

Landslide Susceptibility Mapping in Denmark – a Machine Learning Approach

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SUMMARY

The first Danish national landslide mapping and the resultant comprehensive landslide inventory, produced by The Geological Survey of Denmark and Greenland (GEUS), comprises more than 3200 landslides, indicating that landslide hazard might present a more serious problem in Denmark than earlier estimated, requiring methods to map areas at risk.

This study proposes a Machine Learning approach to identify places that might be vulnerable to landslides based on topographic, hydrological, geological, and anthropogenic exogenous variables in a region of interest with a relatively high number of landslide occurrences situated around Vejle Fjord, Denmark, using publicly available data and open-source software. The supervised, tree-based machine learning algorithm Random Forest has been applied for a binary classification of the sample data as landslide presence (centroids from the landslide inventory) and randomly sampled absence points and the classification has been validated through test data unseen by the model.

The results have been presented in the form of a landslide susceptibility map divided into several probability classes. The overall predictive accuracy of 94% indicates that the applied model has prospects to be applied for mapping areas in Denmark that might be prone to landslides. The mapping can be useful for decision-makers and can potentially pave the way to a legislative framework and land management practices for areas vulnerable to landslides and for preventive decisions as well as mitigative measures of the potential risks associated with landslide events.