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A COMPREHENSIVE ASSESSMENT OF LANDSLIDE HAZARD IN THE STAFFORA BASIN, NORTHERN ITALIAN APENNINES

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Landslide hazard is defined as "the probability of occurrence, within a specified period of time and within a given area, of a potentially damaging failure". A more complex definition includes the magnitude of the event, i.e. the area, volume, velocity or momentum of the expected landslide. The definition incorporates the concepts of location (i.e., "where" a landslide will occur), time (i.e., "when", or how frequently a landslide will occur) and magnitude (i.e., "how large" the landslide will be). Review of the literature reveals that even the more advanced attempts to determine landslide hazard do not fully comply with the given definition. Most commonly, deterministic or statistical models are prepared to determine "where" a landslide can be expected, with a certain probability, within a given mapping unit (e.g., grid cell, unique condition unit, slope unit, litho-hydro-morphological unit, etc.). Such models are best classified as "susceptibility" models, because they do not provide an estimate of "when" landslides are expected. For the Staffora River basin, which extends for about 275 square kilometres in the Northern Italian Apennines (Lombardy Region), an attempt was made to determine all aspects of landslide hazard. The study area was first partitioned into 2243 litho-hydro-morphological units. Spatial assessment of landslide hazard (i.e., "where") was obtained by discriminant analysis of 50 predicting thematic variables, including morphological, lithological, structural and land use variables. Systematic interpretation of five sets of aerial photographs of different ages, from 1954 to 2000, allowed preparing a multi-temporal landslide inventory map. For each mapping unit, average landslide recurrence was obtained by dividing the total number of landslide events by the time span of the investigated period. Assuming that landslide recurrence will remain the same for the future, and adopting a Poisson probability model, we determined for different time intervals the exceedance probability of having one or

more damaging landslide in each mapping unit (i.e., "when"). Landslide hazard was then obtained by multiplying the spatial and the temporal probabilities. Lastly, an estimate of the magnitude of the expected slope failures (i.e., "how large") was obtained by analysing the frequency-size statistics of landslide areas obtained from the multi-temporal landslide inventory map.