



## **Physical, social and institutional vulnerability assessment in small Alpine communities. Results of the SAMCO-ANR project in the Upper Guil Valley (French Southern Alps)**

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The Upper Guil catchment is particularly prone to hydromorphological hazards such as torrential floods, debris flows, landslides or avalanches. Following the catastrophic events of the last 60 years (1957, 1978, 2000, and 2008), some measures were taken to reduce exposure to risks (engineering works, standards of construction, rescue training. . .). Nevertheless, the development of urban settlement in endangered areas and the obsolescence of the existing protective measures revealed the necessity to reassess the vulnerability of the different stakes exposed to hazards and to take into account of these various component parts of the vulnerability (not only physical but also social, etc.). In addition, catastrophic events should be more frequent in the French Southern Alps, according to the last GIEC report.

In the frame of the SAMCO project designed for mountain risk assessment in a context of global change, we developed a systemic approach to assess three specific components of vulnerability – physical, social and institutional – for the six municipalities of the Upper Guil catchment (Ristolas, Abriès, Aiguilles, Château-Ville-Vieille, Molines-en-Queyras and St-Véran).

Physical vulnerability, which represents total potential consequences of hazards on stakes, was estimated and mapped using a GIS model based on an empirical semi-quantitative indicator, the Potential Damage Index (PDI). This index allowed us to quantify and describe both direct (physical injury, structural and functional damage on buildings, network and land cover) and indirect consequences (socio-economic impacts) induced by hazards, by combining weighted parameters (age, state, material, function, etc.) reflecting the exposure of elements at risk. At least 1890 buildings, 367 km<sup>2</sup> of land cover and 902 km of linear infrastructure were considered. To assess social and institutional vulnerability our approach was based on questionnaires (5% of the total population investigated), interviews and mental maps (80 collected) dealing with risk perception, risk memory, mitigation measures and degree of confidence in the actors of risk management.

Our database provides via statistical analysis (i) a typology of endangered people (for instance, new and alone incomers without high education diploma), and (ii) a spatialization of the most vulnerable areas considering the inhabitant knowledge (hazard location, memory of past events, related destructions) and existing mitigation measures (engineering structure, evacuation plan). The most endangered areas are both located on alluvial fan and flood plain or in new housing estate (Garcine, Château Renard). These results contribute to a better assessment of the global vulnerability of the upper Queyras Region to hydrogeomorphic hazards. They could be used to help local authorities to improve and update their Emergency Action plan or their prevention plan.