From Multi-Risk Assessment To Multi-Risk Governance: Recommendations for Future Directions

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3-20. From Multi-Risk Assessment to Multi-Risk Governance: Recommendations for Future Directions

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Disasters caused by natural hazards can trigger chains of multiple natural and man-made hazardous events over different spatial and temporal scales. Multi-hazard and multi-risk assessments make it possible to take into account interactions between different risks. Classes of interactions include triggered events, cascade effects, and the rapid increase of vulnerability during successive hazards (see Marzocchi et al. 2012; Garcia-Aristizabal, Marzocchi, and Di Ruocco 2013).

Recent research has greatly increased the risk assessment community's understanding of interactions between risks. Several international sets of guidelines and other documents now advocate adopting an all-hazard approach to risk assessments (for example, see UNISDR [2005]; European Commission [2010a, 2010b]; for an overview, see Council of European Union [2009, section 2]).

Nevertheless, barriers to the application of multi-risk assessment remain. The challenges for the development of multi-risk approaches are related not only to the applicability of results, but also to the link between risk assessment and decision making, the interactions between science and practice in terms of knowledge transfer, and more generally to the development of capacities at the local level. So far, research has focused on the scientific aspects of risk assessment. But the institutional aspects, such as the issues arising when multi-risk assessment results need to be implemented within existing risk management regimes, are also important, though they have received less attention.

The project described here focused on the institutional context of disasters, which includes a variety of elements ranging from sociopolitical to governance components. It looked at how to maximize the benefits arising from, and overcome the barriers to, the implementation of a multi-hazard and multi-risk assessment approach within current risk management regimes. Working at two test sites, one in Naples and one in Guadeloupe, the research team engaged with local authorities and practitioners to better understand how to effectively implement the results of multi-risk assessment. Among the hazards considered were earthquakes, volcanic eruptions, landslides, floods, tsunamis, wildfires, cyclones, and marine inundation. Beside the practitioners working in the two test sites, risk and emergency managers from 11 countries also provided feedback. In total, more than 70 practitioners took part in the research.

Research design. The project, which aimed to encourage interaction between researchers and practitioners/decision makers, began with a policy/institutional analysis—that is, desk studies of legal, regulatory, and policy documents—to provide a description of the institutional and regulatory framework for risk governance within different natural hazard contexts and countries.

To identify the barriers to effective decision making in the case of multiple hazards, we then engaged practitioners in interviews and focus group discussions. In parallel, we performed multi-risk assessments of some specific scenarios at the two test sites. During workshops with practitioners, we presented the results and also discussed the barriers to and benefits of implementing multi-risk assessments. Table 3-9 summarizes the key research phases, the methods employed, and the accompanying aims.

Both test sites face multiple hazards. Naples, the biggest municipality in southern Italy, has a widely recognized high volcanic hazard and is also exposed to interconnected hazards such as earthquakes, floods, landslides, and fires. The French overseas department of Guadeloupe (Département-Région d'Outre Mer), an archipelago in the Lesser Antilles, is exposed to similar hazards (though it is less exposed to fires) and has a high risk of cyclones and tropical storms; its major geological risk is from the active volcano of la Soufrière and the seismic activity along the inner Caribbean arc, both of which can trigger tsunamis and landslides.

Both Naples and Guadeloupe have plans and policies designed to protect their citizens from these risks, and both have deployed scientists, engineers, and policy makers to reduce risk and vulnerability. Moreover, both sites have performed multi-risk assessments. In Naples, two scenarios of risk interactions were considered for quantitative analysis: the effect (on seismic hazard and risk) of seismic swarms triggered by volcanic activity, and the cumulative effect of volcanic ash and seismic loads. Both cases can be combined into a single scenario of interactions at the hazard and the vulnerability level; the combination highlights the different aspects of risk amplification detected by the multi-risk analysis (Garcia-Aristizabal, Marzocchi, and Di Ruocco 2013). In Guadeloupe, researchers conducted a scenario analysis of cascade effects and systemic risk. Following a deterministic approach, the analysis considered interaction between earthquake and landslide phenomena, along with its consequences on the local road network in Guadeloupe and the transport of injured people to hospitals and clinics (Monfort and Lecacheux 2013).

Results. A first (and expected) finding is that risk and emergency managers rarely have the opportunity to deal with multi-risk issues, including triggered events, cascade effects, and the rapid increase of vulnerability during successive hazards. Moreover, multi-risk assessments for different scenarios are at present rarely performed by practitioners at either the national or local level. A second finding is that most participants saw the benefits of including a multi-risk approach in their everyday activities, especially in land-use planning, as well as in emergency management and risk mitigation.

