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"Bridging the gap between increasing knowledge and decreasing resources"

Soil Respiration in Rubber Plantation and Rainforest Indicate Different Processes During the Rainy Season

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Abstract

Rubber plantations expand rapidly in the upper Mekong leading to remarkable land use change in the region. As part of evaluation of the land use change impact on carbon stock and sequestration, we measured the soil CO_2 flux in secondary rainforest, 22 and 9 years old rubber monoculture and a rubber-tea intercropping in Xishuangbanna, Southwest China. Soil respiration was measured with monthly interval from November 2012 to December 2013, using an open chamber soil respiration system-ADC LCi-SD. We placed 12 collars at different positions of each plot to cover the spatial variation. Soil moisture and temperature were measured with corresponding probes in the mean time. Soil respiration showed distinct difference in temporal pattern between secondary rainforest and rubber plantations during rainy season (May to October). Respiration rate increased gradually in all plots from February to June. From July to October, secondary rainforest had higher respiration rates and peaked during this period, while respiration rates of 3 plots in rubber plantations dropped and showed low emission in August. The moisture data indicated that the soil under rubber plantations was periodically waterlogged and saturated with water. On the contrary, the loose soil in rainforest was not saturated even during very wet period. Soil temperature played a major role in dry season (November to April). Soil respiration was lowest in February when rubber shed leaves, winter chill in December 2013 also contributed to low respiration rate in all plots. The soil moisture dynamics in rainforest and rubber plantations during the rainy season indicates that land use change could affect the diffusivity and gaseous transport in the soil, which further change the CO_2 emission. Soil respiration might be suppressed because of limited available oxygen during certain wet periods; this anaerobic condition could also change the methane consumption to production. Therefore, planned estimation of soil methane flux during wet period will help to verify the contribution of the both processes to the gaseous carbon losses from soil. Our study shows the importance of consideration of soil properties and moisture monitoring for the reliable assessment of land use change effect on carbon emission from the soil.

Keywords: Carbon losses, rubber plantation, soil moisture, soil respiration

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