Comparing Soil Nitrous Oxide and Methane Fluxes from Oil Palm Plantations and Adjacent Riparian Forests in Malaysian Borneo

ABSTRACT

Riparian forests are often kept as buffers between rivers and oil palm plantations. Many benefits of riparian forests, such as increasing biodiversity and providing a travel corridor for wildlife have been documented. Conversely, data on fluxes of the greenhouse gases nitrous oxide (N2O) and methane (CH4) from riparian forests are sparse. Nitrogen (N) from fertilizer applied in the oil palm plantations leached to the adjacent riparian forests, may increase emissions of N2O. Methane (CH4) fluxes might also differ between oil palm plantations and riparian forests due to carbon (C) availability. In this scoping study, we installed transects from three mature oil palm plantations to adjacent riparian forests within the SAFE project landscape in Sabah, Malaysia (https://www.safeproject.net) for measurements of greenhouse gases and associated parameters every 2 months for 13 months. Emissions of N2O were higher from riparian forests with 40.4 [95% confidence intervals (CI): 35.7–44.6] µg N2O-N m–2 h–1 than from an equivalent area of oil palm plantation 27.6 (CI: 23.1-32.3) µg N2O-N m-2 h-1. Methane uptake was significantly higher from the riparian forest with -14.7 (CI: -21.1 to -8.3) μ g CH4-C m-2 h-1 compared to slight positive emission in the oil palm plantations of 6.3 (CI: 1.1–11.4) µg CH4-C m-2 h-1. We are contributing urgently needed flux data for less well studied riparian forests in the Tropics, however, additional long-term studies are needed to be able to draw wider conclusions than possible from this scoping study alone.