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Estimating the quality of probabilistic landslide susceptibility models

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Probabilistic landslide susceptibility assessments attempt to predict the location and threat posed by known landslides. Under the assumption that landslides will occur in the future because of the same conditions that produced them in the past, geomorphologists use susceptibility assessments to predict the location of future landslides. Adding information on the recurrence and the magnitude (e.g., size, volume, speed, destructiveness, etc.) of the expected landslides, the hazard posed by future slope failures can also be predicted. As any other prediction, a landslide susceptibility model needs validation. Validation aims at evaluating the model quality, including the skill of the model to predict future landslides. We propose and discuss a general framework for testing landslide susceptibility models, including a scheme for ranking the quality of the susceptibility assessments. The framework is based on a set of tests and related acceptance criteria aimed at establishing and ranking the quality of a landslide susceptibility assessment, including: (i) the degree of model fit, (ii) the robustness of the model to changes in the input data, (iii) the error associated with the probabilistic estimate, and (iv) the model prediction skill. Based on our criteria, when no information is available on the quality of a landslide susceptibility model the resulting zoning map has the lowest possible level of quality (level 0). When estimates of model fit are available, the susceptibility assessment has the least acceptable quality level (level 1). When the error associated with the predicted susceptibility estimate for each mapping unit is established, the susceptibility assessment has a higher level of quality (level 2). Lastly, when the prediction skill of the model is known, the susceptibility assessment has a still higher quality rank (level 4). The proposed scheme allows for summing the individual quality levels. We tested the proposed framework and acceptance criteria in the Collazzone area, in central Italy. If adopted, the proposed framework will provide

for quantitative comparisons of the results obtained by different investigators working in different areas, and using different methods to predict landslide susceptibility.