The burning issue of the world's vulnerable carbon sinks

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Changing climate conditions and increasing occurrences of wildfires may leave globally important carbon stocks defenceless, new research shows.

A study led by the University of Birmingham (UK), shows vast carbon-rich layers of peat (dead plant debris) found across the world are under threat from a drop in general water table levels and warmer temperatures, as a result of climate change. With drier peatlands becoming more prevalent and wildfire activity on the increase, the peat's carbon content is at a higher risk of being released into our atmosphere.

As wildfires become more severe in a warmer climate, Sphagnum mosses that initially protect peatlands from catching fire are seen not to recover. Peat bogs depend on this protective layer of moss to guard against fires, as well as provide organic matter for new peat. Without moss, peatlands are more susceptible to smouldering fires that could release large deposits of carbon into the atmosphere much quicker than the uptake of the ecosystem.

Peatlands, which can be 40cm-10m thick, are formed over thousands of years of waterlogged conditions. It is estimated that almost a trillion tonnes of carbon is stored globally within peatlands, which is three times more than that held in all the tropical rainforests.

Furthermore, peatland wildfires produce smoke that is dangerous to human health, as it can worsen air quality and trigger respiratory

problems. These wildfires also pose a threat to human populations close to peatlands, with significant economic, social and ecological impacts occurring as a result.

The new research from the University of Birmingham comes from a unique long-term experiment in Alberta, Canada. The water table was artificially lowered in a peatland by about 0.25m in 1983, comparable to projections of future water table reductions under climate change, and this was compared with an undrained area in the same vicinity.

Within ten years of both areas burning during a wildfire in 2001, the undrained area was recovering and beginning to offset the loss of carbon during fire. However, drainage altered the recovery of vegetation, with a 77% reduction in total moss cover. Furthermore, the drained site was colonised by a canopy of willow and birch, which reduce the amount of light at the ground surface and further restricts the growth of moss species. Worryingly, peatland wildfires are expected to double in frequency within the next 100 years in Canada.

As well as Canada, this double disturbance of changing climate conditions and increasing wildfires is threatening peatlands in parts of the UK, the USA and Russia – a country ravaged by nearly 50 peatland wildfires in 2010, which destroyed thousands of homes and contributed to over 10,000 deaths.

Academics will now use this research to explore ways in which they can reduce the severity of wildfires on peatland areas, including small-scale rewetting of bogs and large-scale modifications to surface vegetation.

Lead author of the study, Dr Nick Kettridge, Lecturer in Water Sciences, School of Geography, Earth and Environmental Sciences, University of Birmingham said:

'Peatlands cover around three per cent of the world's surface and are vital in moderating global carbon levels, as well as providing habitats for unique flora and fauna. Changing climate conditions and increasing wildfires poses a major threat to these ecosystems.'

'We will now try to find viable ways to mitigate the effects on peatlands by identifying vulnerable areas and developing management strategies that limit wildfire intensity and promote the recovery of moss species after fire. However, ultimately we may all need to help tackle climate change in order to prevent the significant loss of carbon from these globally import stores.'

More information: "Moderate drop in water table increases peatland vulnerability to post-fire regime shift." *Scientific Reports* 5, Article number: 8063 DOI: 10.1038/srep08063

Provided by University of Birmingham