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The relevance of environmental DNA as a targeted sediment fingerprinting method sensitive to vegetation

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Environmental DNA (eDNA) has recently been considered as a marker that could be used for fingerprinting sediments. Identify sediment sources originating from zones covered with specific plant communities would enhance the sediment fingerprinting method significantly and enable the detailed identification of soil erosion hotspots relative to land use and cover. Here, we explore the relevance of environmental DNA (eDNA) that originates from plant litter and fixes onto fine soil particles as a targeted sediment fingerprinting method. Although research on plant eDNA signatures in soils and sediments is limited, initial results are promising and indicate that eDNA could yield more accurate results than other sediment fingerprints that are sensitive to vegetation. Plant eDNA signatures tend to produce a highly localized signal of sediment sources, mainly reflecting the current vegetation cover of soils. As eDNA is rapidly adsorbed onto fine mineral soil particles such as clay, it is protected against rapid degradation in fluvial environments. Supported by the increasing availability and quality of vegetation maps and eDNA reference libraries, we argue that sediment source fingerprinting using eDNA from plant litter will evolve into a valuable method to identify hotspots of soil erosion and allow stakeholders to prioritize areas where ecological restoration is necessary. We tested our assumptions from a case study in a high mountain environment (catchment of approximately 600 km² in the Central Pyrenees, France) which was recently affected by a severe hydro-climatic event and for which ecological restoration is pertinent.

Keywords:

Pyrenees, river catchments, sedDNA, sediment source fingerprinting, vegetation