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Termites as a factor of spatial differentiation of CO_2 fluxes from the soils of monsoon tropical forests in Southern Vietnam

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Termites play the key role in biogeochemical transformation of organic matter acting as “moderators” of fluxes of carbon and other nutrients. They destroy not only leave litter but also coarse woody debris. Termites translocate considerable masses of dead organic materials into their houses, which leads to significant accumulations of organic matter in termite mounds. We studied the impact of termite mounds on redistribution of CO_2 fluxes from soils in semi-deciduous monsoon tropical forests of southern Vietnam.

Field study was performed in the Cat Tien National Park (11°21′-11°48′N, 107°10′-107°34′E). The spatial and temporary dynamics of CO_2 fluxes from soils (Andosols) populated by termites were studied in plain lagerstroemia (Lagerstroemia calyculata Kurz) monsoon tropical forests. The rate of CO_2 emission from the soil surface was measured by closed chamber method two-three times per month from November 2010 to December 2011. Permanent cylindrical PVC chambers (9 cm in diameter and 15 cm in height) were installed beyond the areas occupied by termite mounds (5 replications). Litter was not removed from the soil surface before the measurements. To estimate the spatial heterogeneity of the CO_2 emission fluxes from soils populated by termites, a special ‘termite’ plot (TerPl) was equipped. It was 10×10 m in size and included three termite mounds: one mound built up by Globitermes sulphureus and two mounds populated by termites of the Odontotermes genus. Overall, 52 PVC chambers were installed permanently on the ‘termite’ plot (ca. 1 m apart from one another). The CO_2 emission rate from TerPl was also measured by chamber closed method once in the dry season (April) and twice through the wet season (July and August).

The average rate of CO_2 emission from termite mounds was two times higher than that from the surrounding area (SurAr). In the dry season, it comprised 91 ± 7 mg C/m2/h from the surrounding soils and 196 ± 16 mg C/m2/h from the termite mounds. In the wet season, the CO_2 emission rate was considerably higher and reached 266 ± 40 and 520 ± 39 mg C/m2/h in SurAr and TerPl, respectively. The highest rates of CO_2 fluxes (730–880 mg C/m2/h) were observed in the wet season in some of the chambers installed on TerPl. In the tropical forest, termites are the factor of the significant spatial variability in the CO_2 fluxes from the soils. On the plots populated by termites, the coefficient of variation of CO_2 emission rates reached 79%, while it rarely exceeded 45% on the surrounding area. The termite mounds occupy about 4% of the area of tropical forest ecosystems. However, the overall effect of termites on the carbon budget was more significant and, according to our estimates, it reached up to 10% of the total annual CO_2 flux from the soils. Thus, underestimation of the influence of termites may lead to significant errors in the assessment of the organic carbon budget in the semi-deciduous tropical forests.