GREIFSWALD
MIRE
CENTRE

Let it grow!

Sphagnum biomass production on rewetted cut-over bog and bog grassland in Germany

Greta Gaudig & Matthias Krebs

Foto: lensescape.org

...Let it grow! → why?

Foto: lensescape.org

1. Sustainable peat substitute for growing media

annually consumption in Germany:

8 Mio m^3 peat, including

3 Mio m^3 ‚white peat‘

Foto: S. Wichmann

1. Sustainable peat substitute for growing media

Sphagnum biomass with
similar properties like ‚white peat'

Foto: A. Prager

2. Sustainable land use of peatlands

GHG emission from bog grassland:

~27 t CO_2 eq. ha^{-1} yr^{-1}

Foto: H. Joosten

Advantages of Sphagnum farming

- reduction of GHG emissions: ~15 t CO_2- eq. ha^{-1} yr^{-1}
- stop of subsidence

Günther et al. 2017, Mires & Peat

Foto: Uni Greifswald

Advantages of Sphagnum farming

- improvement of hydrology and regional climate
- decrease nutrient loads in surface waters:
  64 kg N + 7 kg P ha^{-1} yr^{-1}

Temmink et al. 2017, Ecol. Eng.

Foto: G. Gaudig

Advantages of Sphagnum farming

- habitats for endangered peatland species

Muster et al. 2015, Biodivers. Conserv.

Foto: G. Gaudig

Current bog utilisation types in NW Germany

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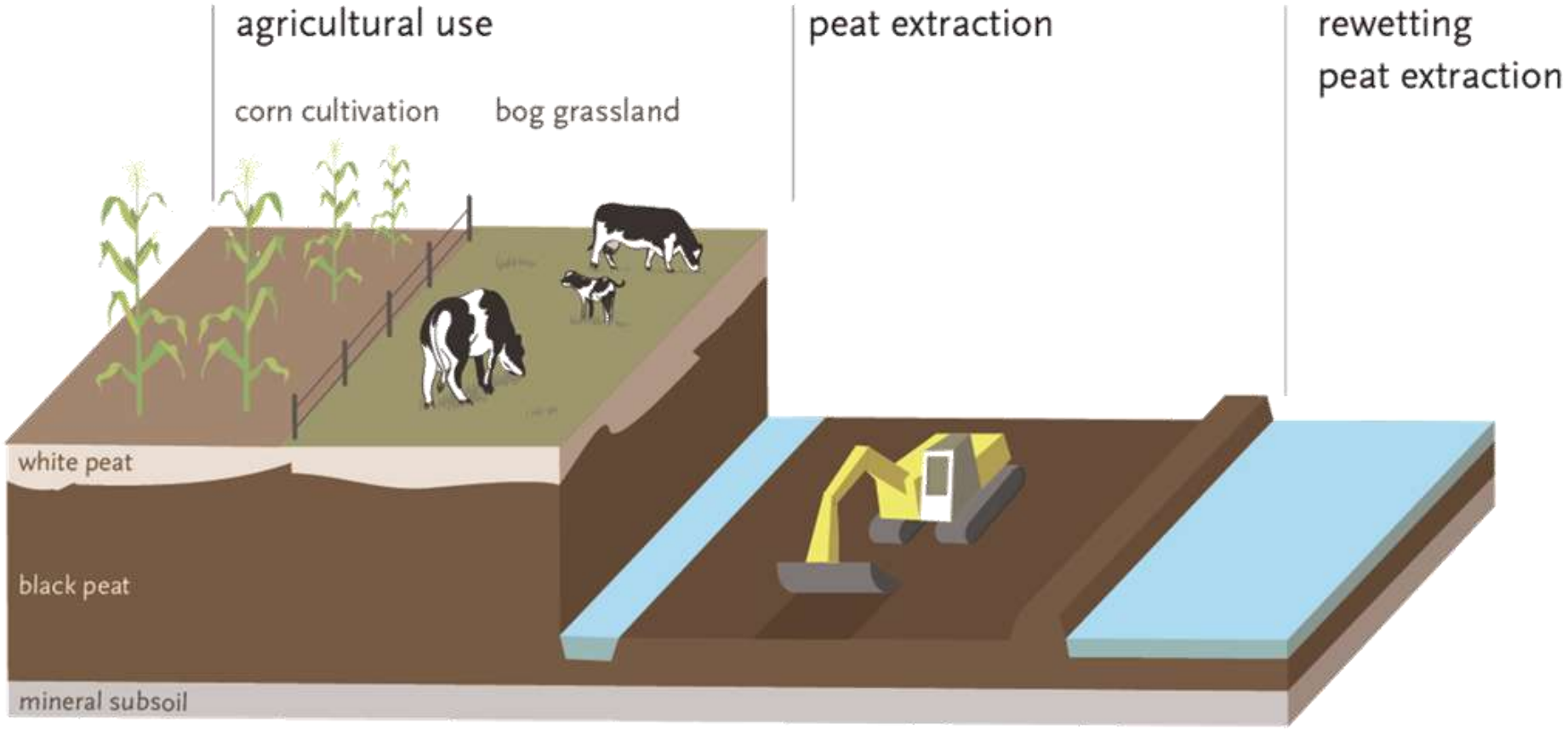

