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Can we make tufa grow? Understanding the hydraulic conditions affecting tufa growth.

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Anthropogenic and climatic events continue to affect river systems despite restoration action. Flooding events are increasing across the UK and placing additional pressure on Local Authorities to mitigate flood risks River restoration remains a key focus of conservation by the UK government, particularly as anthropogenic activities and the changing climate continue to degrade river systems at all scales. The increasing risk of flooding events across the country puts pressure on Local Authorities to mitigate flood. Flooding causes high degrees of sediment transport along the entire fluvial system and has negative ecological and chemical consequences. Under further threat are chalk streams, where the calcium concentration allows for tufa to deposit under varying hydraulic conditions. Chalk streams are heavily degraded by anthropogenic and human activities; however, their consistent flow from grounder aquifers provide ecological opportunities. Tufa naturally occurs within chalk stream environments and creates step barrages within the UK, providing hydraulic conditions such as degassed oxygen which provide ecological benefits and microhabitats. These barrages have been removed in some chalk streams such as the Upper Witham in Lincolnshire and encouraging their restoration may have hydraulic and ecological benefits.

There remains limited understanding of the physical factors controlling tufa deposition and no local understanding of the deposition rate within Lincolnshire. Consequently, the focus of this work is to explore the physical and chemical factors influencing tufa deposition and monitor its growth. The aim is to quantify the tufa deposition rate at Dunston Beck, Lincolnshire, and the role of flow velocity, flow depth and substrate on deposition rates. These aims will be met by measuring the tufa growth on the 14 sandstone and wooden plates that have been placed along a small reach of Dunston Beck that emulate different hydraulic conditions. The tufa growth will be measured using a handheld 3D scanning device monthly and samples of tufa grown on these plates will be taken and scanned using a Scanning Electron Microscope to categorise morphology and substrate. This is extremely important for classification of tufa as its categories can be caused by varying physical factors including flow rate. The results can be used to inform restoration practices as flow rates and microbial activity have a known relationship with tufa deposition. This work will inform the second phase of the Dunston Beck restoration and inform the Environment Agency with further information for restoring and classifying these sites.