



Fluvial organic carbon losses from oil palm plantations on tropical peat, Sarawak, Southeast Asia

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Tropical peatlands are valuable stores of carbon. However, tropical peat swamp forests (TPSFs) in Southeast Asia have increasingly been converted to other land-uses. For example, more than 25% of TPSFs are now under oil palm plantations. This conversion – requiring felling and burning of trees and drainage of the peat - can enhance carbon mineralization, dissolved organic carbon (DOC) losses and can contribute significantly to global anthropogenic greenhouse gas emissions, changing these natural carbon sinks into carbon sources. At present, relatively few scientifically sound studies provide dependable estimates of gaseous and fluvial carbon losses from oil palm plantations or from drained tropical peat in general. Here we present an annual (54 week) estimate of the export of dissolved and particulate organic carbon in water draining two oil palm estates and nearby stands of TPSF in Sarawak, Malaysia, subjected to varying degrees of past anthropogenic disturbance. Spectrophotometric techniques including SUVA₂₅₄ (Specific Ultra-Violet Absorption) were used to gain insight into the aromaticity and subsequent bioavailability of the exported DOC. Water draining plantation and deforested land had a higher proportion of labile carbon compared to water draining forested areas. Preliminary data suggest a total fluvial DOC flux from plantations of ca. 190 g C m⁻² year⁻¹; nearly three times estimates from intact TPSFs (63 g C m⁻² year⁻¹). DOC accounted for between 86 % - 94 % of the total organic carbon lost (most of which was bioavailable). Wit et al. (2015) estimates that an average of 53 % of peat-derived DOC is decomposed and emitted as CO₂, on a monthly basis. Based on these estimates our data suggests an additional 101 g CO₂ m⁻² may be emitted indirectly from fluvial organic carbon in degraded TPSFs per year. Overall, these findings emphasize the importance of including fluvial organic carbon fluxes when quantifying the impact of anthropogenic disturbance on the peatland carbon budget. Given the increasing expansion of oil palm plantations on tropical peat, within Southeast Asia, it is essential that fluvial organic carbon data is incorporated into assessment criteria, helping countries to better monitor, report and verify their land-based greenhouse gas emissions.