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Road influences on landslide inventories

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Roads can both increase and decrease the likelihood of landslides occurring in a given region. This might be due to (i) mapping biases when compiling landslide inventories, (ii) the influence of the road on the landslide susceptibility. Here, we present a spatial statistical analysis of landslide proximity to roads across a range of geographic settings and landslide inventory types. We examine the proximity of landslide centroids to roads at regional to national scales using 12 diverse landslide inventories with variations in inventory type (6 triggered event, 6 multi-temporal), mapping method (1 field-based, 6 remote sensing, 5 a combination of mapping methods), and countries of origin distinguished by their human development index (HDI) (6 high and 6 low HDI). Each inventory contains $270 < n_{\text{Landslides}} < 81,000$ landslides with inventory regional extents ranging from $80 \text{ km}^2 < A_{\text{inventory}} < 385,000 \text{ km}^2$. We have developed a PyQGIS tool that calculates the distance between each landslide centroid and the closest road vector within the same watershed. From these distance values, we create a density distribution of landslides as a function of distance from roads for that inventory. We then compare each inventory's density distribution of landslide-to-road distance to a set of randomly generated points and their distances to roads. For the 12 inventories, we find that the landslide density near roads compared to random points is greater in 3 inventories, equal in 3 inventories, and lower in 6 inventories. We find that a comparison between landslides and random points describes each inventory well in terms of road density. We divide the 12 inventories into 4 typologies with different potential explanations for each group. We believe there is evidence of mapping bias towards roads for the typology with 3 inventories that have greater landslide density (compared to random points), which suggests that a more nuanced use of road proximity within landslide susceptibility models should be adopted. Further research should be done to understand the interactions between landslides and proximity to roads at the regional to national scale.