Long-term observation of greenhouse gases of a *Sphagnum* farming area on former bog grassland in North-western Germany

RRR2021

Renewable resources from wet and rewetted peatlands

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Air image: ASEA aerial 2017

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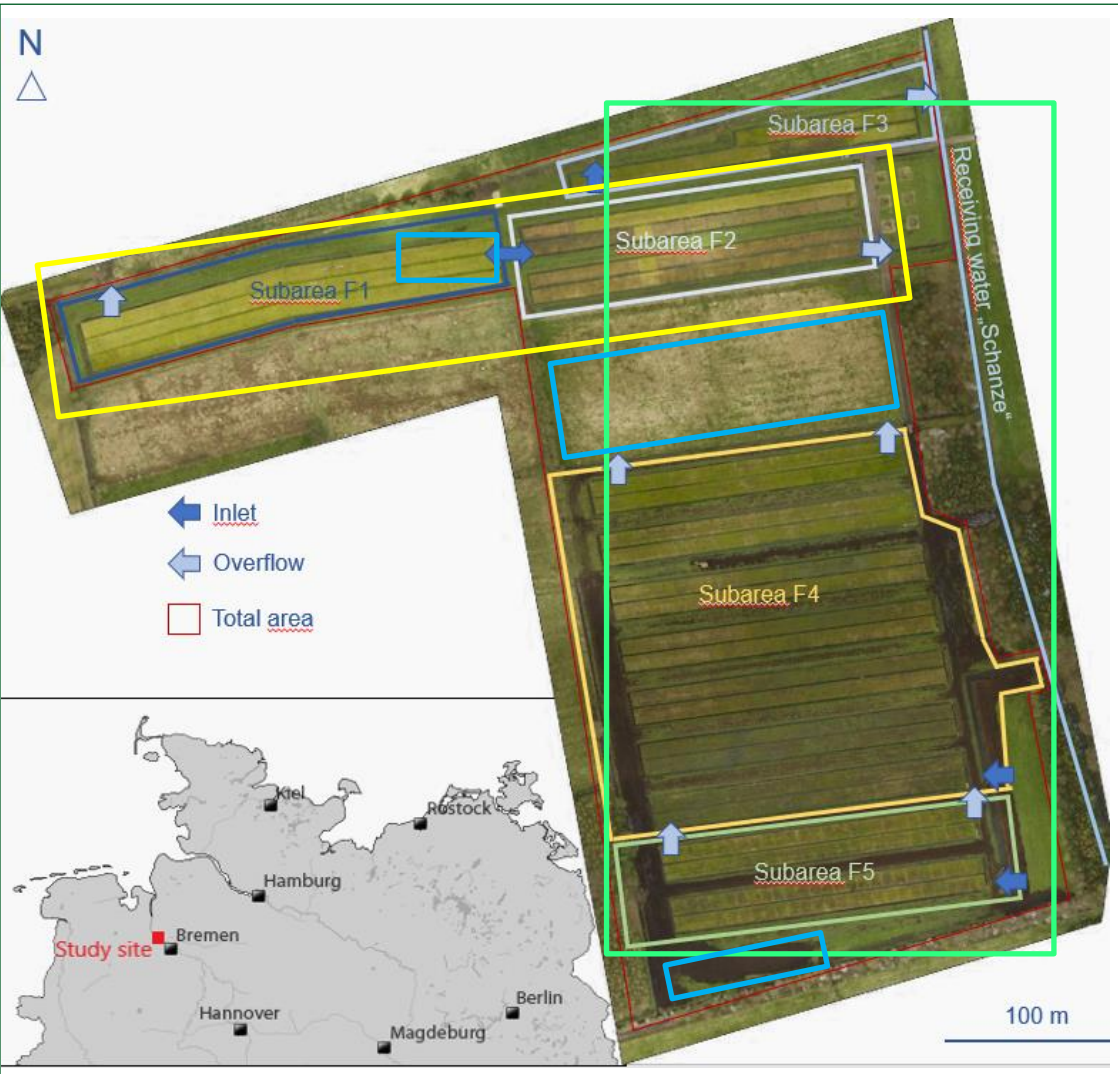
Past and present of the study design



- MOOSGRÜN project (2011-2014) (F1 & F2)
- MOOSWEIT project (2016-2019) (F3-F5)
- OptiMOOS project (2020-2022)

Overview of the entire study site for *Sphagnum* farming in the Hankhauser Moor with irrigation system (Air image: ASEA aerial 2017).

