

CO₂ evasion from channels draining intact and deforested Bornean peat swamp forest

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Tropical peatlands constitute one of the largest terrestrial reservoirs of historic atmospheric carbon dioxide (CO₂) globally, storing ~87 petagrams (1 Pg = 1×10^{15} g) of carbon (C) within organic soils that took millennia to accumulate. 65% of tropical peatland C is located in the peat swamp forests (PSF) of Indonesia, a country undergoing rapid economic development. Deforestation, drainage and burning of Indonesian PSF for plantation agriculture is destabilising the PSF ecosystem, converting a globally significant C sink into a substantial C source. Further, Moore et al.'s [Nature, 493, 660-664 (2013)] study of fluvial dissolved organic carbon (DOC) export showed that C being lost from degraded PSF is ancient (1-5 ka), as opposed to the modern (post-1950) age signature obtained from intact PSF. Using the same intact and degraded Bornean PSF study sites and channels as Moore et al., we employed floating chambers, radiocarbon dating and incubation studies to a) obtain baseline fluvial CO₂ fluxes to the atmosphere and dissolved CO₂ ages, and b) ascertain the degradability of the DOC in the channels from the two land-use types. Intact PSF CO₂ fluxes were approximately double that of degraded PSF, per unit area. However, CO₂ emissions scaled up to total channel and catchment areas were considerably higher for degraded PSF. Radiocarbon dating revealed that dissolved CO₂ from degraded PSF is overwhelmingly ancient indicating that the reservoir of millennia-old DOC leaching from degraded peats is being broken down and emitted to the atmosphere as CO₂.