

Novel MixSIAR fingerprint model implementation in a Mediterranean mountain catchment

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Increased sediment erosion levels can lead to degraded water and food quality, reduced aquatic biodiversity, decrease reservoir capacity and restrict recreational usage but determining soil redistribution and sediment budgets in watersheds is often challenging. One of the methods for making such determinations applies sediment fingerprinting methods by using sediment properties. The fingerprinting procedure tests a range of source material tracer properties to select a subset that can discriminate between the different potential sediment sources.

The present study aims to test the feasibility of geochemical and radioisotopic fingerprint properties to apportion sediment sources within the Barués catchment. For this purpose, the new MixSIAR unmixing model was implemented as statistical tool. A total of 98 soil samples from different land cover sources (Mediterranean forest, pine forest scrubland, agricultural and subsoil) were collected in the Barués catchment (23 km²). This new approach divides the catchment into six different sub-catchments to evaluate how the sediment provenance varies along the river and the percentage of its sources and not only the contribution at the end. For this purpose, target sediments were collected at the end of each sub-catchment to introduce the variation along the entire catchment. Geochemistry and radioisotopic activity were analyzed for each sample and introduced as input parameters in the model. Percentage values from the five sources were different along the different subcatchments and the variations of all of them are summarized at the final target sample located at the end of the catchment.

This work represents a good approximation to the fine sediment provenance in Mediterranean agricultural catchments and has the potential to be used for water resource control and future soil management. Identifying sediment contribution from different land uses offers considerable potential to prevent environmental degradation and the decrease in food production and quality.