CENTER FOR HAZARDS & RISK RESEARCH AT COLUMBIA UNIVERSITY

The World Bank Group

Disaster Risk Hotspots Review Meeting
Synthesis and Issues Paper

December 11, 2002

The following paper summarizes the main points and issues that emerged during a two-and-a-half day meeting at the Lamont Doherty Earth Observatory (LDEO) of Columbia University organized by the Disaster Risk Hotspots project. The project is being jointly implemented by the Center for Hazards and Risk Research (CHRR) at Columbia University, the World Bank, and a number of collaborating partner institutions as an activity of the ProVention Consortium, with funding from the UK Department for International Development (DFID). CHRR participants included researchers from LDEO, the Center for International Earth Science Information Network (CIESIN), the International Research Institute for Climate Prediction (IRI), and other centers within the Earth Institute of Columbia University.

Findings and issues emerging from the meeting are organized below under the following headings:

I. Risk assessment
   A. Applications
   B. Economic aspects
   C. Definition of outcomes
   D. Fundamental terms and concepts
   E. Methodologies for assessing multi-hazard risk

II. Data and methods related to hazards, exposure, vulnerability and outcomes organized by hazard
   A. Drought
   B. Floods
   C. Cyclones
   D. Earthquakes
   E. Volcanoes
   F. Landslides

III. Project management
   A. Immediate next steps
   B. Case study selection and process for development and implementation
   C. Elements of the project workplan
   D. Coordination with related efforts

Full details of the meeting can be found at www.proventionconsortium.org .

I. Risk assessment

Applications

The Hotspots project intends to produce results that will be useful for meeting the overall challenge of reducing disaster losses worldwide. Comments from the sponsors and questions from participants underscored the need to further define and explore the potential applications of the project's results.

In her introductory remarks, World Bank Disaster Management Facility (DMF) Manager Alcira Kreimer stressed the need to focus on the applications, with a particular emphasis on the economic implications of the results. Earth Institute Director Jeffrey Sachs expressed hopes that, by quantifying risk and measuring the economic impacts of hazard events, the project would be instrumental in helping major international development agencies to focus on reducing disaster losses in the context of achieving the Millennium Development Goals.

Reaching these objectives will require that project resources be carefully allocated so that an appropriate balance is achieved: 1) between scientific depth and relevance of the results; 2) in the emphasis placed on physical versus socioeconomic risk factors; and 3) with respect to the investment in data and methodological development versus interpretation of results for risk management applications and decision-making.

The project will develop a statement of intended or potential applications as part of its workplan and as a basis for a planned stakeholder meeting.

Economic aspects

The project terms of reference call for assessment of risks of two types of outcomes, social and economic. The current profile of the project scientists and collaborators, however, is weighted towards physical factors on the one hand and towards disasters and risk generally on the other, with relatively limited expertise in the economic aspects of disasters.

During the meeting, the Earth Institute and World Bank agreed to jointly review a set of case studies on the economic impacts of disasters and to decide how to incorporate economic considerations into the project. The resulting approach will be incorporated into the project workplan.

Definition of outcomes

To inform policy and decision-making, it is necessary to specify the loss units for which risks are being evaluated, for example, dollars or lives lost or the percent of the population falling below the poverty line. The specific outcomes need to be further considered, and decisions taken regarding which types of losses the project will assess in detail.

One approach that emerged from the meeting would be to specify a single outcome: disaster occurrence. If the risks of disaster occurrence could be assessed at each location, the social and economic implications could be evaluated through interpretation of an already extensive body of case studies as well as global and national loss data. Existing global- and national-level data on disaster occurrence, or "realized risk," could be used to validate the results.

Fundamental terms and concepts

To assure coherence across the individual efforts comprising the Hotspots project, it is vital that all scientists and collaborators on the project consistently distinguish between hazards and disasters, vulnerability and risk, cause and effect. In addition to making sure that all project participants have access to the terms of reference for the project, it may be advisable to distribute some basic references on disasters and risk, and/or guidelines on key terms and concepts for consistency's sake.

Methodologies for assessing multi-hazard risk

A consistent theme throughout the meeting was the importance of combining single-hazard with multi-hazard risk analysis. On the one hand, it was noted that the set of exposed elements and their vulnerability factors differ from one hazard to another hazard. For this reason, mitigation is often undertaken on a per-hazard basis. Risks of losses cannot be calculated without inventorying the exposed elements and evaluating their vulnerability to each hazard.

At the same time, overall risks of losses are what are needed in order to calibrate investments in loss reduction in relation to other pressing development priorities. A set of elements may in fact be threatened by several hazards at once, e.g., an urban area on a fault line and near a volcano, or a populated area on a floodplain in a coastal area exposed to cyclones. Thus, to obtain the total risk of losses to each set of exposed elements, the risks posed by all combinations of hazards and vulnerability will also have to be assessed.

