



Upland forest soils have a significant contribution to a catchment-scale CH₄ balance in a wet year

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Upland forest soils affect the atmospheric methane (CH₄) balance, not only through the soil sink, but also due to episodic high emissions in wet conditions. We measured methane fluxes in a northern boreal catchment and found that during a wet autumn the forest soil turned from a CH₄ sink into a large source for several months, while the CH₄ emissions from a nearby wetland did not increase. When upscaled to the whole catchment area with ca. 4/5 of the total area consisting of upland forests and the rest being wetlands, forests contributed 60% of the annual CH₄ emission from the wetlands. In a normal year, the forest soil consumes 10% of the wetland emission. In a monthly scale, the autumn emissions from the upland forests were twice as high as those from wetlands within the same catchment. The period of unusually high upland soil emission was also captured by the nearby atmospheric concentration measurement station. Moreover, the monthly atmospheric CH₄ anomalies in autumn were positively correlated with the water level of the lake collecting waters from the catchment. Since the land cover within our study catchment is representative of larger regions, our findings imply that upland forests in the boreal zone constitute an important part in the global CH₄ cycle not previously accounted for.