EGU22-10365
https://doi.org/10.5194/egusphere-egu22-10365
EGU General Assembly 2022
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The evolution of stone and timber dams, as part of peatland restoration, in eroded gully systems

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Many degraded UK blanket peatland sites have been subjected to restoration using dams in eroded gully systems to trap sediment, slow the flow of water and promote revegetation of bare peat surfaces. There are few studies on how gully blocks evolve with time, what this means for changing ecosystem functions, and the natural flood management benefits of restoration. This study focuses on gully block evolution on the Kinder Scout Plateau, where the blanket peatland was restored in 2011/12 and >2500 gully blocks installed.

We took a random sample of 500 small stone and timber dams 8-9 years following restoration, representing c.20% of the total number of blocks. We measured sediment accumulation behind the dams, vegetation cover and abundance and their propensity to continue to store water with respect to gully morphology. Principal component analysis suggested dam dimensions, channel, and wall slope are associated with sedimentation and change in water storage behind the dams, while other gully attributes were more associated with the change in vegetation cover. Dams installed in gullies with steeper walls and channel slopes typically accumulated more sediment. There was more variability in the evolution of stone dams, typically installed in wider, deeper gullies with shallower peat substrates and larger contributing areas than timber dams. 72% of surveyed dams were actively pooling water, and only two had visibly collapsed. On average, gully floors had 93% vegetation cover, whereas gully walls and dam tops had 90% and 45% vegetation cover, respectively. Sediment accumulation was not significantly different between the stone and timber dams at the 95% confidence interval. A random sub-sample of 26 gullies found no significant difference in sediment depths between subsequent dams in the same gullies (p = 0.255). Comparisons with an earlier survey suggest most sediment accumulation happens in the first year, rapidly reaching an equilibrium. As such, dams may exhibit similar properties regardless of the materials used and gully attributes. Dam top vegetation cover was positively correlated with gully dimensions, and 21% of dams were completely covered by vegetation. However, on average,

58% of the storage available after installation remained behind dams. Therefore, remaining storage combined with additional channel surface roughness may provide more favourable conditions for attenuating runoff 8-9 years after installation than the first year after restoration. We conclude that despite the differences between stone and timber dams, the gully blocking outcomes are very similar 8-9 years after restoration. Perhaps the most striking outcome was the high vegetation cover in channel floors and gully walls which will likely benefit peatland ecosystem functioning and natural flood management.