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Impacts of land management on flood risk: plot scale experimental and modelling investigation in an upland welsh catchment

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Recent floods in the UK have focused attention on the effects of rural land use and land management change on flood risk. Attempts to quantify these effects by examining catchment scale responses have so far been unable to identify the effects of particular land use changes. This is due to reasons such as climate variability, spatial distribution of land management types and poor historical records of land use and land management change. To improve our understanding of the effects on flood risk, a multiscale experimental and modelling programme has been implemented in the Pontbren (18km2) and Rhos Aflo (4km2) catchments in mid-Wales.

As part of this programme, four sets of three manipulation plots have been monitored both before and after land use changes. In each set of plots, the existing land use (grazed grassland) has been changed to ungrazed grassland (by excluding sheep) and to young woodland (by excluding sheep and planting trees). Data collected include soil hydraulic properties, soil moisture and continuous overland flow, soil water pressure and rainfall. The observations from this investigation have been analysed using a detailed physics- based Soil-Plant-Water Model (SPW Model), which simulates saturated and unsaturated subsurface flow and overland flow. Inverse modelling was used to determine the changes in the soil hydrological properties post-manipulation, the results of which were compared with field and laboratory measurements. Significant changes are observed post-manipulation, but heterogeneity between the sites and plots is important.

The results of the investigation provide important insights into the alterations occurring in soil hydraulic properties resulting from land use and land management changes. These results will be used to inform conceptual models which in turn are used to upscale the observed plot scale changes to examine catchment scale effects. The catchment scale models will be used to investigate the potential of local land use changes to reduce downstream flood risk.