Non-Susceptible Landslide Areas in Italy and in the Mediterranean Region

Massimiliano Alvioli (1), Francesca Ardizzone (1), Fausto Guzzetti (1), Ivan Marchesini (1), Mauro Rossi (1,2)

(1) Consiglio Nazionale delle Ricerche, Istituto di Ricerca per la Protezione Idrogeologica, via Madonna Alta 126, I-06128 Perugia, Italy , (2) Universita' degli Studi di Perugia, Dipartimento di Scienze della Terra, Piazza Universita', 1, I-06123, Perugia, Italy

Landslide susceptibility is the likelihood of a landslide occurring in a given area. Over the past three decades, researchers, and planning and environmental organisations have worked to assess landslide susceptibility at different geographical scales, and to produce maps portraying landslide susceptibility zonation. Little effort was made to determine where landslides are not expected, where susceptibility is null, or negligible. This is surprising because planners and decision makers are also interesting in knowing where landslides are not foreseen, or cannot occur in an area. We propose a method for the definition of non-susceptible landslide areas, at the synoptic scale. We applied the method in Italy and to the territory surrounding the Mediterranean Sea and we produced two synoptic-scale maps showing areas where landslides are not expected in Italy and in the Mediterranean area. To construct the method we used digital terrain elevation and landslide information. The digital terrain consisted in the 3-arc-second SRTM DEM, the landslide information was obtained for 13 areas in Italy where landslide inventory maps were available to us. We tested three different models to determine the non-susceptible landslide areas, including a linear model (LR), a quantile linear model (QLR), and a quantile non-linear model (QNL). Model performances have been evaluated using independent landslide information represented by the Italian Landslide Inventory (Inventario Fenomeni Franosi in Italia – IFFI). Best results were obtained using the QNL model. The corresponding zonation of non- susceptible landslide areas was intersected in a GIS with geographical census data for Italy. The results show that the 57.5% of the population of Italy (in 2001) was located in areas where landslide susceptibility was expected to be null or negligible, while the remaining 42.5% in areas where some landslide susceptibility was significant or not negligible. We applied the QNL model to the landmasses surrounding the Mediterranean Sea, and we tested the synoptic non- susceptibility zonation using independent landslide information for three study areas in Spain. Results proved that the QNL model was capable of determining where landslide susceptibility is expected to be negligible in the Mediterranean area. We expect our results to be applicable in similar study areas, facilitating the identification of non-susceptible and susceptible landslide areas, at the synoptic scale.