INSTITUTE OF AGROPHYSICS P A S

Methane uptake by various forest soils with and without litter

A. Walkiewicz, P. Bulak, B. Osborne, M.I. Khalil, S. Faiz-ul Islam, B. Kruijt, R. Hutjes, D. Spengler, P. Gottschalk, T. Sachs, K. Klumpp, A. Vigan, H. Mélynda, D. Henessy, L. Shalloo

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Rationale



- Forest ecosystems may be an important landscape element in mitigating and offsetting greenhouse gases.
- ✓ The litter layer influences the exchange of greenhouse gases between soil and atmosphere and may be a barrier reducing CH_4 diffusion into soil.
- ✓ Including litter in measurements of CH_4 consumption improves the inventory of this gas in the forest ecosystem.
- ✓ The influence of litter on CH_4 uptake may vary in deciduous and coniferous sites due to different properties of litter.

This study is aiming to assess CH₄ consumption in various soils with and without litter in forests with different tree species and ages.



Location and basic characteristic of measurement points in Poland





Tab.1. Basic characteristic of tested forests

Loc. No	Forest type	Vegetation age [years]	Soil type	Texture	SOC [%]	C/N	рН	Eh [mV]	moisture [%]
1	mixed	90; 56	Cambic Umbrisol	silt loam	1.68	13.34	3.54	425.20	12.16
2	coniferous	100	Dystric Cambisol	loamy sand	0.97	16.12	4.41	386.66	3.87
3	mixed	58	Albic Luvisol	sandy loam	0.70	13.17	5.20	389.58	4.38
4	mixed	84	Dystric Cambisol	silt loam	1.73	13.81	4.65	409.14	11.97
5	deciduous	75	Eutric Gleysol	loamy sand	0.90	12.15	5.05	379.04	5.21

Static chamber method (4 chambers per location; $v= 6 \text{ dm}^3$; gas sampling time: 0; 10; 20; 30; 40 min; calculated by linear regressions)









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Fig.1. Consumption of CH_4 in forest soils during summer 2019.

The litter layer influences the gas exchanges between soil and atmosphere, and may be a barrier reducing CH_4 diffusion into soil.

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Summary



- During summer 2019 in variant without litter the highest CH₄ uptake (about 2 mg C m⁻² day⁻¹) occurred in *Dystric Cambisol* (with the highest C/N ratio) under 100 years old coniferous forest, and in *Albic Luvisol* under 58 years old mixed forest (loc. no 2 and 3, respectively).
- > The presence of the litter level reduced the CH_4 flux in the range of 6-27% (Table 2) at these locations.
- Methane consumption was the lowest in silty soils (~ 0.4 1 mg C m⁻² day⁻¹, loc. no 1 and 4) and it was 13-29% decreased when covered with litter layer (Table 2).
- A lower reduction in CH₄ oxidation by the litter occurred in deciduous forest compared to mixed and coniferous forest (the negative effect of the litter layer was ~ 3-4% in sandy *Eutric Gleysol* under a 75-year-old deciduous forest (loc. no 5) with 90% of oak, and 10% of European hornbeam).
- The dry conditions in the summer 2019 (with total rainfall 163 mm during tested months in the studied region) resulted in low moisture in both litter and soil, however even litter with humidity below 10% reduced CH₄ consumption rates in the measured sites.

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Thank for your attention

Acknowledgements

Research was conducted under the project financed by Polish National Centre for Research and Development within of ERA-NET CO-FUND ERA-GAS Programme (ERA-GAS/I/GHG-MANAGE/01/2018).

The National Centre for Research and Development

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