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Soil water erosion studies in the mid-hills in Nepal

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This paper presents an experimental field study on soil water erosion in the Jhikhu Khola Watershed (JKW), which is one of the most intensively monitored watersheds in Nepal. JKW represents a typical mid-hill landscape in the region where human and animal population density is very high and natural resources are under extreme pressure. Even the steep and marginal slopes are under cultivation resulting a series of sloping terraces on fragile terrain that are highly susceptible to both surface erosion and mass wasting. This study was a collaborative undertaking between the People and Resource Dynamics Project and the Nepal Government Department of Soil Conservation and Watershed Management as a part of a regional project coordinated by International Centre for Integrated Mountain Development in five watersheds in four countries (China, India, Nepal and Pakistan) within the Hindu-Kush Himalayan Region.

The observations presented here are based on an analysis of daily runoff and soil erosion data from seven USLE-type experimental plots representing degraded sloping lands (mostly fallow with no or little vegetation, red soil areas highly vulnerable to water prone erosion) and upland cultivated terraces, and daily and two-minute resolution rainfall data for a period of four years (1997 – 2000). The study shows that mean annual runoff (runoff coefficients ranging from <0.03 to >0.30) and soil erosion (soil loss ranging from <1 t/ha to >10 t/ha) vary by order of magnitude in space. There is a strong seasonality in the rainfall, runoff and soil loss at these sites due to significant seasonal changes in vegetation cover and soil moisture. Only a few major events produce most of the annual runoff and soil loss totals, which vary considerably between the years, between the land uses and between the sites within a land use. Land

use and slope aspect have a strong influence on surface runoff generation. Compared with degraded lands (runoff coefficient usually >0.30), cultivated terraces are less responsive to rainfall (runoff coefficient usually <0.04), suggesting a high infiltration capacity and storage on cultivated terraces. It is also observed that rainfall intensities lower than the potential infiltration capacities have generated runoff, suggesting crust formation or saturation excess surface runoff also occurs. For each land use, the runoff coefficient is higher on north- or northeast-facing slopes compared with south- or southwest-facing due to orographic effects. The effect of slope steepness is not very distinct but the general indication is that runoff and erosion increase with slope steepness. Higher sediment concentration is observed on cultivated terraces compared with degraded lands; however degraded lands produce greater total loads than cultivated terraces due to higher runoff generation from degraded lands. At daily scale, rainfall and runoff have a positive linear relation that is strong on sites more responsive to rainfall. Power laws describe the non-linear relation between rainfall and erosion (weaker) and between runoff and erosion (stronger) at daily scale.