Carbon emissions from Indonesian peat fires vary considerably based on fire type, research shows

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Condition of peatland following one fire, two fires, three fires and more than three fires. Credit: 'Credit: Florian Siegert and Peter Navratil'

Carbon emissions caused by burning tropical peatlands in Indonesia vary considerably depending on if the fires are initial or recurrent, according to new research conducted at the University of Leicester.

The study, which was co-authored by Professor Susan Page and Dr Kevin Tansey from the University of Leicester's Department of Geography, also found that peatlands closer to canals have a higher probability of high frequency fires, which release harmful carbon emissions into the atmosphere.

The study, 'Variable carbon losses from recurrent fires in drained tropical peatlands', which was conducted with researchers at the Ludwig-Maximilians-University of Munich (LMU) and published in the journal *Global Change Biology*, presents the first spatially explicit investigation of fire-driven tropical peat loss and its variability, suggesting that there is a strong relationship between burned area depth, fire frequency and distance to drainage canals in tropical peatlands.

Tropical peatlands store huge amounts of carbon as incompletely decomposed plant material that has accumulated over thousands of years in waterlogged, anaerobic environments. They are one of the largest near-surface pools of terrestrial organic carbon, with a total peat carbon pool of 82-92 gigatonnes, of which 65% is located in Indonesia.

Under certain conditions, fires set to clear vegetation can ignite the peat, resulting in long-lasting and smouldering fires that release large amounts of carbon to the atmosphere.

Professor Susan Page from the University of Leicester's Department of Geography explained: "Tropical peatland fires play a significant role in the context of global warming through emissions of substantial amounts of greenhouse gases.

"However, the state of knowledge on carbon loss from these fires is still poorly developed with few studies reporting the associated mass of peat consumed.

"Furthermore, spatial and temporal variations in burn depth have not been previously quantified."

As part of the study, an extensive airborne LiDAR (Light Detection and Ranging) dataset was used by the team to develop a pre-fire peat surface modeling methodology, enabling the spatially differentiated quantification of burned area depth over the entire burned area.

For the first time, they also showed that relative burned area depth and carbon loss decreases over the first four fire events and is constant thereafter.

While the relative burned area depth decreased for each successive fire event over the first three fires, areas with four fires or more occurred only up to a specific maximum distance of 600m from drainage canals, while locations with less fire events occurred across a wider zone up to 1,300m from canals.

This suggests that close proximity to canals not only influences burned area depth but also the probability of high frequency fire events.

Professor Page added: "We showed that with increasing proximity to drainage canals both burned area depth and the probability of recurrent fires increase and present equations explaining burned area depth as a function of distance to drainage canal.

"Any attempt to secure financial support for emission reduction requires reliable methodologies that can measure, report and verify greenhouse gas emissions on a regular basis before, during and after any emissions mitigation intervention has been undertaken.

"This improved knowledge enables a more accurate approach to emissions accounting and will support the reporting of fire emissions."

More information: Kristina Konecny et al. Variable carbon losses from recurrent fires in drained tropical peatlands, *Global Change Biology* (2015). DOI: 10.1111/gcb.13186

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