



Landslides in cultural landscapes: legacy effects of land-use in a centennial perspective

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Research in the ongoing ILLAS project (Integrating Land use Legacies in Landslide Risk Assessment to support Spatial Planning), funded by the Austrian Climate Research Program (ACRP), focuses on the possible effect of land-use legacies on landslide occurrences.

Landslides are recorded especially when economic damage has been caused, which is mostly the case in settlements, along transportation infrastructure, or on agricultural land. However, recent LiDAR-derived inventories often show a surprisingly high landslide density particularly in forested areas. This apparent contradiction underlines the need to better understand the factors explaining landslide occurrence in cultural landscapes. We hypothesize that land-use legacies may be a previously-neglected explanatory factor.

The objective of this study was to assess relationships between landslide occurrence and land-use legacies while also accounting for geomorphological and lithological conditions as possible confounders. For this analysis we digitized and classified land-use patterns for three time points and two study areas (Waidhofen and Paldau, Austria). Data sources include the Franciscan Cadastre of 1820, aerial photographs of 1960, and aerial orthophotos combined with InVeKoS data of 2015. In addition, yields and livestock information was compiled from archival sources and statistical publications. The information was summarized as socio-ecological variables reflecting plot-level land-use legacies for each study area, providing indicators on cumulative biomass extraction, land-use change and soil compaction.

For the assessment of landslide occurrence, we used a semi-parametric generalized additive model (GAM), and combined information on land-use legacies with local geomorphological and geological predictors as input variables. The model performance was assessed using the area under the ROC curve (AUROC) estimated by spatial cross-validation. The explanatory power of land-use legacy predictors was evaluated based on their explained deviances and odds ratios.

Initial findings suggest that including land-use legacies in the analysis improves the model fit. Among the land-use legacy indicators, land-use change is the most relevant factor explaining landslide occurrence. The result has the potential to assess consequences of future land-use change on landslides.