EUROPÄISCHE UNION

EUROPA FÜR NIEDERSACHSEN

SWAMPS

Erhalt von Moorgrünland durch angepasstes Management

LBEG Landesamt für Bergbau, Energie und Geologie

Submerged drains and peatland water levels

Results from two years of testing in a fen and a bog site in Lower Saxony

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Oldenburg, 19th February 2019

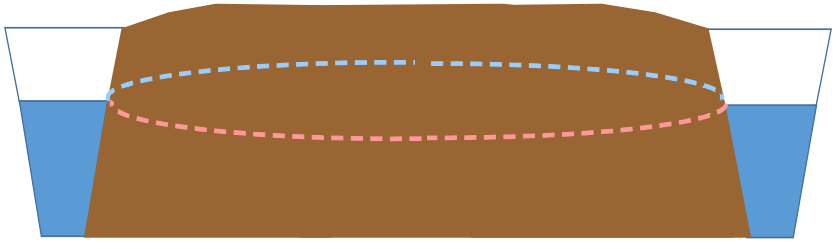
Why submerged drains?

- In Lower Saxony 0.2 Mha bogs and fens are drained for grassland and emit annually 5.4 Mt CO_2-eq. (21% of agriculture, 5.4 % of all sectors)
- Water levels 30 – 40 cm below surface are expected to reduce GHG emissions and allow for ongoing grassland management
- Such water levels are not possible by ditch blocking alone because of small water conductivity
- Submerged drains provide for direct water conducts from ditches into peatland

Hypothesis: Submerged drains support water regulation and help to keep summer peatland water levels high

