# Project Title: Assessing the efficacy of nature-based solutions to mitigate flash flooding and sediment mobilisation using high resolution monitoring

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## Summary

This project focuses on the Ken stream catchment, an area of high fluvial flooding risk and particularly significant problems with sediment mobilization during high flow events. The Ken stream is a tributary of the River Culm, which is a 40 km river within the River Exe catchment, draining predominantly agricultural land. The most recent Water Framework Directive assessment designated the Ken as poor ecological quality, with chemical status declining between 2016 and 2019. The area is the focus of the Devon Resilience Innovation Project (DRIP) and 'Connecting the Culm', aiming to make the River Culm and its tributaries more resilient to hydrological extremes. A high-resolution sensor network was installed along the Ken stream (by project partners from the Devon County Council). The data are telemetered (supported by project partners Westcountry Rivers Trust), providing an unprecedented opportunity to understand how small agricultural catchments respond to environmental triggers at the local scale. Following large scale surface flooding and significant sediment deposition throughout Kentisbeare in September 2023, a number of nature-based solutions have been implemented throughout the catchment, including leaky dams. This project will use the high resolution monitoring network to determine the efficacy of these nature-based solutions in mitigating flash flooding.

## Methods

The high resolution network of seven water level and electrical conductivity sensors installed in 2021 will be supplemented by three additional sensors for turbidity (already funded by DRIP) and a downstream chemical sonde in the Culm (already funded by WRT). The student will collect sediment samples for quantification within the laboratories at the University of Bristol to understand particle size distribution patterns and how in situ measurements can be used to quantify sediment transport. The project will also trial low cost water quality sensors and determine their efficacy against commercially available alternatives as part of the development and evaluation of an open source protocol for assessing nature based solutions. Data from the sensors will be used to understand the effect of cascading dams on streamflow and sediment mobilization across the catchment before and after the installation of the first nature-based solutions (including leaky dams). Sensor data, manual samples and high resolution mapping will be used to validate a model that simulates the effects of land management practices on catchments (e.g. LIS-FLOOD and SWAT+) to determine where in the catchment additional interventions should be targeted, and how these can be optimized to both improve catchment water quality and reduce flood risk.

**Background reading and references**

Nóbrega, R. L. B., Guzha, A. C., Torres, G. N., Kovacs, K., Lamparter, G., Amorim, R. S. S., et al. (2017). Effects of conversion of native cerrado vegetation to pasture on soil hydro-physical properties, evapotranspiration and streamflow on the Amazonian agricultural frontier. PloS One, 12(6), e0179414. https://doi.org/10.1371/journal.pone.0179414

Lamparter, G., Nobrega, R.L.B., Kovacs, K. et al. Modelling hydrological impacts of agricultural expansion in two macro-catchments in Southern Amazonia, Brazil. Reg Environ Change 18, 91–103 (2018). https://doi.org/10.1007/s10113-016-1015-2

Ward, S. 2021 Connecting the Culm Environmental Evidence Review, Interreg 2 Seas, Available at: https://connectingtheculm.com/wp-content/uploads/2021/02/CtC-Evidence-Review-1stEdition-Feb2021_logos.pdf

**How to Apply:** The deadline for this position is 8th April 2024. The studentship will begin in September 2024. Please apply to the "PhD in Geographical Sciences (Physical Geography)" at https://www.bristol.ac.uk/study/postgraduate/apply/