (maps of social marginality, human development (HDI), and extreme poverty indexes) offer very similar results.
Distribution and availability	The information is available but very disperse	The government does little to distribute vulnerability and risk information	Availability is adequate	Information from educational and research institutions is widely available, can generally be accessed from their Internet portals and is distributed for free.	With some exceptions, vulnerability information is not distributed and is confined to academic environments.

TABLE 9. SOURCES OF INFORMATION USED IN THE CASE STUDIES' ANALYSIS OF EXTREME EVENTS

Colombia

- Population of principal cities, 2005 Census, DANE
- Colombian Seismic Hazard Map Standards, 1998
- Areas with construction in Colombian capital cities 2003 ERN Colombia
- Seismic microzonification map of Bogotá UNIANDES
- Building vulnerability functions Universidad de los Andes, CEDERI, ERN Colombia
- National Map of Flood Zones, IDEAM
- Appraisal data from cadastral registries and of crops
- Table of Unitary Construction Costs by Square Meter
- Study "Seismic transference, retention and mitigation study on essential buildings and those essential for attending to the community of the Capital District of Bogota"CEDERI
- Study "Estimación de pérdidas económicas para diferentes scenarios de riesgo en edificaciones públicas y privadas en Bogotá y análisis económico del riesgo residual en el Distrito Capital de Bogotá", ERN Colombia

Chile

- National Housing and Population Census National Statistics Institute
- Farm Census National Statistics Institute and ODEPA.
- National Industry Survey, ENIA National Statistics Institute
- Hospital statistics from the Health Ministry (MINSAL)
- Digital cartographic information, National Irrigation Commission
- Housing Type Based on Predominant Wall Material, National Housing and Population Census. INE, 2002
- Regionalized Gross domestic Product, 1996-2004, Source: Central Bank
- Number of Homes by Damage vs. Housing Material http://siis.reconstrucciontarapaca.mideplan.cl/

Jamaica

- Río Cobre river flooding map Underground Water Authority
- Consultant criteria and knowledge of existing infrastructure vulnerabilities (housing, health services and vital lines) and of societal behaviour during previous events.

Mexico

- Data on economic disaster impact, Regional Disaster Information Centre (CRID)
- 2005 population breakdown by state, National Statistics Institute (INEGI)
- Tectonic map of Mexico National Seismology Service
- Rupture zones of major earthquakes since the beginning of the last century, National Seismology Service (SNS)
- Attenuation curves of typical accelerations proposed by Ordaz et al (1999)
- Statistics on building damage in Mexico City from the earthquake of September 19, 1985 Noreña et al, 1989
- Distribution of homes by type. National Housing and Population Census, INEGI
- RS-MEXVer. 2.1 system developed by ERN Ingenieros Consultores, S.C.
- Seismic zones in the Federal District (D.F.) and Acapulco, Mexican Association of Insurance Institutions (AMIS).
- Geo-technical Zoning in D.F. Socio-economic disaster impact series for Mexico. Characteristics of the socio-economic impact of the principal disasters that occurred in Mexico during 1980-99.
- Available hospital beds by city. INEGI, Health, Healthcare material resources
- Zones susceptible to the generation and impact of tsunamis. Series Fascículos "Tsunamis", CENAPRED.
- Hazard Index of Flammable Sources, Source: Atlas Nacional de Riesgo
- Spatial location of the network, repair sites following the 1985 earthquake and map of average annual flooding. Atlas Nacional de Riesgos

Nicaragua

- Land registry data
- Study "Vulnerabilidad Sísmica de Managua" produced by DRM-ERN and coordinated by SE-SINAPRED
- Map of maximum terrain acceleration Revised and updated version of National Building Code –INETER 2004.
- Map of social marginality index by departments Presidency

