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# Road network exposure, connectivity and hierarchy as input to assess landslide risk hotspots

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From the territorial land use planning perspective new urban areas have been safeguarded during the last decades by the Portuguese regulation and practice that consider land use restrictions on landslide hazard prone areas. Nevertheless, the fatalities due to landslides did not reduce in number, mostly due to the occurrence of rapid shallow landslides, affecting people inside buildings and more recently, inside vehicles, as a consequence of the increasing people's mobility. When the exposure is to deep-seated landslides, structures and infrastructures frequently undergo intense destruction, leading to severe disruption of economic and social activities.

The present work intends to evaluate actual exposure of road network to landslides in the context of a Landslide Early Warning System (LEWS) prototype, developed upon both soft and low-cost technology. To achieve this main goal, three specific objectives were defined: (i) to evaluate the road network exposure considering different road types; (ii) to evaluate the re-routing of circulation for users, the loss of access to functions or services, due to travel time increase; and (iii) to evaluate the road network connectivity hierarchy and its contribute to define landslide risk hotspots for evacuation and rescue access in case of disastrous landslide events.

The study area corresponds to four municipalities (Alenquer, Arruda dos Vinhos, Sobral de Monte Agraço and Vila Franca de Xira) that are partially included in the Grande da Pipa River (GPR) basin, which is one of the most landslide prone areas in Portugal. The road network hierarchy data is based on available official road network maps; the road segment connectivity role in regional network is based on graph analysis; and the landslide risk hotspots - are classified by combining the different types of road segments, the re-routing travel time scenarios and the road network hierarchy and network connectivity function with the shallow and deep-seated landslide maps produced in the context of the BeSafeSlide project.

The final results will be incorporated on the LEWS prototype, which is conceptualized to be people-centred, which means, not specifically focused on hazardous processes, but on reducing exposure and vulnerability, allowing an effective implementation of risk management strategies, contributing for increasing resilience and adaptive capacity building of local communities.

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