Mosaic of different Sphagnum farming types on degraded bogs

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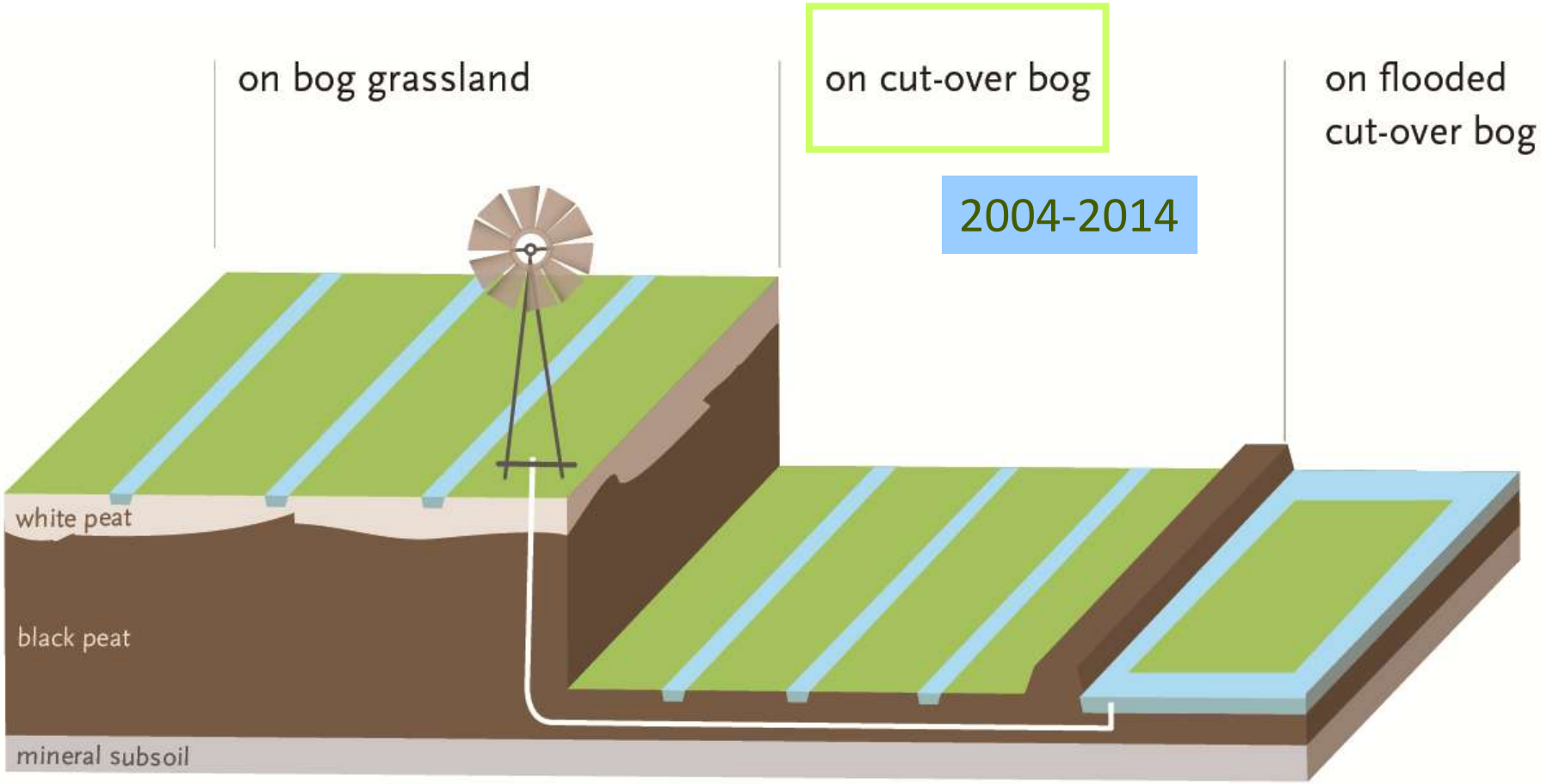


