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The use of novel wooden structures to manage flooding and coarse sediment problems in responsive upland headwater catchments

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Over the past decade economic losses from floods have greatly increased, with sediment related impacts as a key feature of such events. Impacts include changes in river channel course, scour of river banks, sedimentation of infrastructure (e.g. bridges), and deposition of sand and gravel on farmland. Sediment deposition can in turn reduce conveyance capacity and lead to further increased flood risk. The EU Water Framework Directive and Floods Directive highlights that sustainable approaches to flood risk reduction should be used alongside and, where possible, replace traditional structural flood defences and activities that address sediment problems. Natural Flood Management(NFM) is promoted as a method that can reduce flood risk and manage sediment by incorporating natural hydrological and morphological processes. As such, NFM measures are designed to use these fluvial processes to manage the sources and pathways of flood waters and sediments. Techniques include the restoration, enhancement and alteration of natural features and characteristics, but exclude traditional flood defence engineering that works against or disrupts these natural processes.

Here we aim to assess the effectiveness of novel flood mitigation measures for reducing flood risk and capturing coarse sediment in rapidly responding headwater catchments. We present preliminary research findings from a densely instrumented research site (Bowmont catchment, Scotland (85km2)) which regularly experiences flood events with associated coarse sediment problems. NFM measures have been installed to capture course sediment and to store water more effectively on the flood plains during these flood events. For example, novel engineered wooden structures (‘bar apex log jams’) constructed in the river corridor are designed to trap sediment and log bank protection structures have been installed to stop bank erosion. Within a tributary catchment of the Bowmont (0.7km2), new flow restrictors have been installed on a headwater stream to slow the flow whilst collecting coarse sediment. These were designed to have a minimal impact on upland farming practices. In addition, tree planting is also occurring in the catchment for example, within gulley, on the riparian zone and hedgerow belts perpendicular to slopes. During a recent large event, the majority of 40 bar apex structures collected coarse sediment. However, only five were associated with high deposition and modification of the spatial pattern of deposition, which highlighted the importance both of structure design and location of these features to maximise their sediment trapping effectiveness and longevity.