



## **Using indicators to assess physical vulnerability and resilience to natural hazards: a combined approach**

Maria Papathoma-Koehle, Thomas Thaler, and Sven Fuchs

University of Natural Resources and Life Sciences, Institute of Mountain Risk Engineering, Vienna, Austria  
([maria.papathoma-koehle@boku.ac.at](mailto:maria.papathoma-koehle@boku.ac.at))

Societies will have to live with changing environmental conditions and, therefore, they need to build resilience by reducing vulnerabilities to natural hazards. Successful implementation of strategies for disaster risk reduction requires the understanding and analysis of physical vulnerability and resilience of the built environment. The main objective of the presented research is the development of a methodological framework and toolbox which supports mountain hazard risk management through understanding and including resilience and vulnerability indicators of the built environment in risk management plans. These indicators are selected in terms of two temporal dimensions: vulnerability (as lack of physical ex-ante robustness) and resilience (as the ex-post ability and required time to return to a fully functional condition). An enhanced method using vulnerability indicators for the assessment of physical vulnerability of buildings exposed to mountain hazards is presented here. The approach builds on an existing tool for vulnerability assessment and damage documentation which combines well established methods such as vulnerability curves and indicators. It is based on the consideration of a number of structural characteristics of the buildings as well as the intensity of the process to assign a physical vulnerability index for each building. Moreover, indicators representing the physical resilience of the building are also included. Preliminary results focusing on buildings from the European Alps.