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Impact of prescribed and repeated vegetation burning on blanket peat hydrology

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In some peatlands there has been a tradition over the past century of burning vegetation to manage the landscape for a range of purposes. These include producing an environment suitable for game birds used in the gun sports industry and reducing the biomass fuel load to reduce possible wildfire damage to the peat. However, there have been few studies that have interrogated the impacts of this activity on peatland hydrological processes both at the plot scale and at the catchment scale. The EMBER project measured water tables, overland flow, hydraulic conductivity, stream discharge, and a myriad of aquatic invertebrate and peat physical and water chemistry indicators (at plot and stream scale) in ten upland blanket peat catchments in the UK. Five catchments were subject to a history of prescribed rotational patch burning with burning taking place each year over a proportion of the catchment (typically 5-10 %) but where for an individual patch the interval was typically 10-20 years. The other five catchments acted as controls which were not subject to burning, nor confounded by other detrimental activities such as drainage or forestry. Stream flows were flashier in response to rainfall in the catchments with prescribed burning patches and had greater rainfall to runoff efficiencies. Water tables were found to be significantly shallower with a smaller interquartile range for unburnt catchments. In the burnt catchments, more recently burnt plots had significantly greater mean water table depths and water table residence times were much less frequent within the upper 10 cm of the peat profile compared to plots that been burned more than a decade before. The water table residence curves will be explored in the presentation. The occurrence of overland flow was significantly impacted by both burning and time since burn with significantly less overland flow recorded for more recently burnt sites. This ties in well with our water table data since blanket peat systems are dominated by saturation processes rather than infiltration-excess overland flow. In this presentation we focus on the hydrological findings from the EMBER project but where relevant we relate these to other supporting environmental data we collected in order to interrogate process explanations for the differences we observed. For example, surface and near-surface peat temperatures were significantly more variable (both warmer and cooler depending on season and time of day) for burnt sites (and for patches burnt < 5 yrs prior to monitoring within burnt sites) but with warmer peat associated with burning overall. The results provide clear evidence that prescribed vegetation burning on blanket peat significantly impacts peatland hydrology at both the plot and stream scale and therefore raises issues for government bodies who have legal responsibility to protect many peatland landscapes, their integrity, their biogeochemical functions and the ecosystem services that peatlands provide.