pilot site cut-over bog

in NW Germany: Ramsloh

- oceanic climate
- mild winters
- ∅ 9.6°C, 844 mm

study site cut-over bog: before installation

June 2004

Foto: D. Kamermann

study site cut-over bog: site preparation

November 2004

Foto: D. Kamermann

study site cut-over bog: spreading of mosses and straw

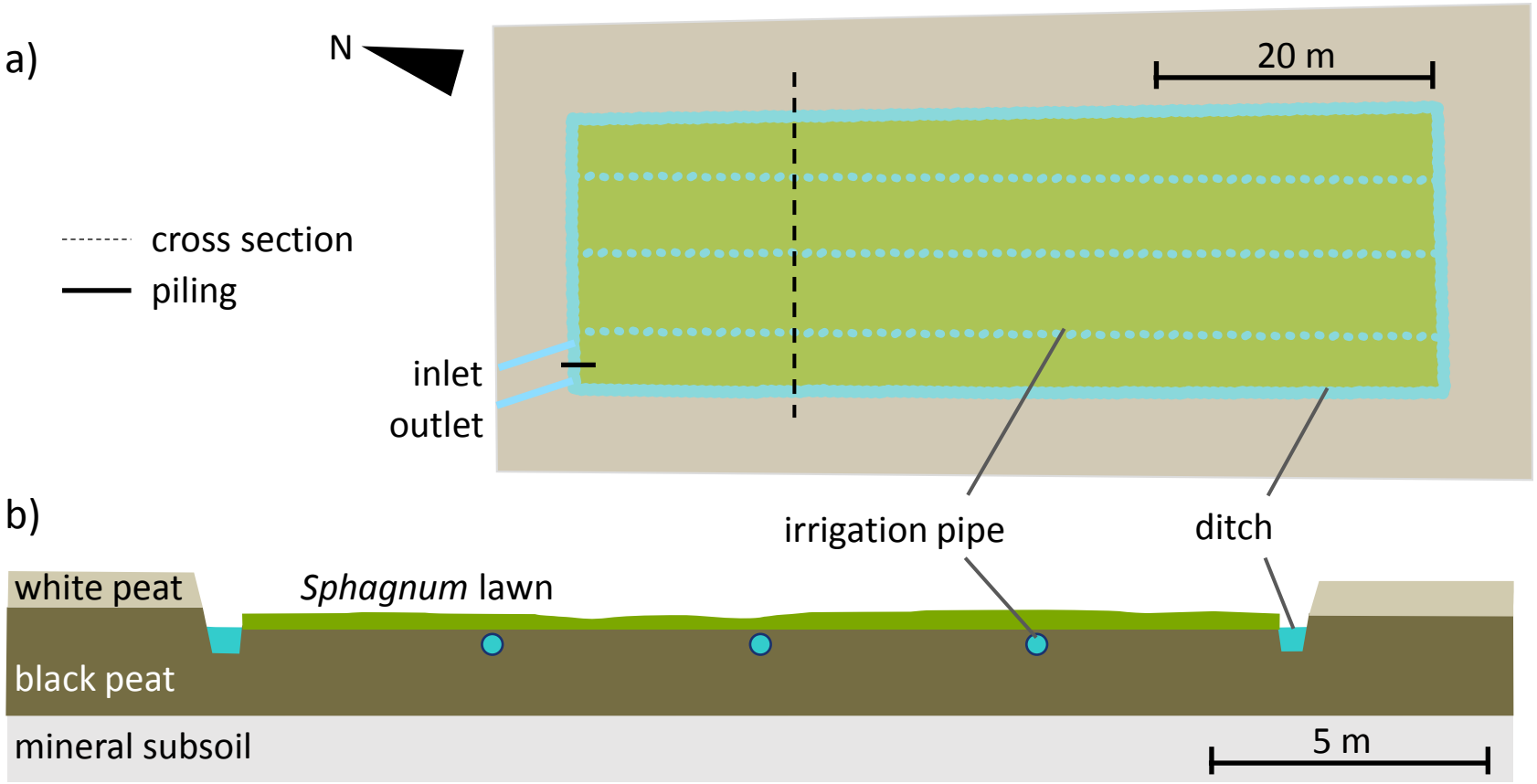
- *Sphagnum papillosum*
- fragment length 0.5-2 cm
- initial cover ~95% (brownish mosses)

