Towards a consistent set of land-surface variables for landslide modelling

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INTRODUCTION

• land-surface variables (LSVs) are easy to obtain from Digital Elevation Models (DEMs)

• a consistent approach in selecting the ones that are the most relevant to landslides is still missing

• **Objective**: This work reports preliminary results of an experiment that aims at finding a set of LSVs capable to help in identifying landslide scarps in various landscape conditions
MATERIAL AND METHODS

Study areas

- **six study areas**, of different environmental conditions
  - 3 study areas are located in Romania - B1, B2, B3
  - 2 study areas are located in Honshu Island, Japan - J1, J2
  - 1 study area is located in Utah, USA - U
MATERIAL AND METHODS

Data

- **databases of landslide scarps** compiled from different sources - archive data, geomorphological field mapping, local authority databases, stereographic photo interpretation, LiDAR

- **Presence data**: one point was randomly selected within each scarp

- **Absence data**: the same number of points was randomly selected outside scarp polygons

- 70% used for training and 30% for validation

- Shuttle Radar Topography Mission (SRTM) **DEM** at 30 m (1 arc second)
MATERIAL AND METHODS

Land-surface variables

- **14 LSVs** were retained after multicollinearity analysis (from initial of 24 LSVs)

Variable importance analysis

- aim: **generalizable subset of terrain variables** for landslide modelling
- **variable importance (VI) analysis** using Random Forest (RF) package in R
- mean decrease in accuracy (MDA) algorithm
MATERIAL AND METHODS

Landslide modelling

- **logistic regression** was used for landslide modelling
- **three models tested**

<table>
<thead>
<tr>
<th>Model</th>
<th>Details</th>
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<tbody>
<tr>
<td>LSM_VI</td>
<td>The identified generalizable subset of variables, emerging as important predictors in all study areas</td>
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<tr>
<td>LSM_best_model</td>
<td>Best model specific to each study area, identified with backward stepwise logistic regression</td>
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<tr>
<td>LSM_tasse</td>
<td>Six <strong>terrain variables</strong>, proposed by Lecours et al. 2017, as they capture more than 70% of the topographic structure of an area, relative difference to mean elevation value, standard deviation of DEM, easternness, northerness, local mean and slope</td>
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RESULTS

Variable importance expressed as mean decrease in accuracy in the six study areas
RESULTS

Models prediction performance
CONCLUSIONS

• three LSVs with the potential of describing satisfactorily landslide scars in various landscape conditions

• negative topographic openness = scarps shape

• slope height = position on the slope

• slope = landslide favorability factor

• models based on these three LSVs produced results comparable or even better (in some cases) than:
  o models built on locally calibrated LSVs
  o models built on a larger number of LSVs
Thank you!