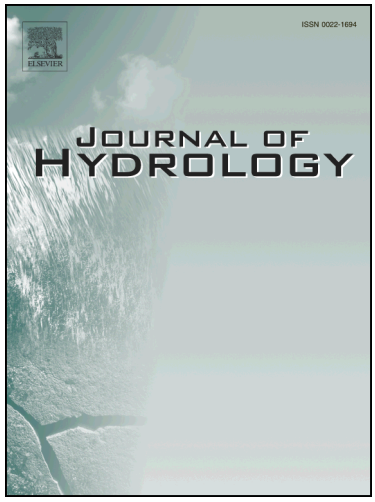

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Effect of land use on interrill erosion in a montane catchment of Northern Laos: an analysis based on a pluri-annual runoff and soil loss database.

J. Patin[a], E. Mouche[a,*], O. Ribolzi[b], O. Sengtahevanghoung[c], K.O. Latsachak[d], B. Soulileuth[d], V. Chaplot[e], C. Valentin[f]

[a] *Laboratoire des Sciences du Climat et de l'Environnement, UMR 8212, C.E. de Saclay, Orme des Merisiers, F-91190 Gif-sur-Yvette, France*
[b] *Géosciences Environnement Toulouse, UMR 5563, Université Paul Sabatier, 14 Av. Edouard Belin, F-31400 Toulouse, France.*
[c] *Agriculture Land-Use Planning Center (ALUPC), Ministry of Agriculture and Forestry, Vientiane, Lao PDR*
[d] *Institut de Recherche pour le Développement, Ban Sisangvone, BP5992, Vientiane, Lao PDR*
[e] *Laboratoire d'Océanographie et du Climat, UMR 7159, Université Pierre et Marie Curie, 4 Pl. Jussieu, F-75005 Paris, France*
[f] *Institut d'Ecologie et des Sciences de l'Environnement de Paris, UMR 7618, Université Pierre et Marie Curie, 4 Pl. Jussieu, F-75005 Paris, France*

Abstract

The introduction of cash crops and the evolution of farming practices in the uplands of Southeast Asia have drastically changed the agricultural landscape of the region during these last decades. This evolution has significantly increased soil erosion leading to important on and off-site effects. A long-term multi-scale monitoring of soil erosion was initiated in the early 2000's in the Houay Pano catchment located near the city of Luang Prabang in Northern Laos to assess these effects and propose sustainable land management solutions. We report here the analysis and the modelling of the soil erosion measurements made during the whole period on $1\,m^2$ plots for different land uses. As expected, land use has an important impact on runoff production and soil erosion. The mean annual runoff coefficient increased from 0.05 for established fallow (4 years) to 0.45 for old teak trees plantation (14 years) with intermediate values for crops. The mean soil loss followed the same trend with respect to land use, from $25\,g\,m^{-2}\,y^{-1}$ to $3765\,g\,m^{-2}\,y^{-1}$. These measurements confirm that established fallow promotes infiltration and reduces erosion and, at the opposite, teak tree increases soil crusting, lowers the infiltration rate and enhances soil detachment. The splash and wash erosion component of a process-oriented model developed for terrace erosion was used. This model describes the soil loss after a rainfall event as the product of an effective soil detachability, the rainfall kinetic energy, the runoff coefficient and different attenuation factors linked to soil surface features. The agreement is good, both at the event and the yearly scales. When aggregated by land use, surface features percentages have low standard deviations and soil detachability variability may be described by a log-normal distribution. This suggests that each land use has a unique signature in the erosion process given by the percentages and the distribution. We conclude that: i) leaving the litter layer and an understorey in crops and trees plantations is the best way to minimize soil erosion, and ii) the splash and wash model may be helpful to set up optimal agronomic strategies for a sustainable land use of Southeast Asia uplands.

Keywords: Interrill erosion model, Micro-plot, Land use, Soil surface features, Southeast Asia

*Corresponding Author
Email addresses: jeremy.patin@lsce.ipsl.fr (J. Patin), emmanuel.mouche@lsce.ipsl.fr (E. Mouche), olivier.ribolzi@ird.fr (O. Ribolzi), vincent.chaplot@ird.fr (V. Chaplot), christian.valentin@ird.fr (C. Valentin)