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Investigating Sediment-Bound Chemical Transport in an Eastern Mediterranean Perennial Stream to Identify Priority Pollution Sources on a Catchment Scale

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Abstract : Soil erosion has become a priority global concern, impairing water quality and degrading ecosystem services. In Mediterranean climates, following a long dry period, the onset of rain occurs when agricultural soils are often bare and most vulnerable to erosion. Early storms transport sediments and sediment-bound pollutants into streams, along with dissolved chemicals. This results in loss of valuable topsoil, water quality degradation, and potentially expensive dredged-material disposal costs. Information on the provenance of fine sediment and priority sources of adsorbed pollutants represents a critical need for developing effective control strategies aimed at source reduction. Modifying sediment traps designed for marine systems, this study tested a cost-effective method to collect suspended sediments on a catchment scale to characterize stream water quality during first-flush storm events in a flashy Eastern Mediterranean coastal perennial stream. This study investigated the Kishon Basin, deploying sediment traps in 23 locations, including 4 in the mainstream and one downstream in each of 19 tributaries, enabling the characterization of sediment as a vehicle for transporting chemicals. Further, it enabled direct comparison of sediment-bound pollutants transported during the first-flush winter storms of 2020 from each of 19 tributaries, allowing subsequent ecotoxicity ranking. Sediment samples were successfully captured in 22 locations. Pesticides, pharmaceuticals, nutrients, and metal concentrations were quantified, identifying a total of 50 pesticides, 15 pharmaceuticals, and 22 metals, with 16 pesticides and 3 pharmaceuticals found in all 23 locations, demonstrating the importance of this transport pathway. Heavy metals were detected in only one tributary, identifying an important watershed pollution source with immediate potential influence on long-term dredging costs. Simultaneous sediment sampling at first flush storms enabled clear identification of priority tributaries and their chemical contributions, advancing a new national watershed monitoring approach, facilitating strategic plan development based on source reduction, and advancing the goal of improving the farm-stream interface, conserving soil resources, and protecting water quality.

Keywords : adsorbed pollution, dredged material, heavy metals, suspended sediment, water quality monitoring
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