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Methane emissions from termites – landscape level estimates and methods of measurement

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Termites contribute between <5 and 19% of the global methane emissions. These estimates have large uncertainties because of the limited number of field-based studies and species investgated, as well as issues of diurnal and seasonal variations. We measured methane fluxes from four common mound-building termite species diurnally and seasonally in tropical savannas in the Northern Territory, Australia. Our results showed that there were significant diel and seasonal variations of methane emissions from termite mounds and we observed large species-specific differences.

On a diurnal basis, methane fluxes were least at the coolest time of the day and greatest at the warmest for all species for both wet and dry seasons. We observed a strong and significant positive correlation between methane flux and mound temperature for all species. Fluxes in the wet season were 5–26-fold greater than those in the dry season and this was related to population dynamics of the termites.

We observed significant relationships between mound methane flux and mound carbon dioxide flux, enabling the prediction of methane flux from measured carbon dioxide flux. However, these relationships were clearly termite species specific. We also determined significant relationships between mound flux and gas concentration inside mound, for both gases, and for all termite species, thereby enabling the prediction of flux from measured mound internal gas concentration. However, these relationships were also termite species specific. Consequently, there was no generic relationship that would enable an easier prediction of methane flux from termite mounds.

On a landscape scale we estimated that termites were a methane source of +0.24 kg methane-C ha-1 year-1 whilst savanna soils were a methane sink of 1.14 kg methane-C ha-1 year-1. Termites therefore only offset 21% of methane consumed by savanna soil resulting in net sink strength of -0.90 kg methane-C ha-1 year-1 for these savannas.

Assuming a similar contribution of termites in the savannas and tropical rain forests worldwide, termites would globally produce around 27 Tg CO_2-e year-1, which is 0.2% of the global methane source budget or an order of magnitude smaller than many of the previous estimates.