Land4Flood Conference 2023
27-29th September 2023
Session 1.1

Understanding time-variable drainage rates to improve local temporary storage area flood mitigation effectiveness

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Temporary storage areas (TSAs) are a type of small scale soft engineered nature-based solution that can provide new additional catchment-based storage to mitigate flooding and erosion (Roberts et al., 2023). TSAs attenuate runoff by disconnecting quick flow pathways (e.g., using barriers such as soil bunds) in the landscape or drainage network. The need for such additional catchment storage will become more urgent as the frequency and magnitude of extreme hydrological events increases due to climate change. However, there is a need to understand how such measures perform during flood events and at different scales. Currently, there is a lack of empirical evidence for how TSAs work at the local scale and their flood mitigation effectiveness. Therefore, understanding differences in TSA drainage rates and the impact on the TSA's available storage will help improve knowledge on TSA functioning. Here we explore time-variable drainage rates across a range of small-scale headwater (hinterland) TSAs (<10,000 m^3) that have been integrated within multifunctional landscapes (e.g., arable and livestock farming, moorland) in the UK. We use the master recession curve method to determine a consistent description for TSA drainage rates, before exploring time-variable differences at each TSA case study site. Preliminary findings suggest that water lost via subsurface flow is time-variable, and that soils within the TSA wetted footprint can recover following prolonged flooding. Future work will model the impact of time-variable drainage rates on TSA available storage for a given rainfall event. Understanding time-variable drainage rates will help design effective TSAs, which are empty enough to attenuate runoff, mitigate flooding and have minimal impact on farming, providing a viable flood mitigation option for landowners.

Roberts, M. T., Geris, J., Hallett, P. D., & Wilkinson, M. E. (2023). Mitigating floods and attenuating surface runoff with temporary storage areas in headwaters. *WIREs Water*, e1634. https://doi.org/10.1002/wat2.1634

Keywords:

temporary storage areas, nature-based solutions, flooding, runoff, catchment management