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Greenhouse gas budgets from oil palm plantations in Sumatra, Indonesia: effect of oil palm age

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The rapid growth of the demand for vegetable oils is supporting the expansion of oil palm (Elaeis guineensis Jacq.) plantations, particularly in Indonesia, which are currently responsible for about half of the world's palm oil production. The existing production is concentrated in Sumatra, where large land-use changes have taken place, e.g. losses of over 21% of forest cover between 2000 and 2012 in the Sumatran lowlands. It has been shown that the conversion of forest to oil palm plantations leads to large carbon emissions, but no full greenhouse gas (GHG) budgets have been performed, where ecosystem carbon dioxide (CO_2), methane (CH4) and nitrous oxide (N2O) have been measured simultaneously. Additionally, the effect of oil palm age on the GHG budget has not been assessed.

We measured CO_2, CH4 and N2O fluxes in a young (1 year-old) and mature (12 years-old) oil palm plantation in the Jambi province, in Sumatra, Indonesia, during 8 months and over 2 years respectively. CO_2 fluxes were measured at ecosystem level, using the eddy covariance technique, and from the soil, with closed chambers. CH4 and N2O fluxes were only measured from the soil, where most of the fluxes take place, using closed chambers.

Preliminary results show that on an annual scale, the young oil palm plantation was a carbon source (636 g C m-2 yr-1), while the mature oil palm plantation acted as a strong carbon sink (-794 g C m-2 yr-1). We observed CH4 uptake in both plantations, but fluxes were very small and therefore had a limited contribution to the global GHG budget. N2O emissions were larger, especially in the mature plantation (0.33 g N m-2 yr-1). We will assess the global warming potential resulting from the three GHGs from oil palm plantation at young at mature phases.