Thus, the project must be able to assess the risks contributed by each combination of hazard, exposed elements and their vulnerability for each hazard individually, as well as for the overall risks of losses from all hazards, exposed elements and vulnerability factors for each location. These two elements are both desirable and necessary for the project to achieve its goals. Fortunately, to identify the highest risk areas, it is not necessary to quantify the entire distribution of risk and vulnerability, but only to screen out the relatively less “risky” areas and to characterize the remaining “high risk” areas in terms of their dominant exposures and vulnerabilities. This makes the problem much more tractable.

One way to sort out the complex process of assessing single- and multi-hazard risks is to begin with a global inventory of exposed elements (however crude), including urban areas, people, transport networks, productive landuses, etc., and to approximately

estimate their economic or social value. Then for each set of elements, their degree of exposure to each hazard and their vulnerability could be assessed in order to estimate risks of possible losses over given time periods.

II. Data and methods related to hazards, exposure, vulnerability and outcomes, organized by hazard

Overall, at the outset of the project the availability and quality of hazard data collected to date generally far outweigh that of exposure, vulnerability, and outcome data. Furthermore, the methodologies for obtaining further improvements in hazard data quality are generally better thought out and more sophisticated at the present time than are the methods for combining hazard, exposure, and vulnerability data to assess disaster risks. This suggests that the project will have to carefully weigh further investment in incremental improvement in hazard data sets when there are large gaps in socioeconomic data that are equally if not more important in terms of disaster causality and the implications of disaster risk for risk reduction efforts.

Presentations and discussion at the meeting suggest that there is considerable data available that could be used to represent exposure and vulnerability, either directly or by proxy. For example:

- Urban data are available from CIESIN's project to map urban extent for cities of over 100,000 people.
- Infrastructure data also include roads and dams.
- The International Food Policy Research Institute (IFPRI) has calculated agriculture sales/unit area.
- The International Livestock Research Institute (ILRI) has data on livestock density.
- The UN Food and Agriculture Organization (FAO) Geonetwork project may be a source of global agricultural and landuse data.
- Jeffrey Sachs *et al.* wrote a paper on the "Geography of Poverty and Wealth" that maps GDP per square km and have since updated the underlying subnational GDP database. From this it would be possible to begin assessing what portion of GDP is being generated in hazard prone areas.
- Poverty maps are becoming increasingly available(e.g., data for 20 disaster prone countries are accessible on www.povertymap.com). A poverty mapping project is being initiated between the World Bank and CIESIN in the context of the Millennium Development Project.
- The Economic Commission for Latin America and the Caribbean (ECLAC) studies on the economic losses due to disasters could be used to calibrate economic losses per event (these studies are mostly in Spanish).
- AIDS and other diseases are drought vulnerability factors. The World Health Organization (WHO) is a key data source.
- Geo-referenced Demographic and Health Survey (DHS) data are available for many poor countries.

- PreView provides access to most of the World Vulnerability Report (WVR) GRAVITY data. GRAVITY employs 24 socioeconomic data sets, most of which are national level.

A key task for the Hotspots project will be to assign these data sets appropriately in a framework of hazards, exposure, vulnerability and risk and to allocate project resources for obtaining them, as well as for developing and applying methods for integrating them in single- and multi-hazard analyses.

Some cross-cutting themes that were highlighted in the area of risk assessment include the need to focus on urban issues as a theme due to the growth of population in developing countries, and the projection of relevant future trends in general. The latter need can be partly met through the use of the disaggregated socioeconomic projections developed for the Intergovernmental Panel on Climate Change (IPCC), which CIESIN has helped to develop and currently disseminates. Water resources was also flagged as a key issue.

In its initial phase the project is concerned with disasters involving major natural hazards. In this context, disease, conflict and other threats to human well-being are for the time being treated as vulnerability factors.

A global analysis will be complemented by case studies designed primarily to provide more detail on the interaction between hazards and vulnerability as causal factors of disaster in particular locations, as well as among hazards and their respective vulnerability factors in the creation of multi-hazard disaster risk. Several case studies have been designed to fill gaps in the global data for key hazards. Case studies discussed at the meeting and the process for further developing them are discussed in section III below.

Drought

Drought is an exceptionally important hazard. Discussion at the meeting concerned which climatalogical datasets to use, how to define drought events, and the most appropriate index of drought to use. To assess drought-related risks, additional work is needed on exposure and vulnerability data. Data on irrigation, a vulnerability factor, may be available from Kassel University.

The IRI has provided input to the UNDP *World Vulnerability Report (WVR)* and UNEP GRAVITY project on drought hazards and exposure and vulnerability indicators. Part of the discussion on drought dealt with expanding and strengthening these areas initially for inclusion in the *WVR*. Further collaboration would assist the Hotspots project in addressing the problem of characterizing risks related to drought.

Floods

Floods are the second most pervasive natural hazard, after droughts. Here too, the hazard data set is provisional and in need of a certain amount of strengthening. The leading candidate for providing global flood hazard data is the Dartmouth Flood Observatory. Greater contact between Columbia researchers and Dartmouth would assist in assessing the adequacy of existing flood hazard data. Large dams are another important factor in the evaluation of flood-related risks. Another possibility is to follow up on initial discussions with the Flood Hazard Centre at Middlesex University, which was unable to send a representative to the workshop due to scheduling conflicts.