Practitioners identified the following as among the greatest benefits of a multi-risk approach:

1. Multi-risk assessment improves land-use planning.

According to practitioners, a multi-risk approach provides a holistic view of the risks affecting a territory and is appropriate in all geographic areas susceptible to several types of hazards. It would be helpful to have clear criteria to use in determining which scenarios would be most appropriate for a multi-risk assessment. For landslide, for example, hazard and risk mapping may not address the specific effects of different possible triggering events (intense rainfall, earthquakes, etc.). In the case of Naples, a detailed map with the areas susceptible to landslides is available, but it does not include information about the possible short-term effects of volcanic eruptions, even though an eruption could produce unstable ash-fall deposits (including in low-susceptibility areas) that afterward contribute to the generation of lahars (mud flows) triggered by rainfall events.

Urban planners emphasized how a multi-risk assessment could influence decisions about building restrictions, which themselves influence urban and economic planning—for example, by permitting or forbidding construction of new houses and/or economic activities.

2. Multi-risk assessment enhances response capacity.

Practitioners asserted that emergency management would greatly benefit from adopting a multi-hazard and multi-risk approach. Civil protection managers were especially interested in developing multi-hazard and multi-risk scenarios to facilitate management of emergency situations in real time (Monfort and Lecacheux 2013). In Guadeloupe, for example, evidence suggests that failure to consider cascade effects (earthquake-landslide interactions) and to employ a systemic approach may result in gross underestimation of risk. The work undertaken in Guadeloupe considered the interaction between earthquake and landslide phenomena and its consequences for road networks and the removal of injured people to medical facilities. It took into account the possibility that a landslide triggered by an earthquake in the northwest of Basse-Terre might cut off a main east-west road that is critical for moving the injured to hospitals and clinics. Damage to some lifelines (water, electricity) was also taken into account. The final results of the scenario determined realistic times required for the evacuation of the injured, either considering or not considering the damage to the road network and the connectivity to lifelines of the hospitals (Desramaut 2013; Monfort and Lecacheux 2013).

3. Multi-risk assessment identifies priorities for mitigation actions.

The quantified comparison of risks that would allow a multi-risk approach was also seen as a benefit. Quantified comparison is particularly useful for identifying priorities for actions—a difficult task for policy makers, who generally rely on assessments that do not take cascade and conjoint effects into account. The quantified comparison of risks has policy implications for the planning of mitigation actions. It can show, for example, that prioritizing a particular hazard may mean giving insufficient weight to other hazards, and that mitigation measures against a prioritized hazard could actually increase the area's vulnerability to a different hazard.

4. Multi-risk assessment encourages risk awareness and cooperation.

Multi-risk assessment can help to increase a population's awareness of natural risks, of multi-risk, and of associated cascade effects. Practitioners in Guadeloupe working for municipal authorities noted that while the culture of primary risks (such as cyclones, earthquakes, and volcanoes) is well established in Guadeloupe, the culture of secondary risks (such as tsunamis, landslides, marine and inland floods, and coastal and slope erosion) is less established. Practitioners from other countries indicated that communicating the results of multi-risk assessment to the general population would help to increase awareness of secondary risk.

A multi-risk approach can also enhance cooperation and foster needed partnerships between policy makers, private sector actors, and scientists. One key to promoting such partnerships is to establish a common understanding of what multi-risk assessment is, what the preferences and needs of practitioners are, and what the implications for regulatory instruments (related to urban planning, for example) may be. Interviewees and workshop participants, especially from the private sector, cited the importance of partnerships between insurers and policy makers in using improved risk information for the development of risk financing schemes that cover large losses after multi-hazard catastrophic events.

Barriers to multi-risk assessment in the science domain. Barriers to effectively implementing multi-risk assessment are found in both the science and practice domains. In the science domain, a major barrier involves differences between the geological and meteorological sciences and the research carried out under their auspices. These differences extend to concept definitions, databases, methodologies, classification of the risk levels and uncertainties in the quantification process, and more. Thus each type of risk has its own scale or unit of measure for quantifying risk or damages (e.g., damage states for seismic risk and loss ratios for floods). These differences may make it harder for the various risk communities to share results and may represent a barrier to dialogue on multi-risk assessment.

