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Can soils act as environmental sponges to help reduce flooding?

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Flooding presents a serious socioeconomic challenge to riverine communities across the world, impacting >300 million people each year and causing loss of life, damage to infrastructure, long-term mental and physical health problems, and threatening food security. Across many parts of the globe, including north-west Europe, climate change is projected to increase the magnitude, frequency, and intensity of rainfall events, thus exacerbating future flood risk and increasing the demand for flood alleviation schemes. Historically, flood prevention strategies have focused on constructing hard defences that restrict the overbank flows and aim to convey them downstream. However, as floods become larger and more difficult to predict, the construction of ever-higher defences becomes unfeasible. As such, natural-based solutions are being adopted as a more cost-effective and sustainable approach to managing flood waters through upland attenuation in leaky dams and offline storage in reservoirs in the lowlands. Here we demonstrate the feasibility and efficacy of using agricultural soils as “environmental sponges” to retain moisture and reduce downstream flood peaks in a heavily-managed lowland catchment. We use combined field, laboratory, and modelling approach to quantify how increases in soil organic matter – introduced through cover crops – can increase soil moisture retention at the field scale and perform groundwater and catchment modelling scenarios to assess how these changes can be extrapolated up to the catchment scale and used to forecast changes in downstream flood risk across a suite of future hydro-climatic and soil management scenarios.