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Past and present of the study design

Past projects provide already six years of data

MOOSGRÜN:

- balancing the fluxes of greenhouse gas emissions of the production areas and the irrigation system of a Sphagnum farming site

MOOSWEIT:

- balancing the fluxes of greenhouse gas emissions of the production areas, the causeway and the irrigation system of a Sphagnum farming site including harvest from GHG collars closing the GHG balance

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Past and present of the study design

Measurement points of MOOSGRÜN/MOOSWEIT (blue) as well as OptiMOOS (green) (Air image: Google Earth)

Measurement program on the MOOSGRÜN/MOOSWEIT area

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Budgets MOOSGRÜN

Sphagnum production strips as CO_2 sink

		CO_2	CH_4	N_2O	Sum GHGs (CO_2eq)
Year 1	*S. palustre*	-629 ± 188	1.4 ± 0.5	0.0 ± 0.3	-578 ± 209
	S. papillosum	-898 ± 196	2.7 ± 0.7	0.1 ± 0.2	-790 ± 221
	Ditches	608 ± 393	14.4 ± 6.2	0.3 ± 0.4	1101 ± 577
Year 2	*S. palustre*	-547 ± 92	1.0 ± 0.4	0.0 ± 0.1	-506 ± 98
	S. papillosum	-875 ± 100	1.2 ± 0.5	-0.1 ± 0.1	-857 ± 108
	Ditches	910 ± 604	4.8 ± 4.9	0.6 ± 0.4	1135 ± 631

Table 1: Estimated annual balances of CO_2, CH_4 and N_2O together with combined climatic effect (all in g m^{-2} a^{-1}) for the production fields and irrigation ditches. Values are given ± SE. Source: Günther et al. 2017, Mires & Peat).

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Budgets MOOSWEIT

Causeway as CO_2 source

Preliminary data

		CO_2	CH_4	N_2O	Biomass export harvest
Year 2017	*S. palustre*	-322 ± 192	4.8 ± 5.7	0.0 ± 0.1	330 ± 13.4
until	*S. papillosum*	87.9 ± 283	5.8 ± 1.8	-0.1 ± 0.1	330 ± 17.6
Year 2018	Causeway	4230 ± 630	23.4 ± 15.6	0.4 ± 0.1	
	Ditches	in prep.	in prep.		

Table 2: Estimated annual balances of CO_2 and CH_4 together with combined climatic effect (all in g m^{-2} a^{-1}) for the production strips and causeway. Values are given ± SD.

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Aims of OptiMOOS

Greenhouse gas measurements on the different experimental plots (Source: G. Gaudig).

Production strips: Harvest March 2020, Growth since 2011 (Photo: C. Daun)

Filter basins with reed/cattail (Photo: K. Gerwing).

- Determination and balancing of greenhouse gas fluxes in the filter basins
- Determination and balancing of the greenhouse gas fluxes of the *Sphagnum* production fields with different topsoil removal and irrigation system
- Balancing the greenhouse gas fluxes of a complete crop rotation in the entire production system.

