Environmental factors controlling spatial variation in sediment yield in a central Andean mountain area

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A large spatial variability in sediment yield was observed from small streams in the Ecuadorian Andes. The objective of this study was to analyze the environmental factors controlling these variations in sediment yield in the Paute basin, Ecuador. Sediment yield data were calculated based on sediment volumes accumulated behind checkdams for 37 small catchments. Mean annual specific sediment yield (SSY) shows a large spatial variability and ranges between 26 and 15,100 Mg km^{-2} $year^{-1}$. Mean vegetation cover (C, fraction) in the catchment, i.e. the plant cover at or near the surface, exerts a first order control on sediment yield. The fractional vegetation cover alone explains 57% of the observed variance in ln(SSY). The negative exponential relation ($SSY=a\times e^{-b\,C}$) which was found between vegetation cover and sediment yield at the catchment scale (10^3–10^9 m^2), is very similar to the equations derived from splash, interrill and rill erosion experiments at the plot scale (1–10^3 m^2). This affirms the general character of an exponential decrease of sediment yield with increasing vegetation cover at a wide range of spatial scales, provided the distribution of cover can be considered to be essentially random. Lithology also significantly affects the sediment yield, and explains an additional 23% of the observed variance in ln(SSY). Based on these two catchment parameters, a multiple regression model was built. This empirical regression model already explains more than 75% of the total variance in the mean annual sediment yield. These results highlight the large potential of revegetation programs for controlling sediment yield. They show that a slight increase in the overall fractional vegetation cover of degraded land is likely to have a large effect on sediment production and delivery. Moreover, they point to the importance of detailed surface vegetation data for predicting and modeling sediment production rates.

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