Taking the pulse of peatland carbon emissions could measure climate impact of development

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A new way to take the pulse of carbon emissions could help track how the industrial development of peatlands contributes to climate change, as well as measure their recovery once development ends.

In a new paper published in the journal *Scientific Reports*, a team of researchers led by the University of Glasgow discuss how they have used carbon-14 dating to determine for the first time the age of carbon dioxide being released from peatland sites.

The researchers monitored carbon emissions from peatlands in Malaysia's North Selangor Peat Swamp Forest (in Selangor State, close to Kuala Lumpur) and an established oil palm plantation in south Selangor over a five-day period during the country's dry season.

Peatlands, which are composed of partially decayed plant and other organic matter accumulated over thousands of years, are 'carbon sinks' which capture and hold decaying plant material.

When peatlands are disturbed, as they are in Malaysia by logging and palm oil production, the carbon they store can be released into rivers. While the process by which peatlands release carbon into rivers is well-understood, the research team were keen to see if these rivers then release old peatland carbon to the atmosphere as gas. Evidence of older carbon release could signal that old carbon is being released into the atmosphere, and as no longer stored would contribute to climate change.

To do so, they collected samples of carbon dioxide being released from the water draining from the peatland and brought them back for analysis at the Scottish Universities Environmental Research Centre (SUERC) in East Kilbride.

The SUERC team measured the levels of a radio- isotope of carbon called carbon-14 in each sample. The level of radioactive decay in those samples allows scientists to accurately determine the age of each sample.

Professor Susan Waldron, of the University of Glasgow's School of Geographical and Earth Sciences, is the paper's lead author. Prof

Waldron said: "We were keen to determine whether we could use carbon-14 dating to measure the pulse of the carbon cycle at both peatland sites.

"Would it be an older and slower carbon pulse, from the thousands of years of carbon held within the peat, or a shorter and faster one, from plant matter deposited on the surface of the peat in the last few years?

"We chose these particular sites in Malaysia because they had both been used for a number of different purposes in recent decades, which gave us the chance to collect samples from peatlands with different degrees of disturbance."

Their analysis showed in the more degraded, industrially-exploited areas carbon, which had previously been trapped over the last seven hundred years was being released—a sign that the peatland's historic stores of carbon was being lost into the atmosphere.

However, their research also revealed that at a forest site where logging had stopped 30 years ago and had been left to regrow, old carbon was not being degassed, suggesting that recovery of a more natural carbon cycle is possible.

Professor Waldron added: "Using carbon-14 dating like this could give conservationists and land managers a deeper understanding of the effect that development work is having on peatlands. That could lead to more informed decision-making, helping balance land management for economic development against their impact on the environment and their contribution to climate change. Although this research was in Malaysia the scientific principles means the technique is transferable to other peatlands globally.

"There's still lots of further research for us to do, including trying to pin

down more precisely when peatland sites begin to capture carbon again after being disturbed, which will widen the potential uses of this tool to take the pulse of peatlands."

Dr. Stephanie Evers of Liverpool John Moores University is one of the paper's co-authors. Dr. Evers said: "Despite peatlands being globally significant stores of carbon, their drainage and conversion to agriculture results in millions of tonnes of carbon being lost annually due to decomposition, fires and flushed into drainage waters. As such, their restoration is massively important for climate change mitigation. Yet there are still large gaps in understanding of the best practices for restoring sites and how long this process takes.

"Development of a tool which can provide evidence of both the level of degradation and where restoration of the carbon storage function has occurred will aid in conservation design, management and evidence of areas in need of greater intervention."

More information: Susan Waldron et al. C mobilisation in disturbed tropical peat swamps: old DOC can fuel the fluvial efflux of old carbon dioxide, but site recovery can occur, *Scientific Reports* (2019). DOI: 10.1038/s41598-019-46534-9

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