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The landslide susceptibility map of Italy at 1:1 Million scale

A. Trigila (1), F. Catani (2), N. Casagli (2), G. Crosta (3), C. Esposito (4), P. Frattini (3), C. Iadanza (1), D. Lagomarsino (2), S. Lari (3), G. Scarascia Mugnozza (4), S. Segoni (2), D. Spizzichino (1), and V. Tofani (2)

(1) ISPRA - Italian National Institute for Environmental Protection and Research, Geological Survey of Italy, Roma, Italy (alessandro.trigila@isprambiente.it), (2) Department of Earth Sciences, University of Florence, Firenze, Italy, (3) Department of Geological Sciences and Geotechnologies, University of Milano-Bicocca, Milano, Italy, (4) Department of Earth Sciences, University of Rome “Sapienza”, Roma, Italy

Landslides are among the most problematic natural hazards in Italy, in terms of both casualties and economic losses. Landslide susceptibility maps are key tools for land use planning, management and risk mitigation. The aim of the work is to present the methodology adopted by ISPRA (Italian National Institute for Environmental Protection and Research), University of Florence, University of Milano-Bicocca and University of Rome "La Sapienza" for the development of a Landslide susceptibility map of Italy at 1:1,000,000 scale. The Landslide susceptibility map of Italy has been realized by using the Italian Landslide Inventory - Progetto IFFI which contains more than 486,000 landslides, and a set of contributing factors such as surface parameters derived from 20x20 m DEM, lithological map obtained from the Geological map of Italy 1:500,000, and land use map (Corine Land Cover). These databases have been subjected to a quality analysis with the aim of assessing the completeness, homogeneity and reliability of data, and identifying representative areas which may be used as training and test areas for the implementation of landslide susceptibility models. Physiographic domains of homogeneous geology and geomorphology have been identified, and landslides have been divided into three main classes in order to take into account specific sets of conditioning factors: a) rockfalls and rock-avalanches; b) slow mass movements, c) debris flows. Bivariate statistical analyses have been performed to assess the frequency distribution of contributing factors on the landslide area. The tests of different techniques (Discriminant Analysis, Logistic Regression, Bayesian Tree Random Forest) have been performed in selected areas of Italy in order to assess advantages, disadvantages and applicability of the models at the scale of analysis. The modelling tests provided good performance with all techniques, once applied with the appropriate selection of training and validations sets and with a significant number of statistical units. These tests also demonstrated that large grid-cells (100x100 m, 500x500 m) are suitable terrain units for the scale of the analysis. Considering the results of the tests, the Bayesian Tree Random Forest model was selected to produce the 1:1,000,000 susceptibility map of Italy. Landslide susceptibility map of Italy at 1:1,000,000 scale can be an important support for the implementation of pan-European landslide susceptibility map and a useful tools for the EU policies and measures finalized to the landslide risk reduction and mitigation.