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Are high CH_4 emissons from restored Central European peatlands due to earlier methanogen transplantation through manure?

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Background

In central Europe drainage of peatlands has been a common practise for the utilization of peatlands, e.g. for agriculture. Rewetting of these sites restores their carbon sink function but increases CH_4 emissions. The potential for very high emissions has been measured especially from sites previously used for agriculture (1,2,3); , e.g. grazing of cattle.

Could the high CH_4 emissions be explained by the previous land use as cattle pasture?

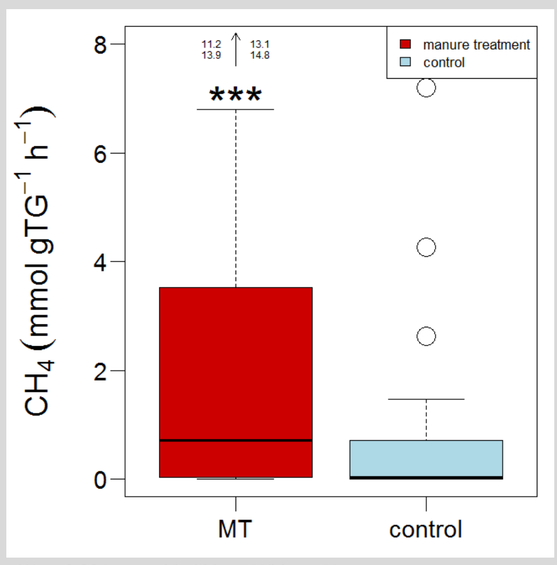
Manure treatment increases the CH_4 production potential of peat soils.

Manure treatment changes the T-RF pattern of methanogenic archea in peat soils.

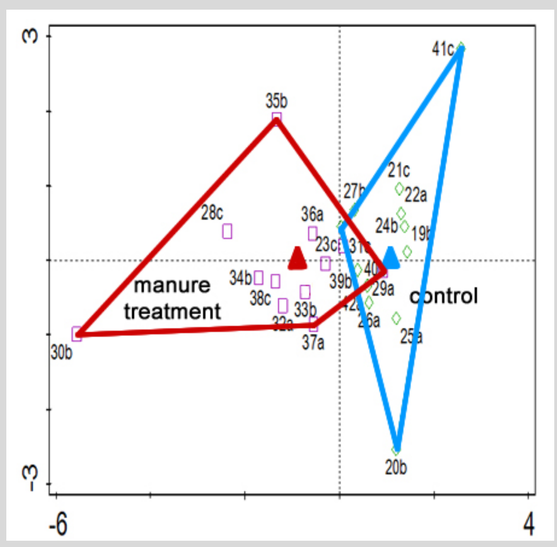
Manure treatment possibly introduces methanogenic archea from cattle rumen to peat soils.

Field experiment

- restored fen sites
- one year artificial impact of cattle manure treatment (MT)
- southern Finland
- n=72



*** p<0.001, one-sided Mann-Whitney-U-test

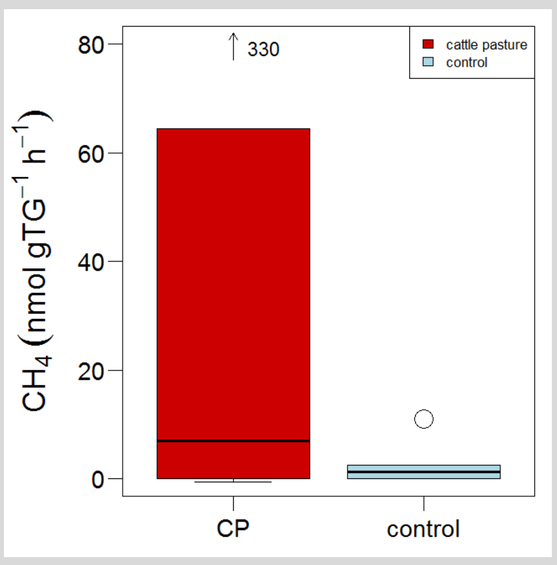


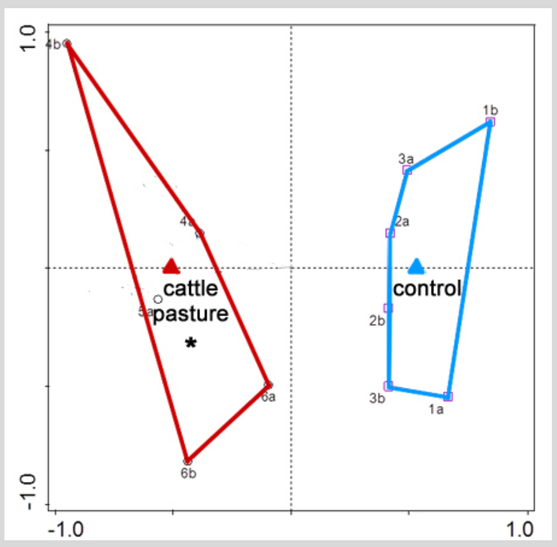
Number of sequences of methanogenic archea from pure manure, untreated peat soil (control) and peat soil that was inocubated with cattle manure in the field for one year (MT).

order	genus	manure	peat soil	
			MT	control
Methano-bacteriales	***Methanobrevibacter***	**21**	**2**	
	Methanosphaera		1	
Methano-microbiales	*Methanogenium*		1	
	Methanoregula	**1**	**4**	**18**
	Methanosphaerula		2	
Methano-sarcinales	*Methanosaeta*			2
	Methanococcoides			7
	Methanosarcina	**4**	**38**	
Methano-massiliicoccales	*Methanomassiliicoccus*			8
	Methanomethylophilus		4	
Methano-cellales	*Methanocella*			6
	Methanoflorensis			7

Land use management

- restored grassland on fen soil
- cattle pasture (CP) since more than 20 years
- northern Germany
- n=11





* p<0.05, Permutation test on CCA, pseudo-F=1.5, binary matrix

Conclusion

The restoration of Central European peatlands previously used as cattle pasture can be of risk regarding high emissions of the greenhouse gas CH_4.

References
1 Hendriks et al 2007. Biogeosciences 4: 411-424.
2 Augustin & Chojnicki 2008. In: Gelbrecht et al, Berichte des IGB 26: 50–67.
3 Freibauer et al 2008. Geophy Res Abstr 10. EGU2008-A-10958.

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