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The need for comprehensive vulnerability approaches to mirror the multiplicity in mountain hazard risk

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The concept of vulnerability is pillared by multiple disciplinary theories underpinning either a technical or a social origin of the concept and resulting in a range of paradigms for vulnerability quantification. By taking a natural scientific approach we argue that a large number of studies have focused either on damage-loss functions for individual mountain hazards or on semi-quantitative indicator-based approaches for multiple hazards (hazard chains). However, efforts to reduce susceptibility to hazards and to create disaster-resilient communities require intersections among these approaches, as well as among theories originating in natural and social sciences, since human activity cannot be seen independently from the environmental setting. Acknowledging different roots of disciplinary paradigms in risk management, issues determining structural, economic, institutional and social vulnerability have to be more comprehensively addressed in the future with respect to mountain hazards in Europe and beyond. It is argued that structural vulnerability as originator results in considerable economic vulnerability, generated by the institutional settings of dealing with natural hazards and shaped by the overall societal framework. If vulnerability and its counterpart, resilience, is analysed and evaluated by using such a comprehensive approach, a better understanding of the vulnerability-influencing parameters could be achieved, taking into account the interdependencies and interactions between the disciplinary foci. As a result, three key issues should be addressed in future research:
(1) Vulnerability requires a new perspective on the relationship between society and environment: not as a duality, but more as a mutually constitutive relationship (including methods for assessment).
(2) There is a need for concepts of vulnerability that emphasise the dynamics of temporal and spatial scales, particularly with respect to Global Change processes in mountain regions.
(3) Loss and damage is part of a process in which interactions of climate change with societal processes shape and transform human societies. They are part of the human-environment interaction that needs assessment and adaptation.