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窒素飽和程度が異なる森林における N2O および CH4 のフラックス
Emissions of nitrous oxide and methane in temperate forests with different nitrogen status in central Japan

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Nitrous oxide (N2O) and methane (CH4) are strong greenhouse gases, which contribute about a fourth to current warming effect globally. Compared with other sources, importance of forest ecosystems has been less quantified. With the increase of anthropogenic N deposition, it is urgent to evaluate the emissions of these gases from N-saturated forests. In general, forest soil has been recognized as a net sink of CH4 and as a source of N2O, but more works are needed because forests differ greatly in N status, which may play an important role in regulating the gas emissions. Soil nitrification, which is a dominant process of N2O emission, often increases with the increase in N status. To the contrary, increased inorganic N availability may inhibit the oxidation of CH4 by soil microbes.

In this study, emission rates of N2O and CH4 were measured monthly in an N-saturated forest (Tamakyuryo, Tokyo; from May-2012 to Jan-2013) and singly in two relatively N-limited forests (in Fukushima and Izu; Aug-2012) in central Japan. The temperature, contents of water and inorganic N in soil were simultaneously determined. In situ net nitrification rate was measured for soil in the forest of FM-Tama. According to the analysis in Aug-2012, the N2O emission rate averaged 18.3 mg-N m-2 h-1 at Tamakyuryo, which was 4.5 times higher than those of other forests. The CH4 emission rate averaged 58.7 mg-CH4 m-2 h-1 at Tamakyuryo, which was significantly lower than those of other forests (67.8mg-CH4 m-2 h-1 for the forest in Fukushima and 95.8 mg-CH4 m-2 h-1 for the forest in Izu). Moreover, a positive correlation was found between the rate of N2O emission and the net nitrification rate, and the emission rate of N2O varied with the soil temperature. Consequently, it can be inferred that nitrification can be a major process of N2O production, and N enrichment in forest will obviously stimulate soil N2O emission.

Keywords: Nitrous oxide, methane, nitrogen saturation, nitrification, temperate forest