Foto: D. Kamermann

study site cut-over bog: after installation

November 2004

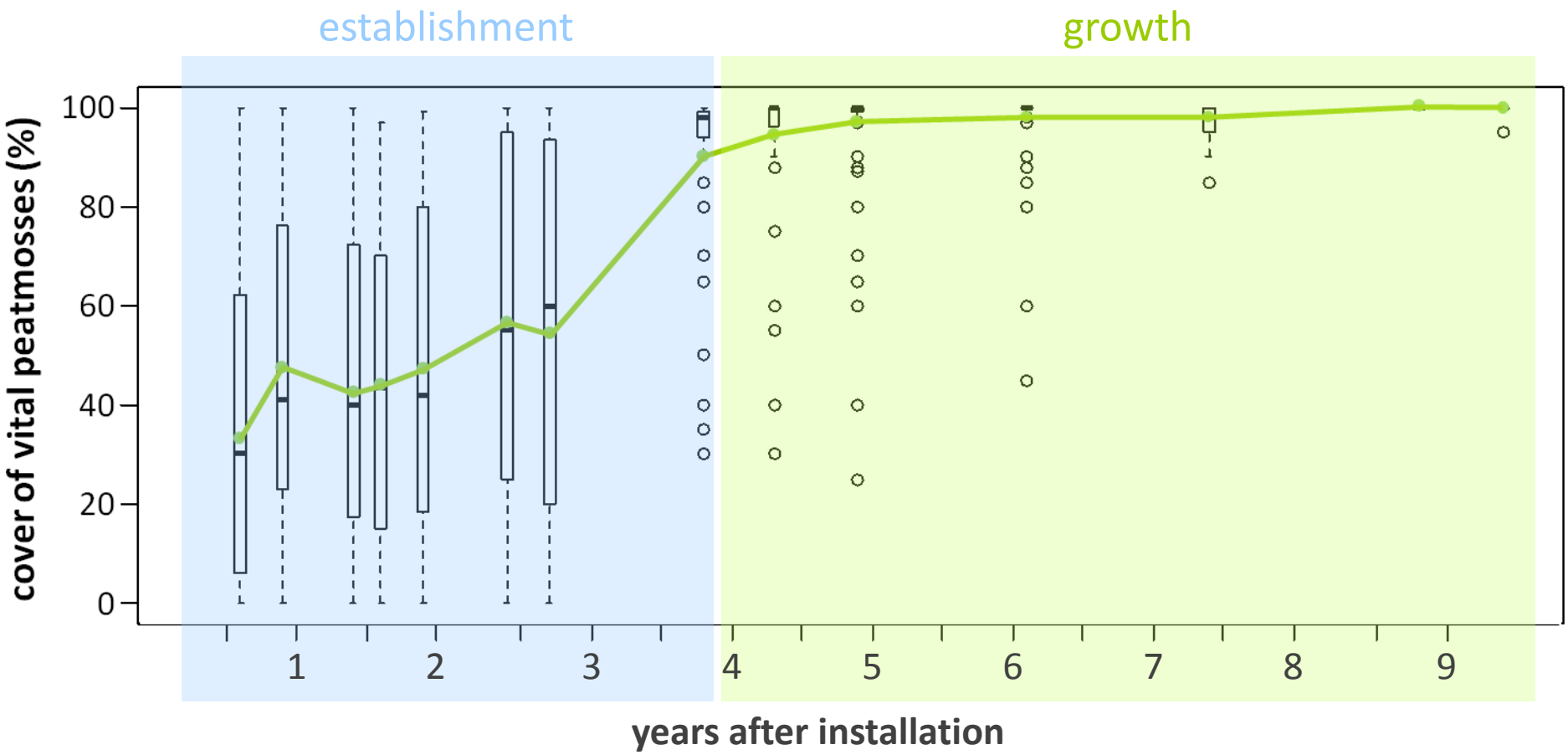
study site cut-over bog: schematic view



- Size: ca. 60x20 m
- Irrigation: pipes every 5 m and surrounding ditch
- On black peat (H7), ca. 1.8 m thick

Gaudig *et al.* 2017, Mires & Peat

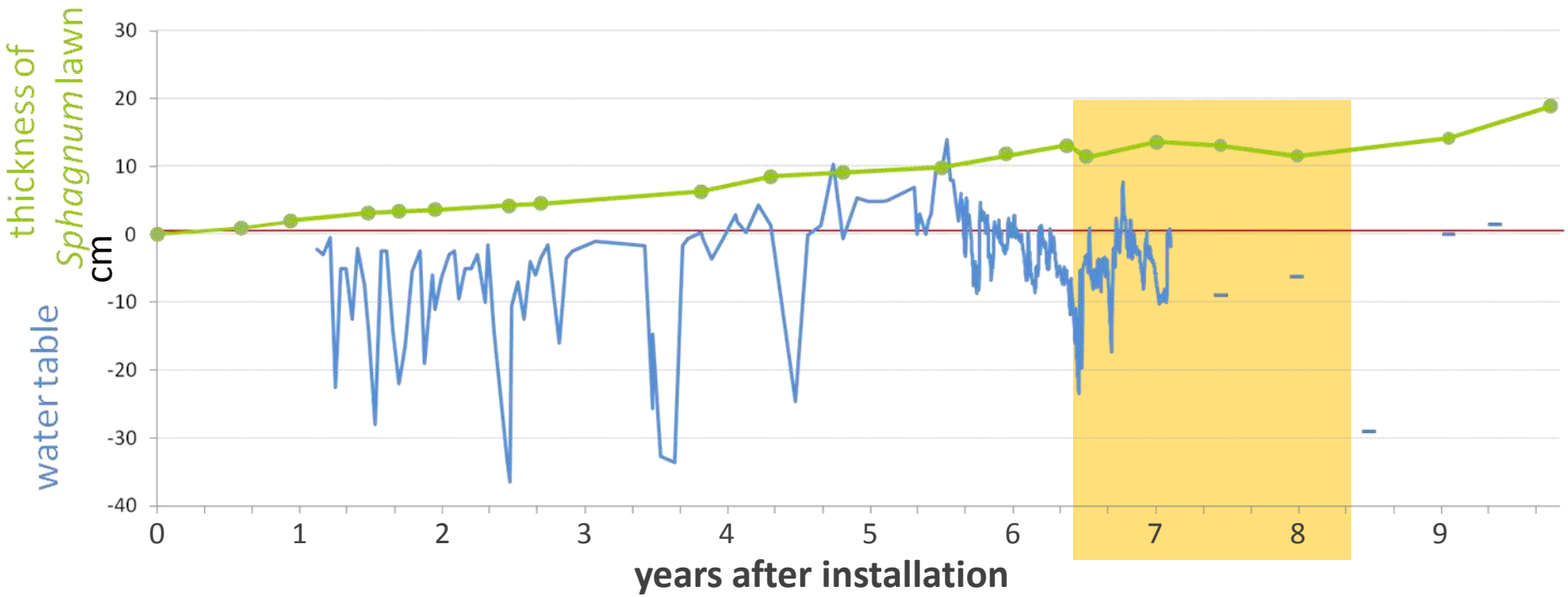
Sphagnum papillosum cover



- Continuous increase of vital (green) *Sphagnum papillosum* cover
- Established after 45 months (3.75 years)

