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## Rubber Cultivation Weakened the CH<sub>4</sub> Sink Function of Tropical Upland Soil, Comparing with Rainforest

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### Abstract

Rubber plantations have been expanded in past decades in the Mekong region where they were not traditionally grown. Investigation of gaseous carbon loss from soil is an important component of evaluating the impact of land use change on carbon dynamics and ecosystem functions. According to observed drop of soil respiration rates and high soil moisture in rubber plantation in rainy season when rainforest kept high rate, we hypothesised that rubber cultivation might change the tropical upland soil into CH<sub>4</sub> source periodically, which result to less net CH<sub>4</sub> oxidation by the soil comparing with rainforest. In order to find out how rubber cultivation affected the CH<sub>4</sub> processes in soil, we set 4 plots in transect that included rainforest and rubber plantations at age of 9, 17 and 30 years. We measured CH<sub>4</sub> flux with closed chamber method for half a year, and analysed CH<sub>4</sub> concentration profiles three times and  $\delta^{13}\text{C}$  ratio of CH<sub>4</sub> once at soil depth of 5 cm, 10 cm, 30 cm and 70 cm. Monthly CH<sub>4</sub> flux measurements had large variation and there was no consistent difference between rainforest and rubber plantations in the early dry season. Comparing with older rubber plantation, more negative CH<sub>4</sub> flux was observed from rainforest and 9 years rubber plantation in the late dry season. The first gas profile sampling in dry season without rainfall events showed CH<sub>4</sub> concentration ranging from 0.43 ppm to 1.31 ppm, with lower values in deeper soil. The second profile sampling in dry season after heavy rain displayed different response, CH<sub>4</sub> concentration in rainforest and 9 years rubber plantation changed range to 0.17 ppm-1.61 ppm, while it changed to 0.46 ppm-22.36 ppm in 17 and 30 years rubber plantation with higher concentration in deeper soil. CH<sub>4</sub> concentration profiles indicated that with increasing of age, rubber plantation tended to change into CH<sub>4</sub> source in response to heavy rains.  $\delta^{13}\text{C}$  ratio of CH<sub>4</sub> in soil varied from -49.73‰ to -38.05‰, with higher enrichments in deeper soil. The isotopic carbon signature in CH<sub>4</sub> confirmed weaker CH<sub>4</sub> oxidation in rubber plantations than rainforest, and decrease of oxidation rates caused by converting rainforest to rubber plantations might stabilise at certain age of cultivation.

**Keywords:** CH<sub>4</sub> oxidation, rainforest, rubber plantation, stable isotope carbon ratio, upland soil

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