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Characteristics of vegetation-derived charcoal in UK peatland fires

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UK peatlands, areas of great scientific interest owing to their major carbon storing capacity, are periodically subjected to prescribed burns as well as experiencing episodic wildfires. Wildfires and prescribed burning exhibit a range of burn characteristics, as well as interacting with multiple different biomass types. The variance within fire characteristics and affected feedstock results in the production of a continuum of charred materials, often referred to as pyrogenic carbon or black carbon (BC). BC constitutes a potentially high density store of carbon, with various studies asserting its resilience to degradation in the wider environment. The resultant BC also has the potential to interaction with wider environmental factors, such as the hydrological cycle and pollutants such as heavy metals, meaning that there is a strong interest in improving the understanding of the kinds of materials that are produced in peatland vegetation fires.

To more fully understand the range of materials that are produced in a typical peatland fire regime, BC was produced in muffle furnaces using various dominant UK peatland vegetation types (e.g. *Calluna vulgaris*, *Polytrichum juniperinum* and *Eriophorum vaginatum*), with the experimental burn conditions within typical ranges of observed characteristics from UK peatland vegetation fires (e.g. 250 – 800°C and 2 – 10 minutes burn duration). Broad severity groupings were established (low – very high) based on mass loss percentage (MLP). The MLP groupings allowed for comparison of BC produced under different combinations of burn characteristics; four groups were established - 60, 70, 80 and 90 MLP. The BC samples were then analysed using Fourier-transform infrared spectroscopy (FTIR), Brunauer-Emmett-Teller (BET) surface area analysis and CHNS elemental analysis.

From these analyses it was possible to demonstrate a good degree of similarity between the different MLP groups. For elemental composition and FTIR spectra, MLP proved to be a good means by which to group samples, for example C:H ratios for the *Polytrichum juniperinum* 60 and 90 MLP groups were 0.217 ± 0.001 and 0.082 ± 0.002 respectively. The highest MLP samples exhibited a high degree of variability for BET results; this may be due to varying ash content between the different burn durations. A generally good degree of similarity was observed for surface area values outside of the 90 MLP groups.

The findings of this study suggest that the degree of charring, as observed from MLP and visual charring characteristics, could be a good predictor of BC physiology. It may, therefore, be possible to estimate BC properties from simple biomass loss estimates in post-burn severity assessments. Future work will look at the longer-term degradation of these BC products in the field and assess its potential to enter the fluvial system.