Gaudig *et al.* 2017, Mires & Peat

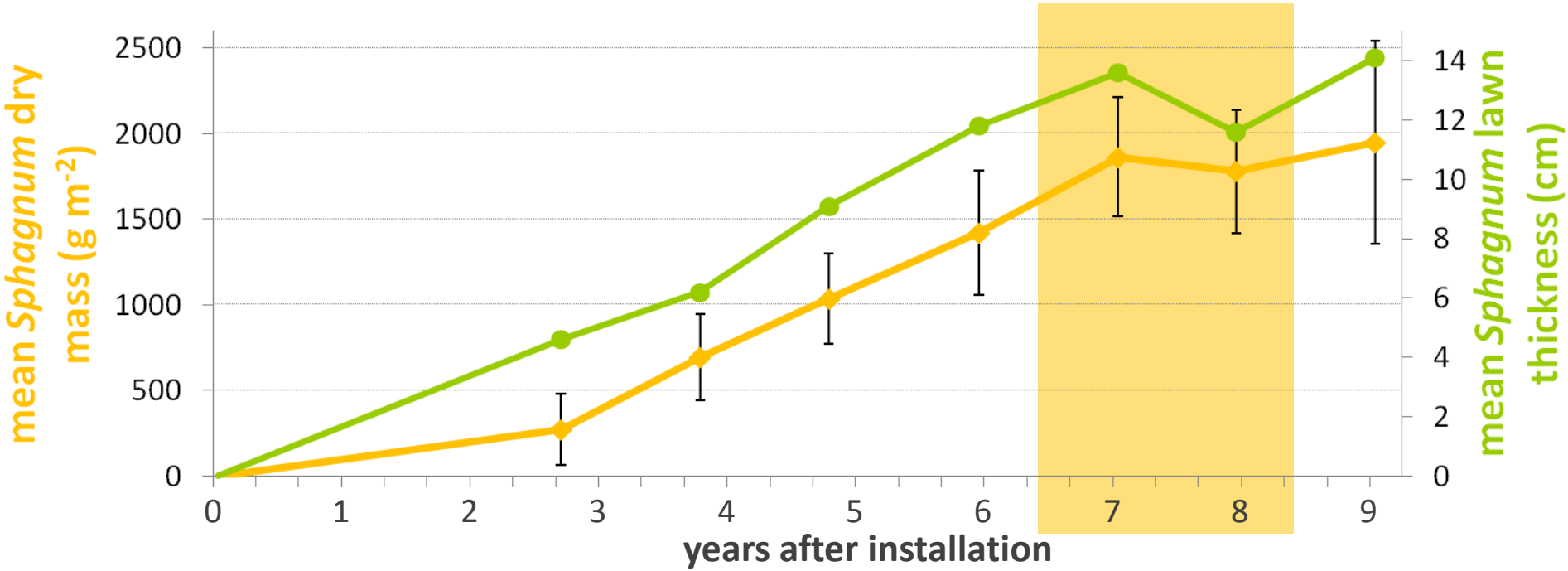
S. papillosum lawn thickness and water table



- Continuous growth of *Sphagnum papillosum* lawn
- Up to 19 cm (mean) after 10 years
- Stagnation period = dry conditions

Gaudig *et al.* 2017, Mires & Peat

S. papillosum biomass and lawn thickness



- Growth in biomass and lawn thickness is related
- Low productivity during establishment phase + stagnation at dry cond.
- Biomass after 9 years: 19.5 t ha^{-1} = 2.2 t ha^{-1} yr^{-1}
- Max. biomass productivity 6.9 t ha^{-1} yr^{-1}

