DEBRIS-FLOW SUSCEPTIBILITY ASSESSMENT USING THE INDEX ENTROPY MODEL IN THE VISO CATCHMENT

Jeancarlo Escalante[1,2*], Cesar Sanchez[1,2], David Gonzalez[2,3], Jefferson Castillo[1,2], Bill Zorrilla[1,2,4]

[1]National University of Engineering, Lima, Peru; [2]Institute for the Mitigation of the Effects of El Niño Phenomenon (IMEFEN), Lima, Peru; [3]Technological University of Peru, Lima, Peru; [4]Royal Academy of Engineering (RAEng), London, The United Kingdom

*Correspondence YP: jescalantep@uni.pe

Abstract Debris Flow is one of the most typical natural hazards in the mountainous areas of Chosica in Peru, which causes significant damages to people and infrastructure, thus affecting lives and the economy. It is essential to research this phenomenon to understand its behaviour and mitigate its effects, thus building resilient cities. Therefore a model was developed for regional susceptibility assessments using geographic information system (GIS) and an index entropy model adapted for sensitivity analysis of several impact factors of debris flows of the Viso catchment. The success rate of debris flow prediction by the model is *72.7%* based on area-under-the-curve (AUC) cross-validation of the model.

Keywords: Debris-flow, index entropy model, susceptibility assessment.

Methods

Geographic information system (GIS) was applied to create a debris-flow inventory map and maps of impact factors (slope gradient, slope aspect, precipitation, NDVI, geology, and developmental stages of catchment).

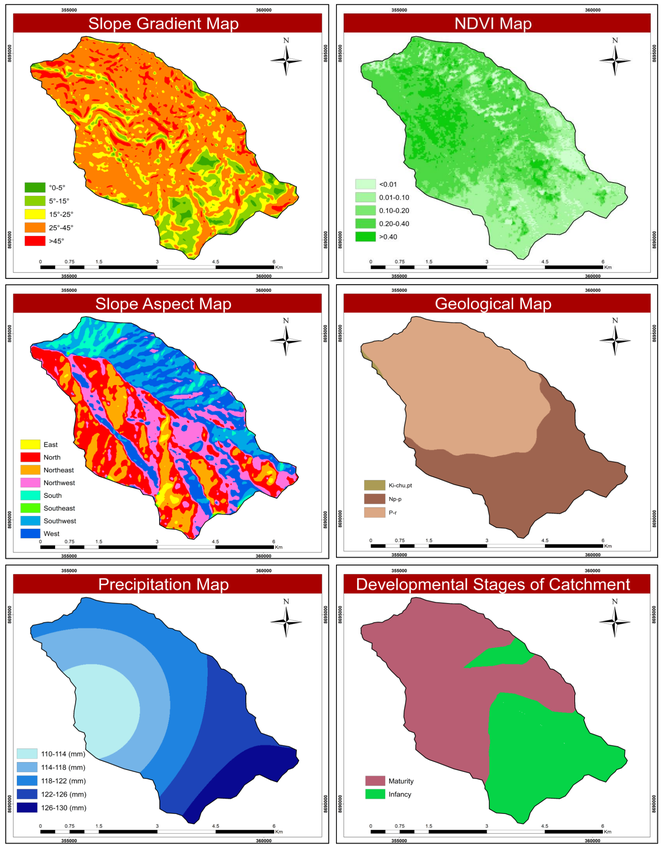
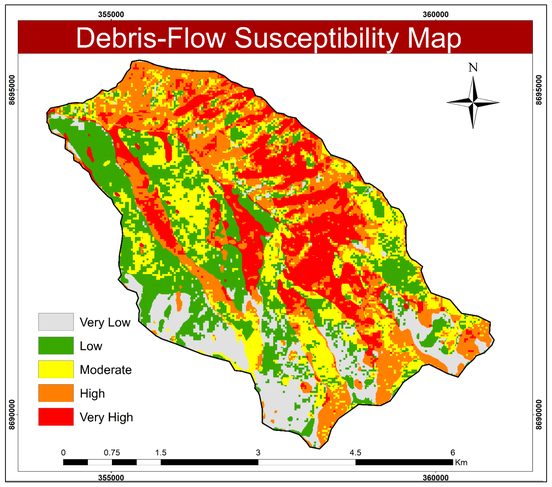


Figure 1: Maps of impact factors.

Results

As a result, the debris-flow susceptibility assessment was performed applying the Index Entropy Model, which is a binary statistical model put forward by Vlčko et al. (1980).



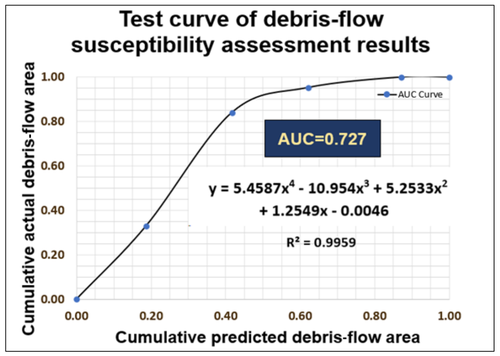


Figure 2: Susceptibility map, cross-validation AUC test, and field research.

Conclusions

- From the susceptibility zonation results, the extreme and high debris-flow susceptibility areas are mainly distributed in Viso catchment on its right bank.
- Slope aspect, NDVI, and developmental stages of the Viso catchment are the most dominant factors influencing on debris-flow events after applying the index entropy model.
- A cross-validation AUC test was performed to assess the accuracy of the model, thus getting an encouraging success rate of debris flow prediction of ***72.7%***.

Bibliography

Chen J., Li Y., Zhou W., Iqbal J., Cui Z. (2017). Debris-flow susceptibility assessment model and its application in semiarid mountainous areas of the Southeastern Tibetan Plateau. Natural Hazards Review 18(2), 05016005.

Vlčko J., Wagner P., Rychlikova Z. (1980). Evaluation of regional slope stability. Mineralia Slovaca 12(3), 275–283.

Wu S., Chen J., Xu C., Zhou W., Yao L., Yue W., Cui Z. (2020). Susceptibility assessments and validations of debris-flow events in meizoseismal areas: Case study in China's Longxi River watershed. Natural Hazards Review 21(1), 05019005.