Investigating the Transferability of Landslide Hazard Assessments

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Introduction

One of the major difficulties in landslide research is the proliferation of methods available, both for landslide identification and for hazard assessment. Many hazard assessment methods depend on the location of past landslides, but many countries do not have a national database of events, and if they do they contain inconsistent and incomplete data.

Implications

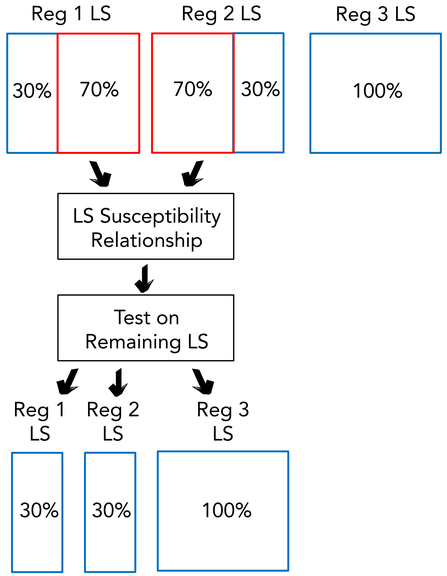
A thorough inventory of known methods will help hazard scientists decide which method to use in each situation.

The small number of explanatory variables and the simplicity of the statistical methods make this approach easy to implement and understand.

These results will allow scientists to use globally available data and the location of landslides in other regions, to conduct hazard assessments in unstudied regions.

Methods

Proposed Methodology:



Frequency Ratio:

$$FR = \left(LSD_{ij}/LSD_r\right)$$

$$LSI = FR_1 + FR_2 + \cdots + FR_n$$

$$P(true) = \frac{LSI - \min(LSI)}{\max(LSI) - \min(LSI)}$$

LSD_{ij} : LS density in jth class of ith response variable (eg. LS density in the 2000-2500 m class of elevation variable)

LSD_r : LS density of total region

LSI : LS Susceptibility Index of each pixel

Logistic Regression:

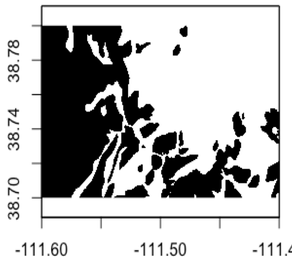
$$P(true) = \frac{\exp(a_0 + a_1x_1 + \cdots + a_nx_n)}{1 + \exp(a_0 + a_1x_1 + \cdots + a_nx_n)}$$

a_n : weighting coefficient of nth explanatory variable

x_n : nth response variable value

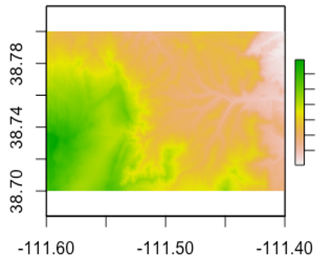
Inputs:

Landslides



Response Variable: past landslide occurrence (binary: "true" or "false")

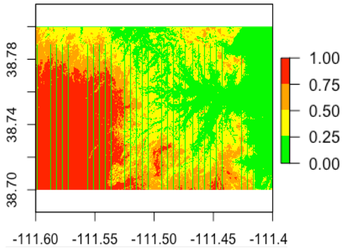
Elevation



Explanatory Variables: elevation, slope, aspect, curvature, topographical positon index (tpi)

Output:

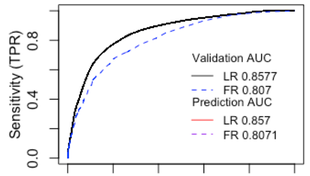
LS Hazard



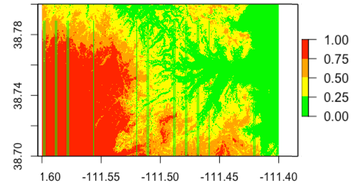
Landslide Susceptibility: Probability of landslide occurrence

Results

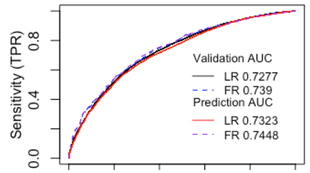
UT ROC Curves



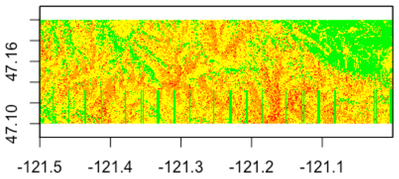
UT Landslide Hazard



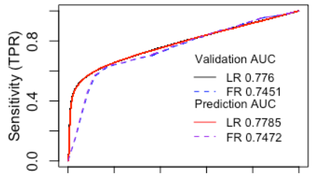
WA ROC Curves



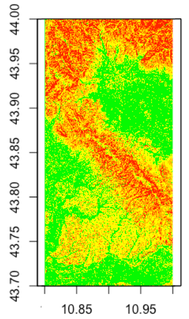
WA Landslide Hazard



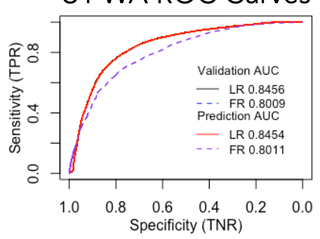
IT ROC Curves



IT Landslide Hazard



UT-WA ROC Curves



Products:

- Inventory of known Landslide Hazard Assessment Methods
- R code package
- Standard method or workflow

Acknowledgements:

Advisor, Rebecca Bendick

Committee, Andrew Wilcox & Kevin McManigal

UM BRIDGES Program

Sources:

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