Hold it there – Utilising soil hydrology and temporary storage areas to attenuate surface runoff

Martyn T. Roberts[1, 2], Josie Geris[2], Paul D. Hallett[3], Mark E. Wilkinson[1]

[1] James Hutton Institute, Aberdeen, United Kingdom

[2] School of Geosciences, University of Aberdeen, Aberdeen, United Kingdom

[3] School of Biological Sciences, University of Aberdeen, Aberdeen, United Kingdom

Temporary storage areas (TSAs) mitigate flood risk and harvest rainwater by attenuating surface runoff and providing additional storage during large rainfall events, that then drain shortly after. They vary from the micro-scale (~0.05m^3) to large retention ponds (~10,000m^3), but all utilise soil water storage and infiltration to mitigate flood and drought risk. Soil hydrology and therefore TSA functioning depends on soil structure, which changes over time periods as short as major weather events or tillage activities, and over multiple years through agricultural and biological activity. Here we explore how spatial and temporal changes in soil hydraulic properties within the wetted footprint and contributing area affect TSA functioning. We used field observations from TSA sites in Scotland with different land uses (winter wheat and spring barley) but similar soil types (Brown soils). Soil properties were collected for 3 zones: (1) *TSA active zone (~10% full)* – inundated for the longest time; (2) *TSA full zone (~50-100% full)* – active during large storms; and (3) *Field zone* – field control points outside the wetted footprint. Preliminary results found that saturated hydraulic conductivity, bulk density, and porosity did not vary spatially between zones. For the structurally stable soils explored, this suggests that soils within the footprint did not degrade since TSA installation, maintaining effectiveness for infiltration and holding water. Understanding the spatial patterns and temporal variations of soil hydrological properties and associated TSA functioning, will help to design effective TSAs for flood risk reduction under a range of (changing) climate conditions.

Keywords:

Temporary storage areas; Soil hydrology; Soil structure; Flooding; Temporal variability