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Estimation of Medium-Term Soil Redistribution Rates in Ibadan, Nigeria, by using the ^{137}Cs Technique

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Abstract

Soil erosion is one of the most critical environmental problems in sub-Saharan Africa. It causes on-site degradation of the natural resource base, as well as off-site problems. Reduction of soil loss is therefore important to maintain soil productivity and contribute to food security in the region. Quantitative data on the extent and rates of soil redistribution are necessary to guide the development of effective resource management. The use of fallout radionuclides as tracers can provide the required information, since fallout radionuclides are quickly and strongly adsorbed by fine soil particles after deposition and primarily redistributed by physical processes associated with water and wind.

The contribution represents the test of this technique conducted in Ibadan, Nigeria, (7°30'N 3°54'E) in 2007 and 2008. To describe the spatial and vertical distribution of caesium-137 (^{137}Cs) in undisturbed soils, reference sites were sampled at the beginning. Fields characterised by ridges prepared parallel to slope or by flat bed preparation were sampled according to a grid design to determine the spatial ^{137}Cs distribution. Cores for depth-incremental sectioning were also taken on the upper and lower slope to describe the ^{137}Cs depth profiles. All soil samples were analysed by gamma spectrometry using a high-purity Germanium (HPGe) detector. The results obtained from the reference sites show the highest ^{137}Cs concentration in the upper few centimeters of the topsoil and a decrease with depth. The analyses of the samples collected from the field are still in progress. As soil erosion was observable, it is expected that the ^{137}Cs inventories will be reduced in the soil of the upper slope and increased in the deposition zone on the lower slope. Different conversion models, including mass balance models, will be used to estimate the rates of erosion and deposition based on the measurements. The ^{137}Cs inventories will be interpolated to visualise the spatial distribution of soil redistribution within the study area on a map. Hence, the study will provide quantitative data on soil redistribution in the savannah of West Africa and contribute to improved soil conservation in Africa.

Keywords: Caesium-137, Nigeria, radionuclide technique, soil erosion, West Africa

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