

### **Plain language summary**

In Northern France, land use is dominated by agriculture. One important threat of agricultural land is the loss (erosion) of its fertile surface soil when heavy rain falls strip the soils carrying it afar in run-off waters. Understanding where fertile soils are eroded preferentially and where the eroded material is transported to is needed in order to diminish the adverse environmental and societal consequences, such as degradation in water quality or occurrence of muddy floods damaging infrastructures and habitats. The case study of the Canche River watershed, herein, demonstrates that magnetic properties, a cost-effective and non-destructive tool, can adequately trace eroded fertile soil material within the particle load that is suspended in the waters of the Canche River. When run-off waters are important, such as during heavy rainfalls and flooding events, the mineral composition of suspended particulate matter in the rivers changes to mineral compositions that characterize the higher input of agricultural soil. The so-called “magnetic fingerprinting” thus traces the fertile soils in the Canche River catchment and serves validating the approach, which can now more confidently be applied elsewhere.