Flood-related discussions at the meeting were largely limited to flood hazards, and there was no participation in the meeting by experts in the specific area of floods. This suggests that floods and assessment of flood-related risks are an area where the project needs to be strengthened.

Cyclones

In contrast to droughts and floods, presentations at the meeting on storm hazards suggest that comprehensive data sets are available. The emphasis to date has been on refinement of storm parameterization. Issues related to exposure and vulnerability were not addressed in detail at the meeting and therefore constitute important unknowns in the overall assessment of disaster risk.

Earthquakes

Global earthquake hazards have been characterized by the GSHAP and UNEP/GRAVITY projects. Housing surveys, DHS data, and other surveys with information on building materials were proposed as ways of characterizing exposure and vulnerability. A proposal was made to build on the work done by the *WVR* and GRAVITY project for this hazard.

Volcanoes

Substantial work has already been done in terms of establishing the affected radii during volcanic eruptions. Challenges with respect to this hazard include improving exposure data quality in areas in the immediate vicinity of active volcanoes, particularly in cases where multiple active volcanoes are clustered.

Landslides

Landslides are being incorporated in the Hotspots project through collaboration with the Norwegian Geotechnical Institute, which is in the process of obtaining independent funding to generate a landslide map and evaluate landslide-related risks. Characterization of landslide hazards is expected to be based on precipitation, flooding, seismicity, digital elevation, and soils data. There is no established methodology or standard index currently

for landslides. A major challenge is therefore to develop a sound methodology that can be consistently used on a global basis. Historical data will in this context be extremely important for validation of the method. One approach that was discussed is to pilot the methodology in some focused locations, e.g., selected countries in Latin America and Asia. For these pilot studies, the NGI will need to take advantage of local assistance and data.

III. Project management

Immediate next steps

During the review meeting, the possibility of a 12-month extension was raised, which would move the project completion deadline from February 28, 2003 to February 28, 2004. A variety of mechanisms for implementing the extension were discussed. Finalizing a 12-month extension would significantly enhance what can be accomplished within the project lifespan.

All materials from the design meeting -- agenda, presentations, participants and this document -- are being made available on www.proventionconsortium.org. This site will continue to be a resource for the project as it moves further through implementation.

Key issues emerging from the review meeting identified above include:

- applications of project results;
- incorporating adequate economic analysis;
- definition of loss units for outcome variables;
- strengthening key hazard data sets and compiling data on exposed elements and vulnerability for all hazards;
- defining methodologies for integrating hazard, exposed element and vulnerability data in single- and multi-hazard analyses; and
- further development and implementation of case studies (see below).

The core project management team will conduct a short series of meetings to be concluded by December 15, 2002 to discuss and resolve these issues.

Case study selection and process for development and implementation

Based on presentations and discussions at the meeting, the following procedures for further development of case studies are proposed:

- Based on the concept papers and presentations provided, the project management team will conduct a meta-analysis of complementarities, overlaps, and gaps among the case study ideas.
- Based on the meta-analysis, the project management team will provide feedback to case study designers, with an indication as to whether or not the project is in a position to provide funding (by December 15, 2002).

- Case study designers will develop brief proposals, with budgets, and submit them by January 15, 2003.
- The proposals will be included as part of the project workplan to be released on January 31, 2003 (see below).
- Time frames for completion of case study work and deliverables, will be established through the proposal review and workplan development process.

Case studies for which information has been received to date include:

- Bangladesh (R. Chowdhury)
- South and Southeast Asia -- several countries (M. Ramachandran)
- Sri Lanka (L. Zubair)
- Kenya (B. Watkins)
- Istanbul (G. Deodatis, A. Smyth)
- Nicaragua (A. Taramelli, P. Angeletti)
- Ecuador (potential, P. Basabe)
- Landslides (O. Kjekstad)
- Drought (B. Lyon, M. Barlow)
- Coastal storm surge (R. Nicholls)

The last three are somewhat different than the others in that they are primarily hazard-focused rather than geographically focused.

Elements of the project workplan

Based on the above discussions and meta-analysis of the case studies, a workplan will be drafted, reviewed, and released by January 31, 2003. In addition to addressing the issues identified, the workplan will identify any gaps in expertise or data that need to be filled. Human and financial resources will be allocated to ensure that all major requirements for generating the project deliverables are met. Timelines for completion of various tasks will be defined, with the responsible parties indicated.

Coordination with related efforts

As noted above, the Hotspots project has been extensively coordinated with the *WVR* and GRAVITY projects. Two weeks of intensive collaboration by key members of both projects have been proposed as a means of moving both projects forward.

During a side meeting under the auspices of working group III of the International Secretariat for Disaster Reduction (ISDR), a new project on information and formulation of indicators for management of natural disaster risks, sponsored by the Inter-American Development Bank, was discussed. This project includes 10 countries in Latin America and the Caribbean, with a focus on urban areas. It will produce tools and capacity building for risk assessment and reduction. An initial workshop is scheduled for February. It was agreed that project documents from both the *WVR*/GRAVITY and

Hotspots projects would be shared with developers of the new project to avoid duplication of effort and establish a basis for potential future collaboration.