



Predisposing factors and susceptibility assessment for deep-seated gravitational slope deformations (DSGSDs): a case study (NW Alps, Italy)

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KEY WORDS: Deep-seated gravitational slope deformation (DSGSD); Risk; Hazard; Susceptibility; Piemonte; Italy

Deep-seated gravitational slope deformations (DSGSDs) and “sackung” deformations are complex processes of gravitational movement that involve large volumes of rock, often several tens of meters thick and several kilometers long. The development and characteristics of deep-seated gravitational slope deformations (DSGSDs) have not yet been fully explained. If unrecognized, these deformations can cause serious damage to rigid infrastructures such as dams, tunnels, and water conduits. Early identification of these phenomena and their predisposing factors through detailed geological and geomorphological surveys is therefore necessary for the correct location, construction, and expansion of fixed infrastructures.

The hazard evaluation component of landslide risk assessment combines measures of susceptibility and triggering variables. This approach may not be applicable to DSGSDs, given the difficulty of quantifying the probability of occurrence within a specified period of time without well-defined DSGSD triggering factors. Evaluation of DSGSDs should thus be restricted to the assessment of susceptibility.

Zones of DSGSD susceptibility can be identified through geological and geomorphological analysis, by overlapping maps of the four main predisposing factors (lithology, neotectonic activity, relief energy, morphological deglaciation evidence). The attribution of a susceptibility level to a certain zone cannot replace a hazard evaluation, but it can be a good index of the potential presence of a DSGSD. A DSGSD is most likely in a territory characterized by the worst combination of predisposing factors (high susceptibility): poor rock mechanics, intense neotectonic activity (high seismicity, active faults), high energy relief, and evidence of past glacialism. The probability of a DSGSD correspondingly decreases if one or more of the predisposing factors are absent (low susceptibility).

A case study of two DSGSDs located in the Rodoretto Valley (northwestern Alps, Italy) has been examined. After detailed field survey provided morphological identification of these features, the authors conducted a back-analysis to assess the susceptibility of the entire valley. Each main predisposing factor has been independently mapped, and the level of susceptibility to DSGSD has been identified through geographic information system (GIS) overlapping of the four maps. The results confirm the combined presence of four main predisposing factors for the examined DSGSDs, indicating high susceptibility.