Wildfire and drainage accelerate carbon loss from northern peatlands, study finds

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The harm caused to the Northern Hemisphere's peatlands as a result of wildfires could lead to greater quantities of carbon dioxide being released into the atmosphere, a new study involving the University of

Plymouth has warned.

Peatlands are a globally important carbon stock, storing twice as much carbon as the world's forests, and until now it has been difficult to measure the impact of wildfire on the northern peatland carbon stock or to predict its future.

New research published in *Nature Climate Change* has estimated for the first time how degradation, wildfire combustion and post-fire dynamics influence carbon emissions from non-permafrost peatlands across vast areas of the Northern Hemisphere.

When peatlands are drained, typically to convert them to agriculture or forestry, they release carbon back to the atmosphere as carbon dioxide. The study estimated that these emissions are enhanced by as much as 10% when taking wildfire into account.

Using a modeling approach, the researchers found that while northern peatlands as a whole are still currently sequestering carbon, small increases to the drained area, fire severity or burn area can all switch the system to a net source of greenhouse gases to the atmosphere.

There is already evidence from other studies of climate-induced drying in peatlands, which could contribute to increased fire severity and higher emissions during a wildfire. Current predictions also point to a drastic increase in annual area burned over the coming century in the Northern Hemisphere, as well as an increase in extreme wildfire weather.

A reduction in the strength of our natural carbon sinks will make it more difficult to remain below critical global climate and emission reduction targets.

Dr. Scott Davidson, Lecturer in Ecosystem Resilience at the University of Plymouth, said, "Our study adds further evidence to the need to deploy peatland restoration at pace and at scale. It is a cost-effective tool that can help minimize the wider impacts to northern peatland carbon stocks and the associated significant costs to society."

Dr. Sophie Wilkinson, a peatland wildfire expert based at the Simon Fraser University, led the study. She noted, "The impacts of drainage and fire have serious consequences for the ability of peatlands to uptake carbon, and together they can cause it to be emitted in large quantities. Our study highlights the resilience of pristine peatland ecosystems: even when including emissions associated to wildfire processes under the current typical regime, pristine peatlands remain a net sink of greenhouse gases, albeit a smaller one. But we have also demonstrated unequivocally the vulnerability of peatland ecosystems and their vast carbon stocks to the interactive effects of drainage and a shifting wildfire regime associated with climate change."

Professor Roxane Andersen is a peatland scientist based at the University of the Highlands and Islands. She is a co-author of the study, and explained, "There are currently around 25 Mha of drained boreal and temperate peatlands. It may only be about 10% of the total area, but these degraded peatlands have a disproportionate impact on carbon emissions, even more so once we take wildfire processes into account. Drained peatlands are not evenly distributed: most of them are in Europe, including approximately 2.3 Mha in the UK. In the context of a changing wildfire regime, these are ticking 'carbon bombs' that may compromise our ability to achieve 'net-zero' targets."

On the other hand, the study also highlights the opportunity represented by peatland restoration. It concludes with a call for international cooperation to fill in data gaps and continue to improve the representation of peatlands and their complex feedback within global Earth system models.

More information: Sophie Wilkinson, Wildfire and degradation accelerate northern peatland carbon release, *Nature Climate Change* (2023). DOI: 10.1038/s41558-023-01657-w. www.nature.com/articles/s41558-023-01657-w

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