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The relationship between vegetation, slope stability and channel processes leading to the recruitment and mobilization of large woody debris

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Large woody debris fulfills important ecological functions in river systems, but it also increases the risk of damage during flood events in populated regions or along traffic routes. The mobilization and recruitment of “fresh” large woody debris has often been documented to be an important component of the total amount of wood transported during flood events in mountainous catchments. Therefore, research interest on recruitment, transport and deposition of large woody debris has arisen during the last decades. Although the main contributing processes are generally acknowledged and several modeling approaches have been proposed, less is known about the precise mechanisms behind recruitment and mobilization in mountainous catchments. Additionally, the role of vegetation in influencing the magnitude and the frequency of these mechanisms is often neglected or not considered in detail. Root reinforcement is particularly recognized to play an important role on bank erosion, bank failure and shallow landslides, but remains particularly difficult to quantify and implement in numerical models.

This work presents a new modeling framework for simulating the effect of the spatio-temporal distribution of root reinforcement on bank erosion and slope stability in small mountainous catchments. The main objective of the work is to couple an existing shallow landslide model (SlideforMAP) with a bank erosion module to improve the prediction of large woody debris recruitment at mountainous catchment scales. Therefore the spatial structure of forest and its effect on root reinforcement, as obtained by remote sensing data, will be explicitly accounted for. Based on a first case study, we present results that help to quantify the effect of vegetation on the recruitment of „fresh“ large woody debris and allow to detect potential contributing areas in small mountainous catchments. Further, suggestions on where forest management could improve overall slope and bank stability will be made and guidelines for selecting slope stabilizing trees species will be established in an attempt to reduce recruitment and mobilization of large woody debris.