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Guiding soil conservation strategy in headwater mediterranean catchments

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Reservoir siltation due to water erosion is an important environmental issue in Mediterranean countries where storage of clear surface water is crucial for their economic and agricultural development. In order to reduce water erosion, this study aimed to design a methodology for guiding the implementation of efficient conservation strategies by identifying the dominant sediment sources in Mediterranean context. To this end, a fingerprinting method was combined with long-term field monitoring of catchment sediment yield in five headwater catchments (0.1-10 km²) equipped with a small reservoir between 1990 and 1995. The five catchments were chosen to cover the large diversity of environmental conditions found along the Tunisian Ridge and in the Cape Bon region. The fingerprinting techniques based on measurements of cesium-137 and Total Organic Carbon within the catchments and in reservoir sediment deposits successfully identified the contribution of rill/interrill and gully/channel erosion to sediment yield at the outlet of five small headwater catchments during the last 15-20 years. Results showed the very large variability of erosion processes among the selected catchments, with rill/interrill erosion contributions to sediment accumulated in outlet reservoirs ranging from 20 to 80%. Overall, rill/interrill erosion was the dominant process controlling reservoir siltation in three catchments whereas gully/channel erosion dominated in the other two catchments. This demonstrates that the dominant erosion process in the Mediterranean regions highly depends on the local environmental context. The lowest rill/interrill erosion contribution (2.2 Mg ha⁻¹ yr⁻¹) in the five catchments remained significantly higher than the tolerable soil loss indicating the severe levels reached by soil erosion along the Tunisian Ridge and in the Cape Bon region. This study also showed that although the implementation of improved topsoil management measures greatly reduced rill/interrill erosion within parcels, they amplified gully/channel erosion at downstream locations. Erosion control measures should therefore be applied to both cultivated fields and gullies/channels. These results underlined the importance of considering the combination and feedbacks between both hillslope and channel erosion processes for the design of soil management strategies at the catchment scale in Mediterranean environments.