Risk to housing induced by slow-moving landslides and reactivations in Vaud County (Switzerland)

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The Vaud County, which is located in the western part of Switzerland, can be divided in three regions, namely the Jura thrust belt, the Molassic plateau and the Prealps. The County is characterized by numerous landslides, some of which include several houses. A landslide inventory has been made in 1985 based on photointerpretation and actualized in 2008 with aerial LiDAR data. Four classes of depth (shallow, medium, deep and undetermined), four classes of speed (0-2 cm/y, 2-10 cm/y, >10 cm/y and undetermined) and three classes of age (recent, ancient and undetermined) are used to describe the landslides. The 2008 study, which was prepared for a regional hazard map, also added potential landslides in zones contiguous to proven landslides where the local conditions were similar.

The first observation that can be made is that the houses built on landslides are most of the time in slow moving landslides (69%, but in 19% of the cases, the speed is unknown), whereas only 0.5% of the houses built on landslides are on fast moving ones. The relation to the depth is less linear, since the proportion of the buildings in deep and medium seated landslides are more or less similar, while only 2% are located on shallow landslides (and 9% on undetermined ones). The location of the landslides regarding zoning has been studied in order to assess the potential development inside sliding areas. The first reassuring result is that 95% of the landslides surface is not classified as building zones (although it doesn't mean that there is no building at all in these areas, since most of the buildings located on landslides are not inside a building zone). However, some of the communities have a large part of their building zones in proven or potential landslides, the maximum being 100% in 8 communities for both categories of landslides and 56% for proven ones. This will lead to problems in land use planning.

Another goal is to assess the potential effect of a reactivation or a strong acceleration phase of one of the landslides. For this purpose, the number of houses per landslide has been extracted, disregarding the landslide type. It results than more than 75% of the landslides contain no houses at all. If we assume that each landslide has the same likelihood to be reactivated, we can observe that the probability to have more than or exactly a given number of houses in the landslide can be approximated by a Pareto function. From this, if we assume a certain reactivation frequency "f", we obtain the frequency of, for example, one damaged house, which is equal to f/8, or 25 damages houses, which is equal to f/100.

These observations will be helpful to manage the territory and to build risk scenarios for the house insurance company.