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The impacts of peatland restoration on runoff generation and downstream flood risk in the UK uplands: a comparative study of headwater catchments in the Peak District National Park

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Blanket peats represent the dominant land cover in the UK uplands and the headwater catchments of many UK rivers are characterised by peat soils. However, these peatlands have been significantly degraded by erosion and drainage. Peatland restoration with the aim of restoring ecosystem function is now a major focus of activity in upland land management and major investment is taking place in catchment-scale restoration, in particular through techniques such as ditch and gully blocking and the reseeding of bare peat. Flood mitigation is increasingly cited as a benefit of this restoration, but we have very limited data on the impacts of restoration on both processes of runoff generation and the resulting characteristics of storm hydrographs (e.g. lag times, peak flow). This paper describes ongoing (2010-2012) research at the experimental DEFRA 'Making Space for Water' catchments in the Peak District, UK (53.27.58N, 1.51.09W). The research aims to quantify the impacts of restoration on storm-flow discharge and includes (i) comparisons between the runoff characteristics of eroded/bare peat and restored sites, (ii) monitoring of storm flow responses before and after catchment restoration (gully blocking and re-vegetation).

Five small headwater catchments (c.7000 m2) have been instrumented for continuous rainfall/meteorology and stream discharge monitoring. These represent: (1) intact reference catchment; (2) bare peat control catchment; (3) eroded/bare peat catchment to be restored in early 2011 (re-vegetation and gully blocking); (4) eroded/bare peat catchment to be restored in early 2011 (re-vegetation only); (5) eroded/bare peat catchment restored in 2003 (re-vegetation only). Overland flow generation is monitored using runoff plots (continuous monitoring) and crest stage tubes. Peat water tables are monitored using logging dipwells.

Preliminary results indicate significant differences between the hydrological and storm-flow characteristics of the eroded, restored and intact catchments. Water tables are significantly depressed in the eroded catchments, but respond very rapidly to rainfall suggesting a low specific capacity and limited storage potential. Overland flow generation is observed at all sites, but the eroded/bare peat catchments have significantly shorter hydrograph lag times than the restored and intact catchments. Initial data also indicate lower relative peak flows at the intact and restored sites in comparison with the eroded/bare peat catchments. Although preliminary, these observations suggest more rapid storm-flow generation at the eroded/bare peat catchments, and by inference that restoration will attenuate storm flows and potentially reduce downstream flood risk. However, analyses of the complete dataset will be required to confirm the processes associated with the between-site differences (e.g. storage effects vs surface flow attenuation by vegetation). The remainder of the study will also focus on evaluating the changing hydrology of the catchments restored in 2011.