



Impact of the soil sample intensity on soil erosion estimation using ^{137}Cs methodology

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The measure of the spatial redistribution of ^{137}Cs is an efficient technique to estimate soil movement budgets at different spatial scales. In the past, most studies involving ^{137}Cs were done on areas not exceeding few tens of ha. Under such conditions, a sampling strategy based on transects or a grid generates accurate and detailed results. However, when the area of interest covers many tens of hectares, or several square kilometres, the cost for soil sampling and isotope analysis rises rapidly and may become prohibitive. A balance must then be found between the precision that should be reached with the soil movement estimates and the costs of the study.

To investigate these aspects, we took advantage of the results of a previous study done on an experimental watershed located in Lennoxville (Québec, Canada), on the Appalachian Piedmont, some 150 km east of Montréal. Most of this 80 ha watershed was sampled on a 25 x 30 m grid basis, for a total of 539 sampling points. Based on this approach, it had been estimated that 77 % of the watershed area had suffered a net loss, with an average rate of $4.1 \text{ t ha}^{-1} \text{ yr}^{-1}$. Net deposition was identified for 5 % of the area, with an average rate of $3.2 \text{ t ha}^{-1} \text{ yr}^{-1}$. No net movement was estimated for 18 % of the area. The net output of sediments was estimated at $2.9 \text{ t ha}^{-1} \text{ yr}^{-1}$, for a sediment delivery ratio of 93 %.

In this study, we recalculated the soil movement budgets, using a 50 x 60 m grid (260 points) and one of 100 x 120 m (133 points). The 50 x 60m grid resulted in similar magnitude and spatial distribution of soil movement rates. However, significant

differences were obtained when using the 100 x 120 m grid. The stable zone increased from 18 to 24 % of the watershed area, the net deposition area doubled and the net loss zone was reduced from 77 % to 66 % of the watershed area. The net output of sediments and the sediment delivery ratio were reduced in a proportion of 40 %.

This study suggests that it is possible to reduce to some extent the sampling density for ^{137}Cs . A balance can be reached between the scientific objectives, the costs of the investigation and the limitations of the human, technical and financial resources without a significant loss of information on the soil redistribution rates and their spatial distribution in the studied area. Although it may be difficult to generalise the results obtained in this study to all watersheds, it is clear that soil sampling efforts can be significantly reduced in areas where the topography is rather uniform, but should be increased in the case of a more rolling area.

Key Words: Cesium-137 (^{137}Cs), soil erosion, sampling grid, sampling density, Canada.