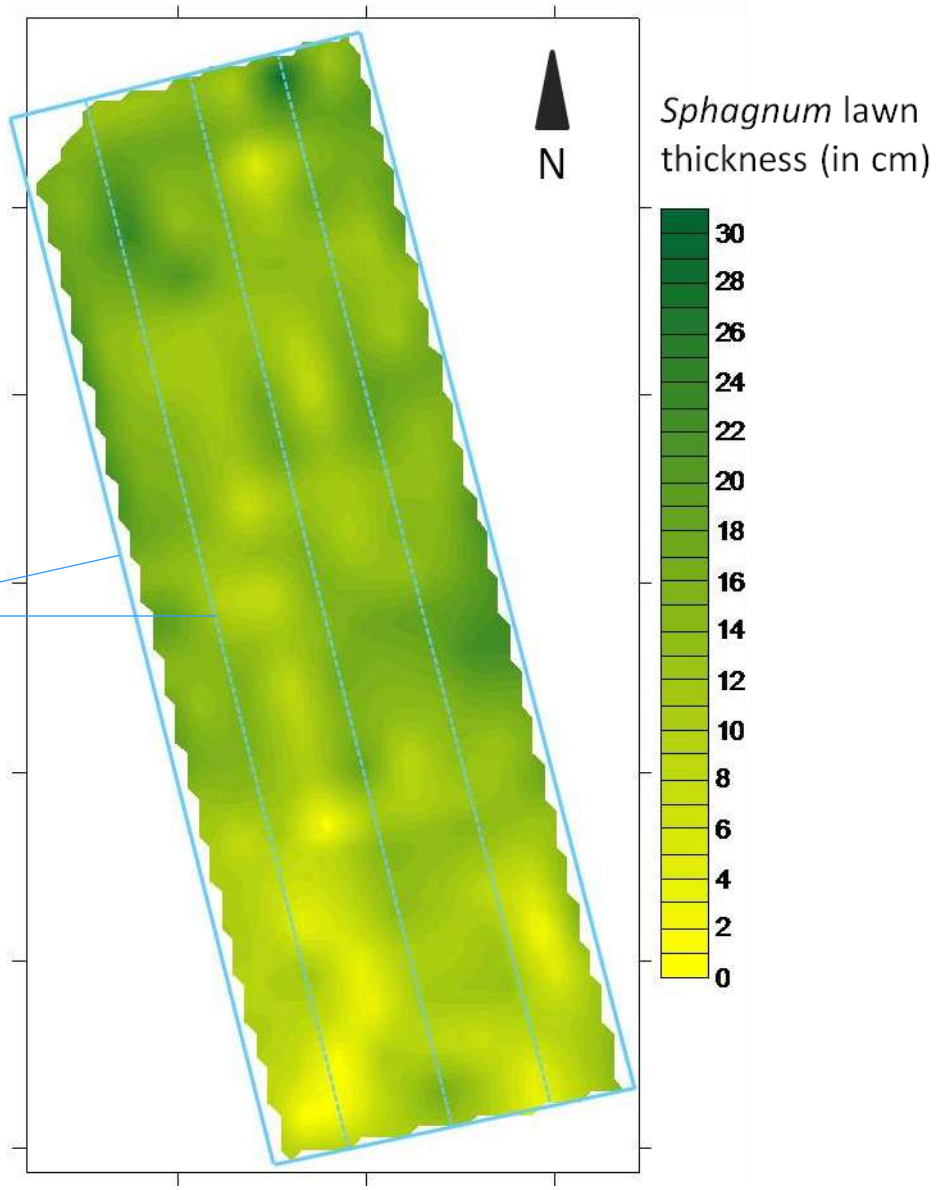
Gaudig *et al.* 2017, Mires & Peat

Lawn thickness 6.5 years after installation

Sphagnum lawn thickness

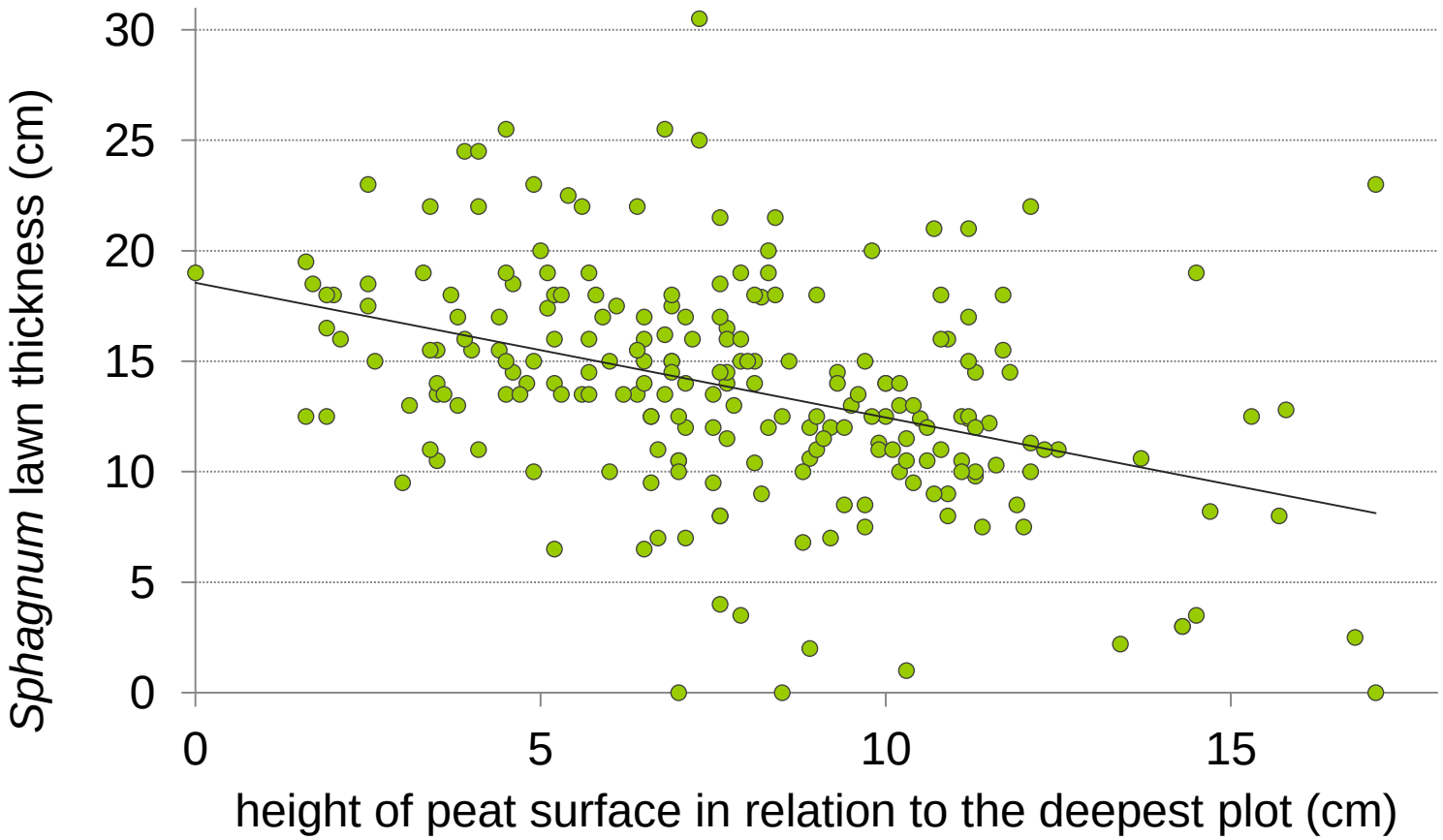
- higher the closer to the irrigation system (P<0.001)

irrigation system



Gaudig *et al.* 2017, Mires & Peat

Lawn thickness 6.5 years after installation



- the higher the peat surface, the lower *Sphagnum* lawn thickness ($P < 0.001$, $r = -0.4$)
  → height of peat surface as a proxy for water supply

Gaudig *et al.* 2017, Mires & Peat

…Let it grow! → How?

