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Socio-economic vulnerability to natural hazards - proposal for an indicator-based model

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Vulnerability assessment, with respect to natural hazards, is a complex process that must consider multiple dimensions of vulnerability, including both physical and social factors. Physical vulnerability refers to conditions of physical assets, and may be modeled by the intensity and magnitude of the hazard, the degree of physical protection provided by the natural and built environment, and the physical robustness of the exposed elements. Social vulnerability refers to the underlying factors leading to the inability of people, organizations, and societies to withstand impacts from the natural hazards.

Social vulnerability models can be used in combination with physical vulnerability models to estimate both direct losses, i.e. losses that occur during and immediately after the impact, as well as indirect losses, i.e. long-term effects of the event. Direct impact of a landslide typically includes casualties and damages to buildings and infrastructure while indirect losses may e.g. include business closures or limitations in public services. The direct losses are often assessed using physical vulnerability indicators (e.g. construction material, height of buildings), while indirect losses are mainly assessed using social indicators (e.g. economical resources, demographic conditions).

Within the EC-FP7 SafeLand research project, an indicator-based method was proposed to assess relative socio-economic vulnerability to landslides. The indicators represent the underlying factors which influence a community's ability to prepare for, deal with, and recover from the damage associated with landslides. The proposed model includes indicators representing demographic, economic and social characteristics as well as indicators representing the degree of preparedness and recovery capacity. Although the model focuses primarily on the indirect losses, it could easily be extended to include more physical indicators which account for the direct losses. Each indicator is individually ranked from 1 (lowest vulnerability) to 5 (highest vulnerability) and weighted, based on its overall degree of influence. The indicator weights range from 1 (least influential) to 3 (most influential) and have been selected on the basis of expert judgment. The final vulnerability score is taken as the weighted average of the individual indicators.

The method was applied for locations in Norway, Greece, France, Andorra and Romania. The purpose of the case studies was to compare vulnerability levels and to test and possibly improve the methodology. In the case studies, similar vulnerability scores were obtained for the locations in Norway, Andorra and France. A higher vulnerability score was obtained for the location in Greece, while the highest vulnerability score was obtained for the location in Romania. The higher score for the locations in Greece and Romania are mainly due to economic conditions and conditions regarding preparedness and recovery.