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Modelling landslide hazard, soil redistribution and sediment yield of landslides on the Ugandan footslopes of Mount Elgon

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In this study, the LAPSUS-LS landslide model, together with a digital terrain analysis of topographic attributes, is used as a spatially explicit tool to simulate recent shallow landslides in Manjiya County on the Ugandan slopes of Mount Elgon. Manjiya County is a densely populated mountainous area where landslides have been reported since the beginning of the twentieth century. To better understand the causal factors of landsliding, 81 recent landslides have been previously mapped and investigated. Through statistical analysis it was shown that steep concave slopes, high rainfall, soil properties and layering as well as human interference were the main factors responsible for landslides in the inherently unstable study area. LAPSUS-LS is used to construct a landslide hazard map, and to confirm or reject the main factors for landsliding in the area. The model is specifically designed for the analysis of shallow landslide hazard by combining a steady state hydrologic model with a deterministic infinite slope stability model. In addition, soil redistribution algorithms can be applied, whereby erosion and sedimentation by landsliding can be visualized and quantified by applying a threshold critical rainfall scenario. The model is tested in the Manjiya study area for its capability to delineate zones that are prone to shallow landsliding in general and to group the recent landslides into a specific landslide hazard category. The digital terrain analysis confirms most of the causal topographic factors for shallow landsliding in the study area. In general, shallow landslides occur at a relatively large distance from the water divide, on the transition between steep concave and more gentle con-

vex slope positions, which points to concentration of (sub)surface flow as the main hydrological triggering mechanism. In addition LAPSUS-LS is capable to group the recent shallow landslides in a specific landslide hazard class (critical rainfall values of 0.03-0.05 m day^{-1}). By constructing a landslide hazard map and simulating future landslide scenarios with the model, slopes in Manjiya County can be identified as inherently unstable and volumes of soil redistribution can yield four times higher than currently observed. More than half of this quantity can end up in the stream network, possibly damming rivers and causing major damage to infrastructure or siltation and pollution of streams. The combination of a high population density, land shortage and a high vulnerability to landslides will likely continue to create a major sustainability problem.