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Determination of the main soil erosion sources in forest catchments using nuclear techniques in Chile

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Soil erosion is one of the largest problems related to agriculture and the environment worldwide. There are several conventional methods to determine soil erosion rates and sources. However, nuclear techniques have become increasingly important due to its simplicity and effectiveness. The Compound-Specific Stable Isotope technique (CSSI) has become an effective tool to determine soil erosion sources on a watershed. This method employs biomarkers such as fatty acids, which are naturally produced by plants, to match soil sources with land uses within a catchment. To identify sources and measure sediment contribution rates this method match δ13C of fatty acids with bulk δ13C data using a mixing model called CSSIAR V1.
The study site were located in central Chile. Los Ulmos catchment (Valdivia) and Quivolgo (Constitución), which have several potential soil erosion sources such as slopes (with pinus, native forest and eucalyptus plantations), roads, buffer zone (mainly comprised by native forest) and stream banks. Sediment traps were placed in V notched weirs at the output of watercourse and by CSSI technique were determined which of the land uses were the main contributors of sediments.
The results indicated that in both catchments (with no harvest) the average contributions of fine sediments to the weir were: For Los Ulmos (roads: 8.9%, buffer zone: 25.2%, stream banks: 59.5%, eucalyptus: 2.4% and pines: 4.0%) and Quivolgo: (roads: 41.6%, buffer zone: 4.8%, stream banks: 39.4%, native forest: 6.3% and pines: 5.6%). Roads, roads were the main sediment contributor to both catchments due to results indicated that stream banks were comprised by more than 70% by sediments from roads.
Finally, it is possible to conclude that the technique is capable to discriminate between different land uses and estimate sediment contribution in percentage according to total sediment load within the catchments.

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