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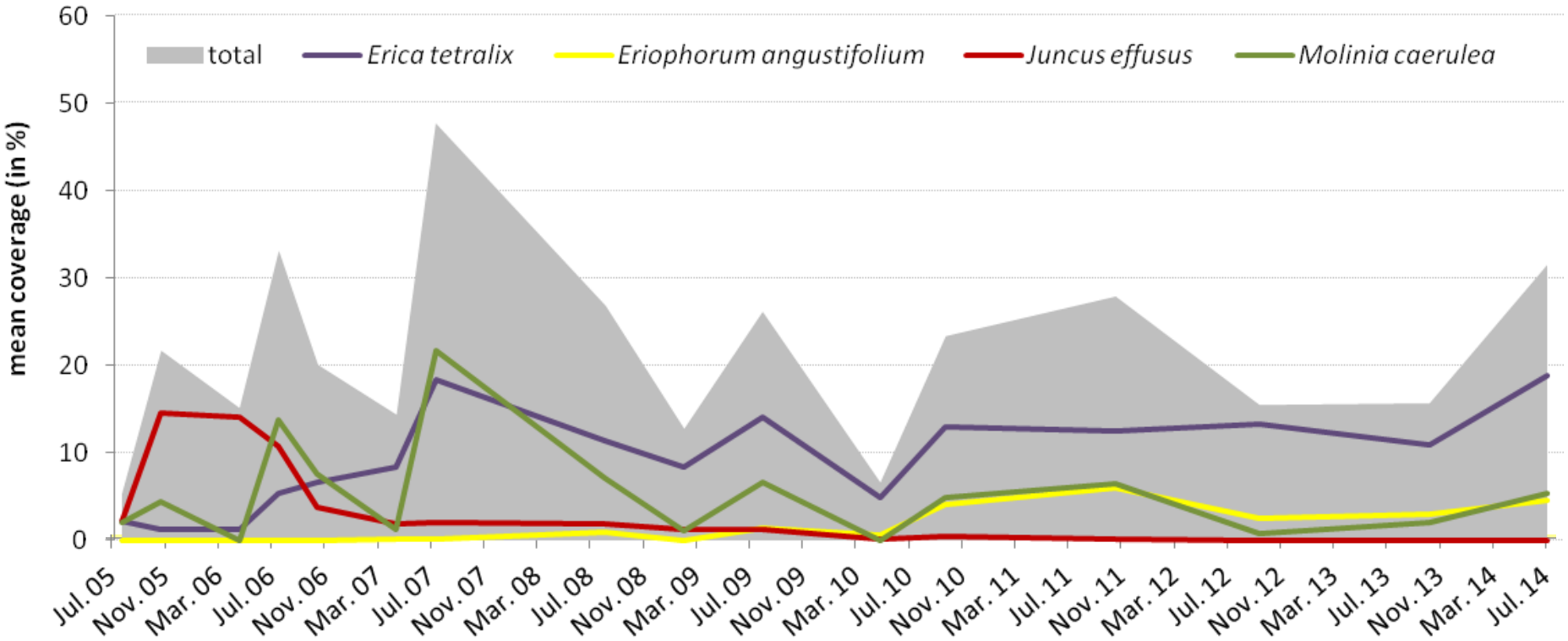
→ most important factor for high *Sphagnum* yields:

- constant high water table

Gaudig *et al.* 2017, Mires & Peat

Vascular plant cover



- mean total cover declined in the long term by regularly mowing
- *Juncus effusus* disappeared, increase of *Erica tetralix*
- no retarding effect on *Sphagnum* growth

Gaudig *et al.* 2017, Mires & Peat

...Let it grow! → How?

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→ important factors for high *Sphagnum* yields:

- constant high water table
- low vascular plant and litter cover
- straw cover thickness < 3 cm