TABLE 10. INFORMATION FOR DISASTER MANAGEMENT					
Topic	Colombia	Chile	Jamaica	Mexico	Nicaragua
Degree to which information is accessible to decision makers	A considerable volume of information is generated by a variety of groups, but little coordination with the national science system.	An abundance of information on hazards and mapping, but in some cases the institutions that produce the information sell it at costs that make it rather inaccessible.	International agencies and donors are intensely engaged in generating information and transferring it to decision makers.	A broad and accessible supply of hazard-related information, but little of it takes into account local characteristics that reshape hazard conditions.	The volume of vulnerability has increased in recent years with the participation of public and private as well as international institutions.
Information distribution and the public's risk perceptions	Functioning monitoring networks, but some are of questionable usefulness for disaster prevention purposes.	The institutions in charge of monitoring phenomena have their own public information programmes.	There is a public risk-awareness programme that is structured on both a national and municipal level.	There have been intense and constant public information campaigns but risk perception varies greatly.	The INETER has played an important role in informing and educating the public.
Damage information	Some polls suggest that the public feels that there is a lack of information available. A very complete data base on economic losses and victims has been maintained since 1971 and which also tracks lesser disasters.	There is no agency in charge of evaluating disaster-related losses.	The ECLAC methodology has recently been applied on a rudimentary level.	Since 1995 the CENAPRED has been in charge of determining direct and indirect losses from the main disasters.	There is no collection or systemization of data, or any good data on damage and disaster response.

TABLE 11. PRINCIPAL CHARACTERISTICS OF FINANCIAL DISASTER RISK MANAGEMENT

	Colombia	Chile	Jamaica	Mexico	Nicaragua
Catastrophe Funds	A National Catastrophe Fund exists but is seriously limited. NCF funding has come from very unstable sources and government funding has fallen as a percentage of public revenues.	No fund exists for covering disaster situations. The President of Chile is authorized to use budgeted funds or reassign funds designated for other purposes.	No adequate fund exists for the handling of risks, so the necessary resources are obtained by diverting funds from other programmes. The effectiveness of the National Disaster Fund (NDF), created in the wake of hurricane "Gilbert", is quite limited.	The country has a disaster fund (FONDEN) for emergencies, rehabilitation and reconstruction. Recently two other funds were created for attending to damage at the state and municipal levels.	A National Catastrophe Fund exists that is unregulated and may only be used to support those affected in a disaster situation. The Presidency of the Republic may authorize the transfer of funds from existing projects.
Financing mitigation and prevention activities	The National Disaster Fund has assigned a significant percentage of activities to prevention (more than 60%)	The Finance Ministry decrees the reassignment of funds for prevention	No risk reduction funds exist.	FIPREDEN and FOPREDEN are programmes aimed at implementing prevention measures.	An IDB refundable financing mechanism exists for risk identification, prediction and mitigation operations.
Risk transference	Penetration of catastrophic insurance is limited. The law requires that state property be insured.	Catastrophic insurance penetration is significant only in the case of major firms, and is limited throughout the rest of the private sector.	Most government assets are not insured, but there is gradual movement toward a greater culture of insurance.	Insurance penetration is relatively low compared to the scale of the economy. The financial authorities launched a catastrophe bond for seismic event coverage.	Through its National Risk Management Fund SINAPRED promotes financial protection, especially for improving the coverage terms of insurance for state goods.

TABLE 12. INSTITUTIONAL STRUCTURE					
Topic	Colombia	Chile	Jamaica	Mexico	Nicaragua
Legal framework	The legal framework emphasizes prevention and decentralization on an inter-sectorial level and coordination	The structure is not well integrated and is based on legal bodies for the various exposed systems.	All phases of activities are directed by ODPEM, an operational office of the National Disaster Committee (NDC), comprised of representatives from all sectors.	There is a very complete and suitable set of norms and regulations. Urban land-use planning is weak and compliance is minimal.	A complete and modern legal framework. Emergency attention is disconnected from other management phases. Scant compliance with land-use and zoning rules.
Institutional coordination	There are technical and operational components on a national level. The various public sector agencies work in a coordinated manner.	The ONEMI is focused on emergency response and public information campaigns. The management system is delegated to the institutions responsible for each sector and has performed well in recent disasters.	It is a priority issue and there is a good degree of coordination between institutions and the various levels of government.	All sectors of the federal government have operational plans for emergency response and recovery that have been working with increasing efficiency. Coordination between sectors could be better.	Good coordination between the various sectors of SINAPRED. The system lacks human and economic resources, and is dependent on international aid.
Participation by other actors	Private participation has not been very active. An exception was the participation of the business sector in the reconstruction programme for the 1999 earthquake.	Basic services are privatized and the execution and financing of the various phases of risk management are left up to private consortia.	The prioritizing of the subject, the actions taken, private sector participation and public preparation have all improved since hurricane Ivan in 2004.	The armed forces play a decisive role in emergency response tasks but there is scant private sector participation.	Private sector participation is weak while the armed forces efficiently play a major role.