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## **Growing Risk and Vulnerability—The Mountain Challenge**

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# Risk and Vulnerability in Mountain Regions



Given current reported and projected trends in global environmental change, exposure to risk and vulnerability in mountain communities could increase in coming decades. Mountain communities can be exposed to various hazards simultaneously, including rapid-onset hazards such as earthquakes, landslides, and volcanic eruptions, as well as creeping processes such as soil degradation, deforestation, loss of biodiversity, and drought. It is thus urgent to increase current efforts to assess vulnerability and risk, and particularly to consider the aggregated stress of multiple hazards.

Over the past 20 years the United Nations University (UNU) has played an important role in promoting understanding of the challenges facing mountain communities and in fostering political commitment

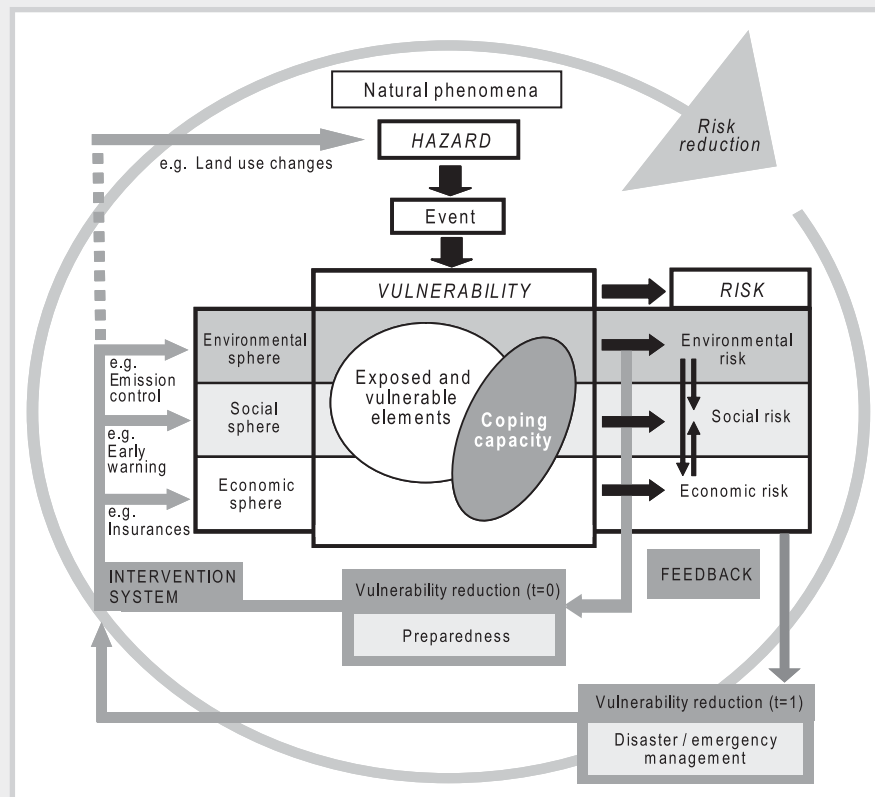
and cooperation to address them. More recently, the Institute for Environment and Human Security (EHS) of the UNU, created in 2003 and based in Bonn, Germany, was given a mandate to advance human security in order to reduce vulnerability and risk related to environmental threats through targeted research and capacity development activities. Most of the Institute's activities are centered on vulnerability assessment—the most crucial and least known part of the risk equation. This is arguably the most difficult component to address for a variety of reasons, including lack of a common definition, multiple complex assessment tools, the need to understand complex systems, and quantification of thresholds that characterize the states of the systems considered. Despite these difficulties, there is currently a shift

from a tendency to address mainly hazard in the risk equation, to increased assessment of the vulnerability component of risk.

