Geophysical Research Abstracts
Vol. 17, EGU2015-9383-1, 2015
EGU General Assembly 2015

Extrapolating soil redistribution rates estimated from ^{137}Cs to catchment scale in a complex agroforestry landscape using GIS

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The use of fallout radionuclides, particularly ^{137}Cs, in soil erosion investigations has been successfully used over a range of different landscapes. This technique provides mean annual values of spatially distributed soil erosion and deposition rates for the last 40-50 years. However, upscaling the data provided by fallout radionuclides to catchment level is required to understand soil redistribution processes, to support catchment management strategies, and to assess the main soil erosion factors like vegetation cover or topography. In recent years, extrapolating field scale soil erosion rates estimated from ^{137}Cs data to catchment scale has been addressed using geostatistical interpolation and Geographical Information Systems (GIS).

This study aims to assess soil redistribution in an agroforestry catchment characterized by abrupt topography and an intricate mosaic of land uses using ^{137}Cs data and GIS. A new methodological approach using GIS is presented as an alternative of interpolation tools to extrapolating soil redistribution rates in complex landscapes. This approach divides the catchment into Homogeneous Physiographic Units (HPUs) based on unique land use, hydrological network and slope value. A total of 54 HPUs presenting specific land use, strahler order and slope combinations, were identified within the study area (2.5 km^2) located in the north of Spain. Using 58 soil erosion and deposition rates estimated from ^{137}Cs data, we were able to characterize the predominant redistribution processes in 16 HPUs, which represent the 78% of the study area surface. Erosion processes predominated in 6 HPUs (23%) which correspond with cultivated units in which slope and strahler order is moderate or high, and with scrubland units with high slope. Deposition was predominant in 3 HPUs (6%), mainly in riparian areas, and to a lesser extent in forest and scrubland units with low slope and low and moderate strahler order. Redistribution processes, both erosion and deposition processes, were recorded in 7 HPUs (49%). The units of forest with high slope but low strahler order showed low redistribution rates because the soil surface was well protected by vegetation, while cultivated units with moderate slope and low strahler order showed high erosion and deposition rates due to the tillage practices. This new approach provides the basis for extrapolating field-scale soil redistribution rates at catchment scale in complex landscapes. Additional ^{137}Cs data in strategic locations would improve the results with a better characterization of some of the HPU's.