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CO_2 and energy fluxes from an oil palm plantation in Sumatra, Indonesia

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Oil palm plantations are expanding in Indonesia due to global increased demand of palm oil. Such plantations are usually set in previously forested land and in Sumatra, massive transformation of lowland forest into oil palm plantations is taking place. These land transformations have been identified as a potential driver of climate change, as they might result in changes of greenhouse gas (GHG) fluxes. However, very limited information is available on GHG fluxes from oil palm plantations and their sink or source strength at ecosystem scale is yet unknown.

An eddy covariance tower was therefore installed in a 2 year old oil palm plantation in the province of Jambi, Sumatra (1˚50' 7"S, 103˚17' 44"E), with the aim of studying carbon dioxide, water and energy fluxes during the non-productive phase of oil palm cultivation. The canopy was not yet closed and trees were around 2m high. The eddy covariance system consists of a Licor 7500A and an ultrasonic Metek Anemometer, operating at 10 Hz and installed on a 7m tower. In addition to the eddy covariance measurements, the site is equipped with a weather station, measuring short and long wave radiation, PAR, rainfall, profiles of air temperature, air humidity and wind speed, soil temperature and moisture and soil heat fluxes. Measurements started in July 2013 until January 2014, in order to capture possible differences which may happen during the dry (July-October) and wet (November-February) seasons.

A large CO_2 uptake would have been expected at this young oil palm plantation, as palm trees during this period of their cultivation are growing fast. However, our preliminary results show that during the first 5 months of measurements, the ecosystem was a small carbon source (below 10 g CO_2 m-2). Latent heat flux was higher than sensible heat flux during the period of study, indicative of the high evaporation taking place. Our results show that both for CO_2 and energy fluxes, large differences were observed between the dry and wet seasons. First analyses indicate that the young oil palm plantation could act as a CO_2 source in the dry season and as a sink in the wet season. The possible driving factors will be discussed.