Gaudig *et al.* 2017, Mires & Peat

Mosaic of different Sphagnum farming types on degraded bogs

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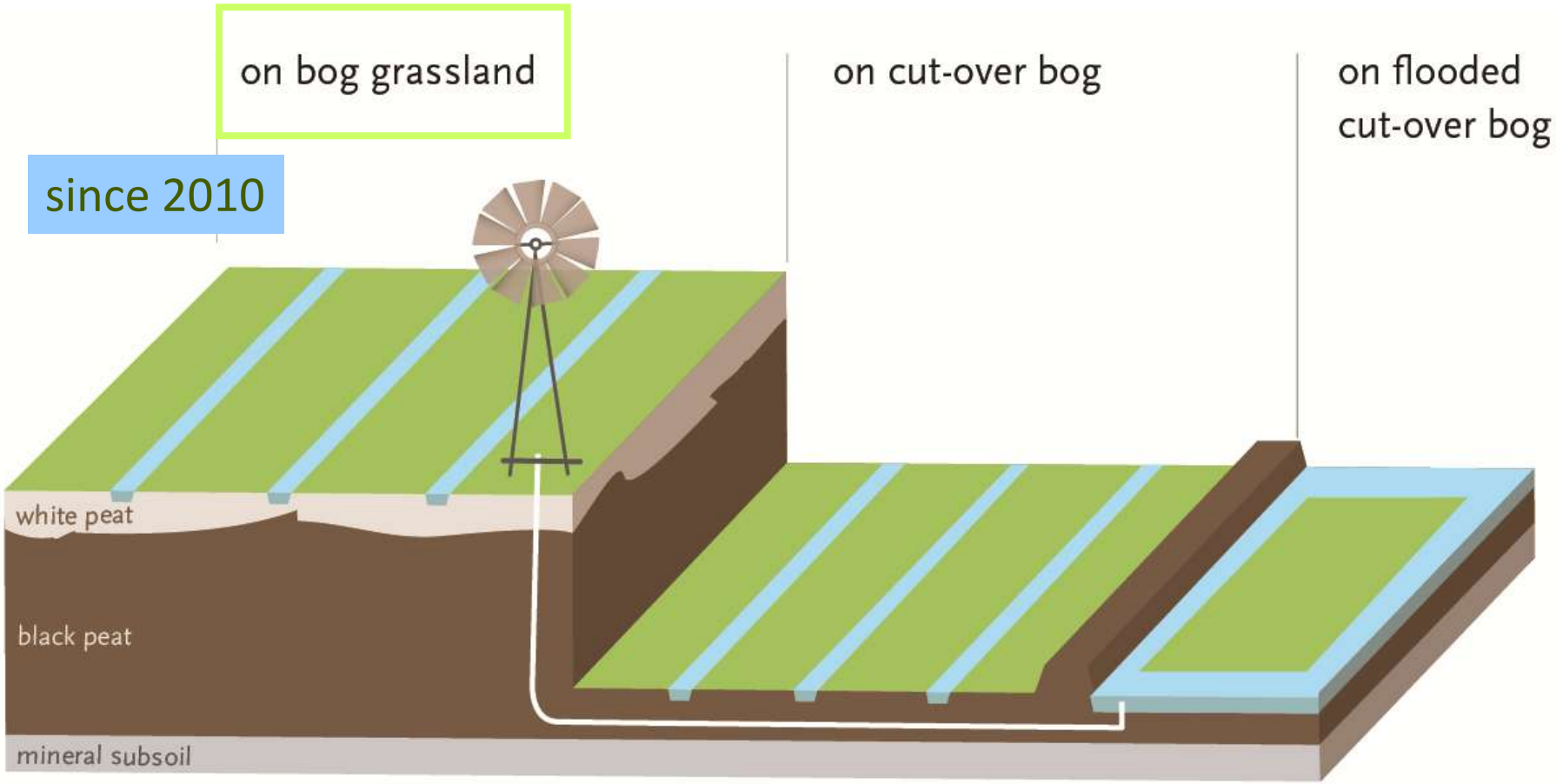

study site bog grassland: before installation

October 2010

Foto: G. Gaudig

study site bog grassland: site preparation

April 2011

Foto: G. Gaudig

study site bog grassland: spreading of mosses and straw

study site bog grassland: after installation

June 2011

Foto: M. Krebs

study site bog grassland: 3 years after installation

Comparison of Sphagnum farming types

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		cut-over bog	bog grassland
tested ***Sphagnum* species**		*S. papillosum*	*S. papillosum* *S. palustre* *S. fallax*
established lawn (years after installation)		3.75	1.5
dry mass **productivity** (t ha^{-1} yr^{-1})	mean	2.2	4.7
	max.	6.9	8.6
		Gaudig *et al.* 2017	preliminary results

Comparison of Sphagnum farming types

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		cut-over bog	bog grassland
water tables (cm below *Sphagnum* surface)	mean	14.3	7.6
pump system for irrigation*		windmill	electronic
peat **decomposition** degree		H7-8 ‚black peat‘	H2-5 ‚white peat‘

*Wichmann *et al.* 2017 Gaudig *et al.* 2017 preliminary results

Comparison of Sphagnum farming types

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	cut-over bog	**bog grassland**
area potential in Germany	~500 ha	~90.000 ha
climate protection potential	+	+++

→ Bog grassland with highest potential in Germany

Wichmann *et al.* 2017, Mires & Peat

Sphagnum farming on 14 ha in ‘Hankhauser Moor’

→ 40,000 ha necessary
to substitute 3 Mio m^3 white peat
in Germany annually

Foto: lensescape.org

Sphagnum farming at RRR2017

2b	Sustainable harvesting of *Sphagnum magellanicum* moss in Chile: a case analysis | Christel Oberpaur
2b	From natural peat moss to a commercial growing media constituent | Jan Köbbing
3b	Paludiculture and freenhouse gases: case studies from three sites in Germany | Anke Günther
4a	Economics of paludiculture: Sphagnum farming, reed harvesting and cattail cultivation | Sabine Wichmann
5b	Species protection by paludiculture: *Sphagnum* cultures as surrogate habitats | Matthias Krebs
5b	Performance of *Sphagnum* species in experimental extracted peatland restoration | Edgar Karofeld
5b	Protection for optimal *Sphagnum* growth | Martha Graf
6b	Sphagnum farming initiatives in Canada: an overview | Sandrine Hugron
6b	The water balance of a Sphagnum farming site in Germany | Kristina Brust
6b	Sphagnum farming in a eutrophic world: the importance of optimal nutrient stoichiometry | Ralph Temmink

+ poster


Thank you for your attention!
www.sphagnumfarming.com
Foto: G. Gaudig

Any questions?

Foto: Uni Greifswald