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Assessment of landslide risk in the Arno river basin (Italy)

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Landslides cause disasters resulting in deaths, injuries and homelessness every year. They affect communities, roads and other infrastructures and constitute a major problem in many developed and developing countries. Despite the large impact of mass movements on natural and human environment, there are only few well-developed methodologies to assess landslide risk. This is particularly true for the risk evaluation at the catchment scale, due to the large amount of data required for the analysis. The research presented is an attempt to assess landslide risk in the Arno river basin, Northern Tuscany, Italy. The aim is to create a dynamic tool, managed in a Geographical Information System environment, useful for landslide risk pre-disaster planning and management, definition of scenarios and policy design. Starting from a recently completed landslide inventory (including about 28,000 mass movements) and a newly developed statistically-based susceptibility map, the present work focuses mainly on the assessment of the remaining components of the equation of risk, i.e. vulnerability and value of the elements at risk. The definition of position, typology and characteristics of the elements at risk has been carried out with two different methodologies, partially derived from the "Plans d'Exposition au Risque" proposed in France: i) buildings and infrastructures were directly extracted from digital terrain cartography at the 1:10,000 scale, whilst ii) non-urban land use was identified and mapped based on an updated and improved CORINE land cover map at the 1:50,000 scale. Recorded and used information includes building volume, height, construction period and main use; land tract use, economic and environmental value, productivity; infrastructure geometry and typology and so on. The definition of economic and environmental value, still in progress at present, relies upon contingent valuation methods and form-based interviews. Vulnerability has been assessed using a contingency matrix approach, based

on the definition of landslide intensity classes and the subsequent overlay with the typology of the elements at risk. Landslide intensity, usually defined as proportional to kinetic energy, was obtained considering landslide typology as a proxy for expected velocity and landslide area as a substitute variable for volume. Surface area classes were established on the basis of the frequency-size distribution of landslides. The final result is an information management system that maintains and makes use of data structured for the definition of landslide risk, to the use of policy makers, risk managers and researchers. For intrinsic reasons of design, risk analyses based on such system are easily updatable and particularly suited for catchment scale pre-disaster or emergency planning.