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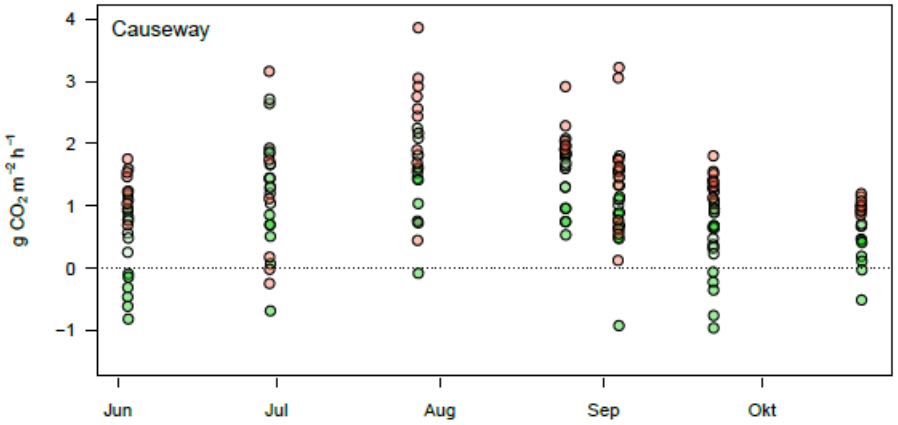
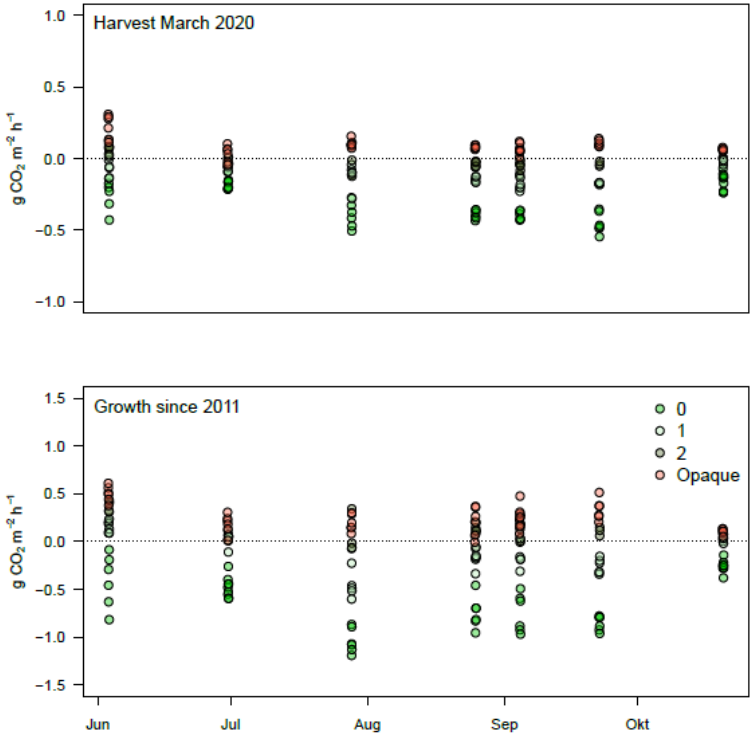
First results of OptiMOOS (2020)

High CO_2-emissions from causeway





- Causeway values indicate source of CO_2
- Production strips indicate a CO_2 sink

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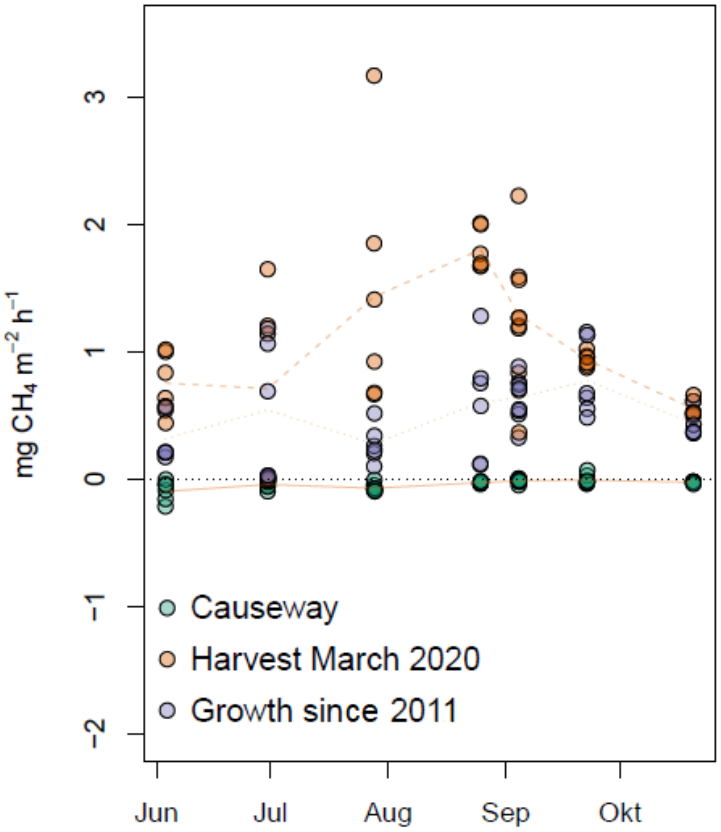
First results of OptiMOOS (2020)

Generally low CH_4-emissions with differences between production strips (negligible from causway)



- Harvest March 2020 variant with higher CH_4-emissions
- Possible reason:
  - Removal of parts of the methanotroph community with the harvest
  - Dominating shunt species *Juncus effuses*

Outlook

- *Sphagnum* production fields still indicating a CO_2 sink almost 10 years after establishment
- An optimization of the entire production area towards a minimum of dams and ditches is desirable

Thank you for your attention!