Geophysical Research Abstracts,
Vol. 11, EGU2009-5091-3, 2009
EGU General Assembly 2009

Assessing soil redistribution on slope transects at different temporal scales by using radiotracers.

L. Gaspar, A. Navas, and J. Machín
Dept. of Soil and Water, Aula Dei Experimental Station – CSIC. Postal Box 13034, 50080 - Zaragoza, Spain. (lgaspar@eead.csic.es)

Soil erosion and sediment deposition represent a serious problem throughout the world, because of their impact on sustainable agricultural production as well as on environmental conservation. The isotopic techniques based on the use of fallout radionuclides ^{137}Cs, ^{210}Pb$_{ex}$and ^{7}Be as tracers allow to obtain estimates of soil redistribution rates within undisturbed and cultivated landscapes over a range of different timescales. Increasing risk of erosion under climate change regimes precise data on soil erosion rates at different temporal scales. The ^{137}Cs technique (T$_{1/2}$=30.17 years), an artificial radionuclide coming from nuclear test, is the most widely used of the fallout radionuclides, and provides results of medium-term average rates of soil redistribution. ^{210}Pb$_{ex}$ (T$_{1/2}$= 22.26 years), a natural geogenic radionuclide, offers estimates to quantify large-term soil erosion rates, and reflect a longer period of time, between 100 and 150 years than the 40 years with ^{137}Cs .

The study area is located in the subhumid mountain in the north of Spain. To document soil redistribution, 24 soil cores spaced 50 m apart were collected along slope transect. The site selected to establish the local reference inventory was situated in the upper part of the transect, on a flat area under natural forest. The reference inventory for ^{137}Cs is 1570 Bq m^{-2} and for ^{210}Pb$_{ex}$ is 1891Bq m^{-2}. Comparison of ^{137}Cs versus ^{210}Pb profiles for the uncultivated soils show that the maximum concentrations of both radionuclides occur at the surface horizon. For the cultivated soils the two radionuclides are relatively uniformly distributed with depth. However ^{210}Pb$_{ex}$ concentrations show some evidence of increasing slightly towards the surface. The areal activity density (inventory) showed large variations, between 489.2 – 6080.1 Bq m^{-2} for ^{137}Cs, and 117.6 – 7788.3 Bq m^{-2} for ^{210}Pb$_{ex}$. The ^{137}Cs and ^{210}Pb$_{ex}$ inventories at the middle of the slope were extremely low in cultivated soils, and the highest inventories were found at the bottom of the slope in flat areas where the sediment is accumulated. The mean ^{137}Cs,^{210}Pb$_{ex}$ inventories measured in cores collected from the upper part of the transect, with an average slope of 24%, were 1699 Bq m^{-2} and 1713Bq m^{-2}, respectively, for the midslope (21% slope) were 1713 Bq m^{-2} and 1720 Bq m^{-2}, and for the lower part of the transect (15% slope) were higher with values from 2296 Bq m^{-2} and 2325 Bq m^{-2}. The estimates of erosion and sedimentation rates based on conversion models by using ^{137}Cs measurements provide a maximum erosion and sedimentation rates of 31.9 Mg ha^{-1} year^{-1} and 24.5 Mg ha^{-1} year^{-1}, respectively. The highest erosion rate occurred in cultivated areas at the midslope, while the highest sedimentation rates are found at the bottom part of the transect. Comparison with previous research along the slope that documented soil redistribution after a 22 mm storm event by using ^{7}Be reflect that erosion dominated at most sampling points along the transect, and estimated soil losses ranged between 5.5 and 40 Mg ha^{-1} year^{-1}.

The pattern of radionuclides redistribution along the transect reflects the effects of water erosion on different types and land uses according to the slope gradient and soil properties. The results obtained confirm the potential for using ^{137}Cs and ^{210}Pb$_{ex}$for assessing soil redistribution on slope transects at different temporal scales in Mediterranean environments.