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Geomorphic response to land use change of tropical mountain areas: can analogies help us in prediction and remediation ?

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The Pauté catchment in the Ecuadorian Andes is characterised by high sediment yields (over 10 ton ha-1yr-1 on average) which threaten electricity production in the Amaluza hydropower plant that provides 40-50 % of the total Ecuadorian electricity. Naturally, questions arise as to what are the major sources of this sediment and to what extent sediment production may be reduced by promoting changes in land use and other countermeasures. Direct measurements can provide quantitative data of sediment production by surface erosion at a relatively small scale in various geomorphic subunits while large-scale data can be obtained from dam infillings. However, collecting data on sediment production and sediment transfer over a sufficiently long time span to establish a reliable sediment budget requires substantial resources. Perhaps more important is that, although such information is required it is not sufficient to predict the effect of future land use change as it is also necessary to create the necessary socio-economic circumstances that may lead to the desired changes.

It is therefore interesting to see what can be learnt from analogies with other areas that face(d) similar problems. The Paute catchment is in many ways not dissimilar to areas in the western border of the French Pre-Alps. In this area massive land use changes have taken place within the last 100 years and their effects on river morphology and hydrology have been quite well documented. River widths, especially of lower-order

streams have been significantly reduced as well as peak flood discharges and hence also sediment transport. Analogies with certain phenomena within the Paute catchment, such as the morphological and sedimentological changes that have occurred in the Deleg river are obvious. An analogy may also be drawn with respect to relevant socio-economical evolutions. The dramatic land use changes in the French Pre-Alps were to a large extent due to changes in societal structure, from an subsistency agriculture to an integrated, market-oriented economy. These changes led to an exodus of the rural population, freeing up land that was hitherto used for subsistency agriculture. Similar tendencies may be noted in the Paute catchment: areas where marginal land near to the city centres is increasingly being reforested. At the same time, further expansion of subsistence agriculture on highly marginal land can be seen in remote areas, not yet integrated in the local economy. This suggests that reducing sediment production in the Paute catchment requires attention for attention for local socio-economic issues as well as sound technical information.