A barrier that is more worrying for risk managers than for researchers is the lack of open access to risk and hazard databases, the lack of tools for sharing knowledge, and the difficulties associated with accessing new research results. According to a practitioner working for a meteorological service, "The researchers want to keep the data because they want to publish." Another practitioner stated: "Private companies and research institutions often do not make their data available . . . for the benefit of their competitiveness." Scientists view the matter differently and maintain that research results are freely available online. The same is not true for the databases, however, although the reason for this is simple: most practitioners do not know how to use them. The issue, then, is not whether data are available, but who uses and interprets the data and for what purpose—or more fundamentally, who is able to access and present information in a meaningful and useful manner. Scientists maintain that data collected by private actors (such as private consultants or insurers) are often not available to them, or that these data are not collected systematically and thus cannot be used for scientific purposes.

Practitioners and researchers also have different views about the preferred agenda for future research on multi-risk assessment. Researchers working on the technical/scientific aspects want to improve knowledge of the physical processes and models related especially to cascade effects; harmonize terminology and databases; make uncertainty assessment a focus; combine single-risk analyses into integrated multi-risk analyses; integrate the results of multi-risk assessment into existing emergency scenarios and capture cascading effects in probabilistic terms; and conduct multi-vulnerability assessment.

Practitioners on the other hand prioritize collecting evidence about lives and property saved using a multi- versus a single-risk approach, gaining an overview of multi-risk contexts at the town level, and especially learning to use and integrate new research results in existing emergency and urban plans. Depending on the practitioners themselves (risk versus emergency managers, regional officers, insurers, etc.), the needs and expectations vary extensively.

Barriers to multi-risk assessment in the practice domain. Differences in the approaches, tools, and methodologies used for single-risk assessment have resulted in a lack of integrated practices for multi-risk governance. Especially where risks are managed by authorities acting at different

governmental levels, cooperation among institutions and personnel is a challenge. The priorities of the various agencies vary extensively, and there may be insufficient financial capacity to cover them all. In some cases a multi-risk approach is perceived as competing with (rather than complementing) single-risk approaches.

Capacities, mainly financial, but sometimes also technical and institutional, are especially lacking at the local level, even though responsibility for DRM often falls to local authorities or private actors. The transfer of responsibility for disaster risk reduction to the local level (to the municipal level in many European countries) has often occurred without sufficient resources for implementing necessary programs (UNISDR 2005b, 2013). Private actors, especially property owners, are being given increasing risk-related responsibilities, which—depending upon the risk, the country, and the availability of insurance schemes—may differ. Different levels of responsibility are attributed to property owners in geological versus meteorological risk prevention, for example. In the case of earthquakes, the level of individual responsibility is high (given that property owners are usually in charge of household vulnerability reduction measures). In the case of floods, public authorities have responsibility for decisions about risk mitigation measures such as protection works, and the costs are covered collectively. In general, there are few options for public-private responsibility sharing, especially for households exposed to multiple risks (and especially where insurance schemes are not available, as is the case in some European countries).

82 See the Global Flood Working Group portal at http://portal.gdacs.org/Expert-working-groups/Global-Flood-Working-Group.

83 EM-DAT: The OFDA/CRED International Disaster Database, www.emdat.be, Université catholique de Louvain, Brussels, Belgium.

84 The quotation is from D. Wielinga, senior disaster risk management specialist, World Bank Africa Region; see GFDRR, "GFDRR Connects Science with Policy to Help Address Flood Risk in Nigeria," https://www.gfdrr.org/node/27850.

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86 World Bank, "Tonga to Receive US$1.27 Million Payout for Cyclone Response," press release, http://www.worldbank.org/en/news/press-release/2014/01/23/tonga-to-receive-payout-for-cyclone-response.

87 Analysis benefited from funding provided under a grant from the Global Facility for Disaster Reduction and Recovery.

88 The identification and tracking algorithm used was based on the works of Nguyen and Walsh (2001), Walsh and Syktus (2003), and Abbs et al. (2006), and applies eight criteria to identify a tropical cyclone. Further details of the method can be found in Abbs (2012).

89 The five models were ACCESS 1.0, Can ESM, CSIRO Mk3.6.0, IPSL CM5A, and NorESM-1M. More information is available about the PACCSAP program on the Australian Department of the Environment website, http://www.climatechange.gov.au/climate-change/grants/pacific-australia-climate-change-science-and-adaptation-planning-program.

90 This case study draws on D. Lallemant, S. Wong, K. Morales, and A. Kiremidjian, "A Framework and Case Study for Dynamic Urban Risk Assessment" (paper presented at the 10th National Conference in Earthquake Engineering, Earthquake Engineering Research Institute, Anchorage, AK, July 2014).

91 Rao's Ph.D. thesis, entitled "Structural Deterioration and Time-Dependent Seismic Risk Analysis," is being completed at the Blume Earthquake Center, Stanford University.

92 OpenQuake 2013 release, Global Earthquake Model, http://www.globalquakemodel.org/openquake/.

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