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Impact of land management on fire resilience and carbon fate in blanket bogs: The FireBlanket project

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Maintenance and enhancement of peatland carbon storage is a major policy objective towards meeting greenhouse gas (GHG) targets. Management interventions can influence both the storage capacity and the vulnerability of the stock to climate-change induced increases in drought frequency and severity, and incidence of wildfires. Quantification of these interactions is vital in informing best management practice, but is also challenging, given the ephemeral nature of climatic extremes and the usual paucity of high-quality ground-based observations within an area of interest capable of providing the necessary pre-impact and control data.

Following a dry and warm spell in spring 2019, a large wildfire burnt approximately >60 km^2 of blanket bog and wet heath within the Flow Country peatlands of Caithness and Sutherland, North Scotland. While the Flow Country is a site of global significance currently under consideration for UNESCO World Heritage Site Status, it has also been substantially modified in places by drainage and notably forestry (670 km^2) and is now undergoing rapid and large-scale restoration. Serendipitously, the fire scar impacted the whole range of land-uses and occurred in an area actively used for research, and therefore where some baseline datasets were available.

The NERC funded FireBlanket project used this opportunity to investigate how land-uses interacted with wildfire in terms of 1) InSAR-derived “bog breathing” patterns exhibited during the 2018 drought 2) immediate and longer-term effects on vegetation communities 3) export and fate of organic carbon from land to ocean. By understanding how different management strategies of forestry and forest-to-bog restoration influence fire risk and damage, we hope to inform decision-making in the future.

Our preliminary results show that in near-natural and restored (drain-blocked) blanket bogs, the drought of 2018 led to a rapid surface compression that maintained near-surface moisture until 2019, in turn reducing the severity of the wildfire. In drained and degraded blanket bogs, this mechanical feedback is absent, due to higher bulk density and differences in vegetation assemblages, notably reduced cover of Sphagnum mosses. In those areas, the 2018 drought led to a rapid and sustained loss of moisture in the upper peat layers, associated with higher burn severity and more pronounced fire damage on vegetation. Furthermore, while DOM concentrations increased post-fire in streams receiving water from all burnt areas compared to unburnt ones, the changes were more pronounced in catchments with man-made drains.

Whilst further data processing and analysis is still underway, our study currently suggests that restoration is likely to increase wildfire resilience and reduce wildfire severity. When taking management decisions at the landscape scale, strategic re-wetting around vulnerable areas (e.g. highly degraded or undergoing forest-to-bog management leading to large volumes of brash on the ground) may help reduce the risks of occurrence of large catastrophic wildfires, and help minimise the carbon losses associated with these events.