**RRES PRESS RELEASE 15/01/24 New Biotracer Sheds Light on Land-use Response to Extreme Wet Weather**

*Forensic science approach reveals lack of resistance to soil erosion during periods of heavy rain*

Scientists using a new tracer have shown that cereals dominated arable land contributed over half of all sediments and associated organic matter dislodged by heavy winter rains in a watercourse in Southwest England. The result confirms fears that, as the severity of wet periods increases under climate change, some current farm practices are accelerating soil erosion.

The study team used Carbon-13 isotopes of dicarboxylic fatty acids (diFAs) as tracers to identify which land uses were contributing to in-stream sediments at test sites along an 8km stretch of a catchment in Devon. These molecules are particularly useful as tracers because they are mostly produced by roots and their isotopic signature differs with vegetation. This means that the type of land use (grassland, arable land, woodland or stream banks) that sediment has been eroded from can be relatively easily identified using n-stream sediment and source area samples.

Taken over the record-breaking wet winter of 2019/20, the results showed that stream banks contributed most of the sampled sediment in the early winter (October-December) period. In contrast, the dominant sediment source shifted after a period of prolonged consecutive rainfall days in the late winter (January-March) to winter cereals-dominated arable land.

“There is a high likelihood that winter rainfall in South-West England will be more prolonged and intense under climate change,” said Rothamsted’s Dr Hari Ram Upadhayay. “So we need to better understand the differing levels of resistance different catchment sediment sources have to erosion driven by extreme wet weather. This new technique enables us to do that with more confidence.”

Sediment fingerprinting using root specific biomarkers is a relatively new approach. The diFAs are a  structural component of suberin which is one of the important biopolymers in roots. This acts as a protective layer between root tissues and their environment and contains a high proportion of diFAs which are very stable in soils.

Samples were taken of potential sources in the catchment and compared with sediment samples to build up a landscape scale picture of elevated erosion and sediment transfer over the record-breaking wet winter period.

“There appears to be a high degree of correlation between land use and diFA distribution in soils,” said Upadhayay. “This linkage suggests that this technique could become an invaluable tool in accurately identifying what proportions of sediment and associated organic matter come from certain land types. In turn, this could help inform land management decisions to build more resistant landscapes to help reduce erosion under current and future climate scenarios.”

Professor Adie Collins, co-author on the paper and leader of a new UKRI-BBSRC funded strategic programme at Rothamsted Research, Resilient Farming Futures, said, “The new research programme will further explore landscape resilience to weather extremes using a range of tracers deployed in the institute’s forensic science toolkit. This will include co-working with the Catchment Sensitive Farming initiative in priority landscapes.”

PUBLICATION

Upadhayay, H.R., Joynes, A. & Collins, A.L. 13C dicarboxylic acid signatures indicate temporal shifts in catchment sediment sources in response to extreme winter rainfall. *Environ Chem Lett* (2024). <https://doi.org/10.1007/s10311-023-01684-1>