

## Carbon emissions from drainage ditches in oil palm plantations on peat soil

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Tropical peatlands contain approximately 17% of the total global peat carbon and are under pressure for deforestation and the formation of oil palm plantations. The conversion of large peatland forests in Malaysia and Indonesia has resulted in these plantations becoming substantial sources of greenhouse gases. While previous research has focused on estimating the C loss from the soil, the impact of drainage ditches on the overall C budget remains largely unexplored. However, on average, drainage ditches with free surface water cover roughly one-third of the total drained land. Hence, these ditches could be significant CO<sub>2</sub> and CH<sub>4</sub> sources and while not considered for C budget calculation it could lead to significant underestimation of total C loss from these ecosystems. Here we represent the CO<sub>2</sub> and CH<sub>4</sub> emissions from drainage ditches in an oil palm plantation located in Sarawak, Malaysia. CO<sub>2</sub> and CH<sub>4</sub> samples (n=107) were collected from a recently created plantation (~5 y.o.) and from the plantation, which is under second rotation using a floating chamber and LI7810 analyzer. The results revealed that the average net CH<sub>4</sub> flux (combining both diffusive and ebullitive emissions) from drainage ditches in the first and second rotations was  $10.8 \pm 14.3$  mg m<sup>-2</sup> h<sup>-1</sup> and  $13.2 \pm 23.9$  mg CH<sub>4</sub>-C m<sup>-2</sup> h<sup>-1</sup>, respectively. The average CO<sub>2</sub> flux from the first and second rotations was  $0.16 \pm 0.1$  g CO<sub>2</sub>-C m<sup>-2</sup> h<sup>-1</sup> and  $0.17 \pm 0.1$  g CO<sub>2</sub>-C m<sup>-2</sup> h<sup>-1</sup>, respectively. Consequently, the annual emission from the ditches in the first rotation was 400 kg CH<sub>4</sub>-C yr<sup>-1</sup> and 4198 kg CO<sub>2</sub>-C yr<sup>-1</sup>, while in the second rotation, the emissions were slightly lower, with 118 kg CH<sub>4</sub>-C yr<sup>-1</sup> and 3352 kg CO<sub>2</sub>-C yr<sup>-1</sup>. These results strongly underscore the significant role of drainage ditches in contributing to the overall carbon loss from oil palm plantations. Proper consideration of these emissions is essential for accurate carbon budget calculations and for devising effective strategies to mitigate greenhouse gas emissions in these ecosystems.