

Utilizing Geographic Information Systems to
Identify Potential Lahar Pathways in Proximity to Cascade Stratovolcanoes

Abstract

This project focused on the creation of a simple lahar pathway identification model for Mount Saint Helens that can be readily reproduced using publicly available datasets. The model parameters included: slope derived from a depressionless digital elevation model (DEM), land cover, and a hydrological network. Previous lahar studies utilized complex mathematical equations or process modeling schema such as the LAHARZ model. While slope had been used in previous modeling efforts, most lahar models examined lahar inundation zones from the perspective of flow volume by calculating cross-sectional and planimetric area.

Two modeling methods, simple overlay and weighted overlay, and two classification schema of slope factors, steep slope and inverse slope, were investigated to determine potential lahar pathways and compared against United States Geological Survey (USGS) volcanic hazard zones in the vicinity of Mount Saint Helens. The inverse slope overlay models were more successful at determining potential lahar pathways in low-lying valley and the steep slope overlay models would be more useful in identifying locations where a lahar could begin. The inverse slope weighted overlay model with the highest overall accuracy of 57.3 % performed better overall when compared against the steep slope overlay models with the highest overall accuracy of 17.9 %. Utilizing USGS volcanic hazard zone map as ground truth in accuracy assessment might cause the low

accuracy value because zone 2 was primarily focused on pyroclastic surge hazards instead of lahar hazards which in could have potentially led to model results being inaccurately evaluated. The results were displayed in a map with recreational and transportation infrastructure to show the relationship between the recreational and transportation infrastructure and potential lahar pathways.

The model results were not perfect, but they show that simplistic lahar pathway identification models can utilize publicly available data, and that there is potential for the development and refinement of simplistic modeling in volcanic hazard applications. With further research, simplistic lahar models might be used for preliminary lahar hazard mapping in local communities where budgetary constraints limit GIS users to only publicly accessible data sources. In addition, simplistic lahar models could provide useful information for further data collection efforts enabling the development of more precise lahar models.