



## **Quantify landslide exposure in areas with limited hazard information**

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In Daunia region, located in the North-western part of Apulia (Southern Italy), landslides are the main source of damage to properties in the urban centers of the area, involving especially transportation system and the foundation stability of buildings. In the last 50 years, the growing demand for physical development of these unstable minor hillside and mountain centers has produced a very rapid expansion of built-up areas, often with poor planning of urban and territorial infrastructures, and invasion of the agricultural soil. Because of the expansion of the built-up towards not safe areas, human activities such as deforestation or excavation of slopes for road cuts and building sites, etc., have become important triggers for landslide occurrence.

In the study area, the probability of occurrence of landslides is very difficult to predict, as well as the expected magnitude of events, due to the limited data availability on past landslide activity. Because the main limitations concern the availability of temporal data on landslides and triggering events (frequency), run-out distance and landslide magnitude, it was not possible to produce a reliable landslide hazard map and, consequently, a risk map. Given these limitations in data availability and details, a qualitative exposure map has been produced and combined with a landslide susceptibility map, both generated using a spatial multi-criteria evaluation (SMCE) procedure in a GIS system, for obtaining the qualitative landslide risk map.

The qualitative analysis has been provided the spatial distribution of the exposure level in the study area; this information could be used in a preliminary stage of regional planning. In order to have a better definition of the risk level in the Daunia territory, the quantification of the economic losses at municipal level was carried out. For transforming these information on economic consequences into landslide risk quantification, it was necessary to assume the temporal probability of landslides, on the basis of the expert knowledge on the landslide phenomena.

For each of twenty-five municipalities included in the study area, the expected losses (or consequences), in monetary terms, due to different hazard scenarios have been evaluated. After calculating the economic losses, the total risk at municipal level was evaluated, by generating the risk curves and calculating the area under the curves. The analysis of the risk curves related to the 25 municipalities has showed that the total risk values, expressed in monetary terms, is higher for the bigger municipal areas located in the southern part of the study area where the elevation is lower, as are more numerous the elements at risk distributed on the municipal territory.

Finally, this quantitative risk assessment procedure, which calculates the exposure in monetary terms of elements at risk, allows to establish the changes in risk in future with urban development and monetary inflation.