## Complexities linked to vulnerability assessment

- Risk, sensitivity, resilience and vulnerability are defined differently in different disciplines. A glossary of risk-related terms compiled at UNU-EHS provides 35 definitions of vulnerability, without claiming to be exhaustive. Although agreement on a single definition is unlikely, a broad consensus on general concepts would be useful, particularly for more effective communication among the scientific and expert communities.
- Nature cannot be dissociated from social systems, as both interact in complex, non-linear, unsteady, stochastic ways. Community vulnerability to single or multiple hazards is thus best analyzed by considering environmental, social, and economic dimensions, or by analyzing coupled human–environment or socio-ecological systems. Coupled systems are by their very nature extremely complex and difficult to model. Complexity increases in the case of interactions between elements at various temporal and spatial scales. It is also difficult to quantify the amount of disturbance that a system can absorb before it changes to a new and usually unfavorable state.
- Several vulnerability assessment frameworks have been developed in academic circles to try to capture the above complexities. One example is the Sustainability Systems Program's vulnerability framework (Turner II et al 2003), which looks at the vulnerability of coupled systems by accounting for various interacting spatial dimensions of vulner-

**FIGURE 1** Feedback loop system with intervention tools to reduce vulnerability—part of the integrative BBC Conceptual Framework developed at UNU-EHS in Bonn, Germany (see Birkmann 2006).



ability and stressors, and by describing their exposure, sensitivity and resilience. A second is the BBC Conceptual Framework developed at UNU-EHS, which focuses on the social, economic, and environmental dimensions of vulnerability, linking and integrating the concept of sustainable development with the vulnerability framework. It also incorporates the notion of intervention tools to reduce vulnerability (represented as a feedback loop system in Figure 1). Despite the availability of such assessment frameworks, characterizing vulnerability remains difficult, as it is impossible to collect all relevant information and determine the required threshold values.

### Vulnerability-related activities of UNU-EHS

In accordance with its mandate, UNU-EHS has developed vulnerability assessment methodologies and conducted vulnerability research looking at various hazards affecting floodplains and coastal areas. UNU-EHS is also part of the project on Sustainable Management in the High Pamir and Pamir–Alai in Tajikistan and Kyrgyzstan. This project has a work package dealing with vulnerability assessment in communities facing land degradation, which can be categorized as a creeping process. Scientists at the Institute collaborate with scientists in the region and other project partners to further develop and test the BBC Conceptual Framework and evaluate its suitability as a tool for assessing vulnerability to land degradation in rural mountain communities, and to determine the impact of better ecosystem management in reducing vulnerability and improving economic well-being. Other vulnerability frameworks will also be considered. More specifically, the frameworks will be used to:

- Establish the link between mountain ecosystem degradation and community vulnerability;
- Determine the degree to which different community social groups are vulnerable to environmental degradation; and
- Characterize the similarities and differences in coping strategies used by different communities.

In the process, research will also concentrate on identification and field testing of a set of objectively verifiable environmental and socioeconomic indicators that can be used to: 1) assess the vulnerability of mountain communities to land degradation; and 2) measure the impact of changes in ecosystem resource management on the local environment and socioeconomic well-being of different social groups in individual communities.

UNU-EHS has also initiated an Expert Working Group on Measuring Vulnerability as an exchange platform for experts and practitioners from various scientific backgrounds who deal with identification and measurement of vulnerability. The overall goal of the Expert Working Group is to promote the concept of security for societies vulnerable to natural hazards. In this context the development of methodologies, approaches, and indicators to measure vulnerability is a key to bridging the theoretical concept of vulnerability and practical application in decision-making processes. The Expert Working Group will continue to meet annually in the foreseeable future and the results of research activities in the High Pamir and Pamir–Alai will be discussed in this forum.

UNU-EHS has a Chair on Social Vulnerability funded by the Munich Re Foundation. Activities include research on the cultural and economic dimensions of social vulnerability, including institutional and governance factors. Special attention is given to indigenous percep-

tions, participatory approaches, and community-based coping practices to detect and reduce vulnerability. UNU-EHS and the Munich Re Foundation also hold an annual summer academy on social vulnerability. The academy provides an opportunity for experts and PhD researchers from around the world to develop new approaches to complex themes such as human security and resilience of complex social systems related to disasters. UNU-EHS also implements a training program for experts dealing with risk and vulnerability assessment in large cities, including cities in mountain regions.

All these activities will help in the long run to refine assessment tools and methodologies to identify policies and concrete actions designed to reduce the vulnerability of communities facing natural hazards. This will have relevance and be applicable in mountain regions as well as other environments.

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