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How spatial vegetation distribution affects soil erosion and sediment transport

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There are a multitude of factors that affect soil erosion and the process of sediment movement. One particular factor known to have a considerable impact is vegetation coverage within catchment areas. Previous studies have examined the impact of vegetation cover on erosion. However, there is a lack of research on how the spatial distribution of vegetation influences erosion rates.

A greater understanding of hillslope erosion is fundamental in modelling previous and future topographic changes under various climate conditions. Here, the physical based erosion model EROSION 3D © is used to evaluate the impact of a variety of vegetation patterns and degrees of vegetation cover on sediment erosion and transport. The model was applied on a natural catchment in La Campana (Central Chile). For this purpose, three different vegetation patterns were created: (i) random distribution, (ii) water-dependent distribution (TWIR) and (iii) banded vegetation pattern distribution. Additional to this, the areas covered by vegetation generated in the first step were expanded by steps of 10% [0...100%]. The Erosion3D © model then was applied on all vegetation patterns and degrees of cover.

Our results show an initial increase of soil erosion with increasing plant coverage within the catchment up to a certain cover threshold ranging between 10 and 40%. At larger vegetation cover soil erosion rates decline. The strength of increase and decline, as well as the cover-threshold is strongly conditioned by the spatial vegetation pattern. In the light of this, future research should pay particular attention to the properties of the plants and their distribution, not solely on the amount of biomass within catchment areas.