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Landslide Susceptibility Analysis Based on Citizen Reports to a 311 System

Landslide susceptibility estimates are essential for reducing the risk posed by landslides to social and economic well-being. However, estimates of landslide susceptibility depend on reliable landslide inventories whose production requires extensive field or remote sensing efforts. Further, most inventories are not updated through time and thus may not capture the influence of changes in climate and/or land use. An inventory with a potential to overcome these limitations can be produced from citizen-reports to a 311 phone and online system. This nationwide database updates hourly and records reported landslides location and timing. Whereas this landslide inventory is promising, it was not yet used for landslide susceptibility analyses and may be associated with spatial uncertainties and reporting biases. In this study we explore the use of 311-based landslide inventory for landslide susceptibility estimates in Pittsburgh, PA, where landslide risk is among the highest in the nation. To do so, we compare the 311-based inventory to field validated inventories through a multi-pronged approach that combines field validation of 311-reported landslides, probabilistic analysis of the association between landslides and the underlying topographic and geologic factors, and spatial filtering. Our results show that: (a) Approximately 70% of the 311-reported landslides are associated with an identifiable landslide in the field; (b) The spatial uncertainty of the 311-reported landslides is 104 ± 25 meters; (c) 311-reported landslides differ from other landslide inventories in that they are primarily associated with proximity to roads, however, field- correction of 311-reported landslide locations fixes this anomaly; (d) A simple spatial filter, scaled by the uncertainty in landslide location as determined from a subset of the 311 data, can increase the consistency between the 311-reported landslide inventory and field validated inventories. These results suggest that 311-based landslide inventories can generally improve susceptibility estimates at a relatively low cost and high temporal resolution.