Ditch blocking

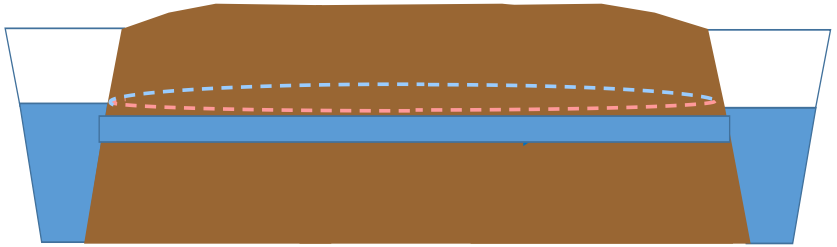
Winter



Summer

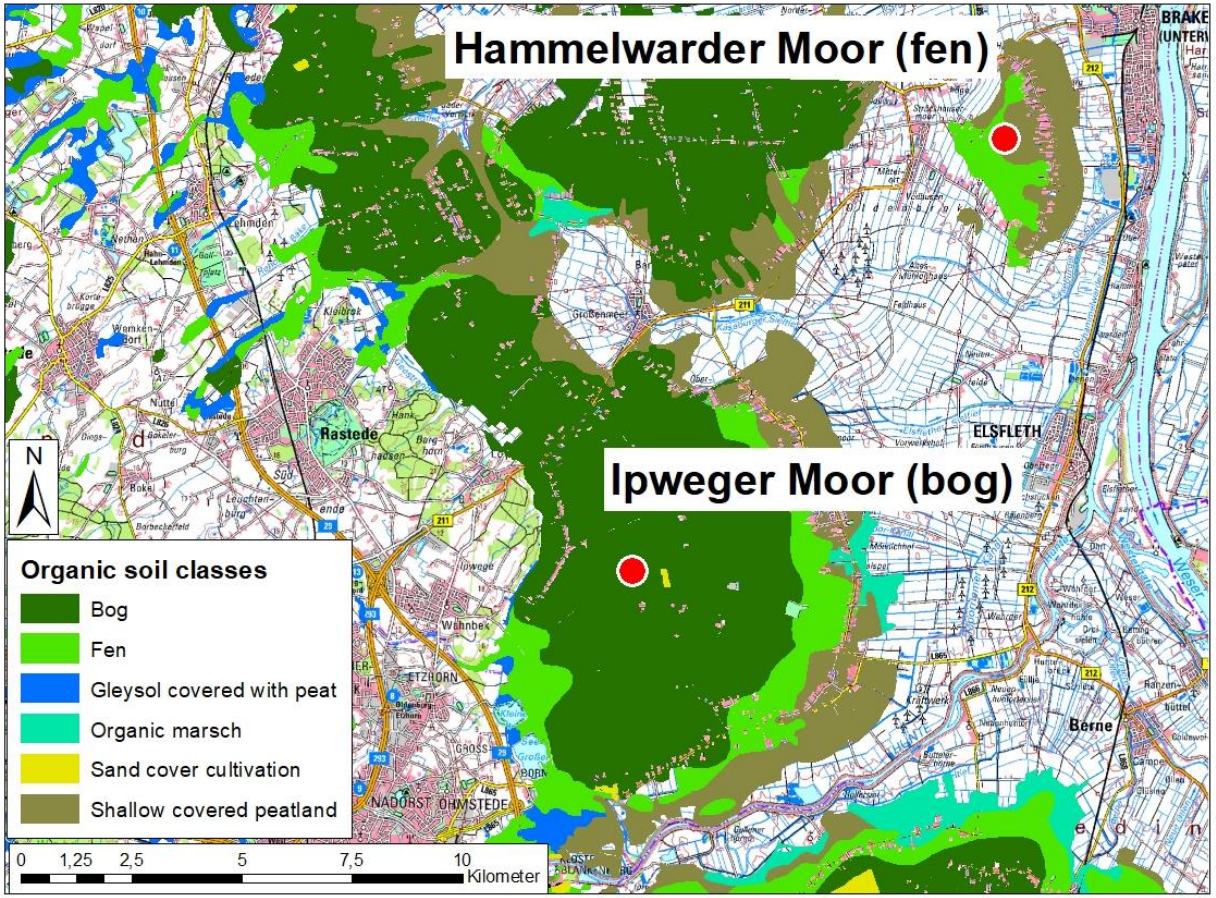
Submerged drains

Water moves faster out of the site



Water moves faster into the site

Research sites



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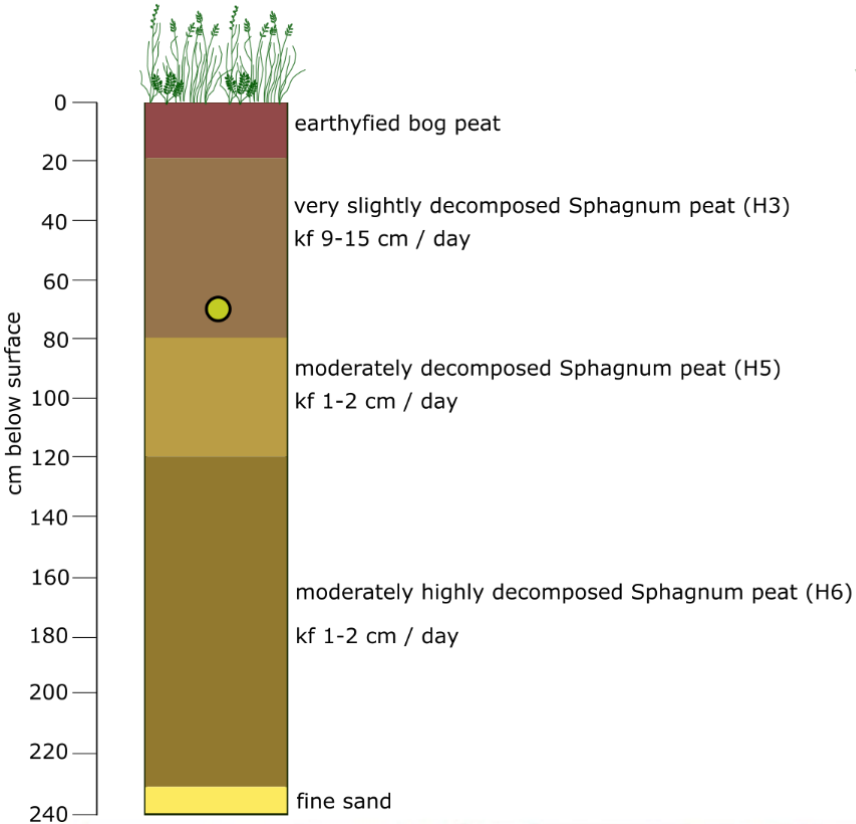
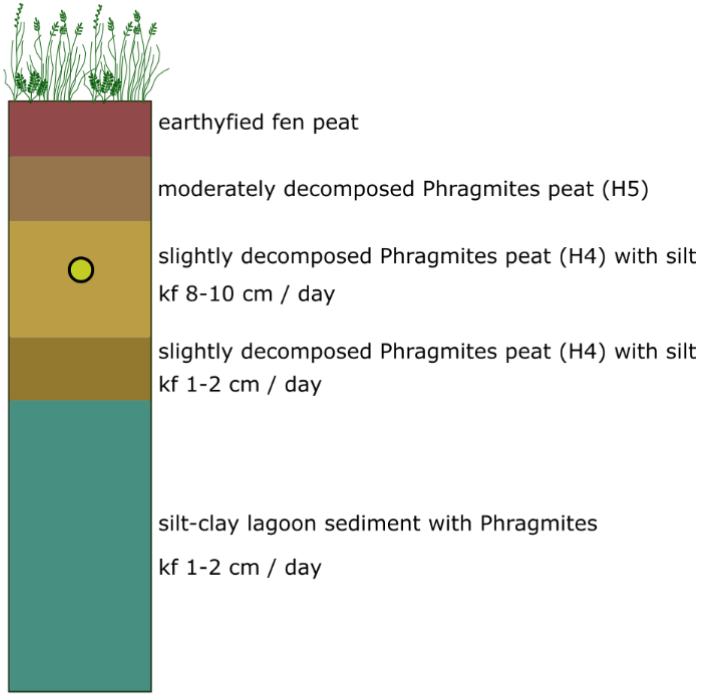
Bog – Ipweger Moor



Fen - Hammelwarder Moor



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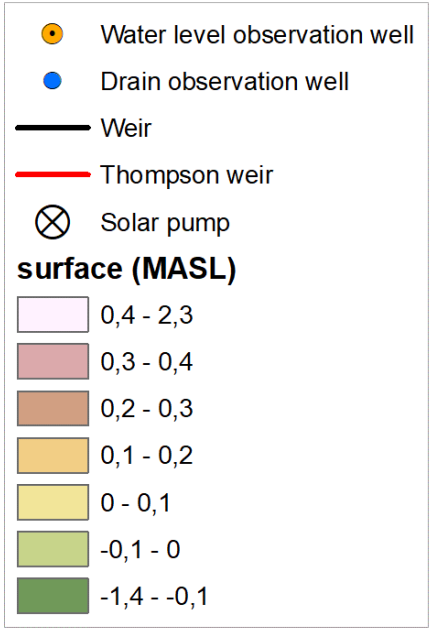
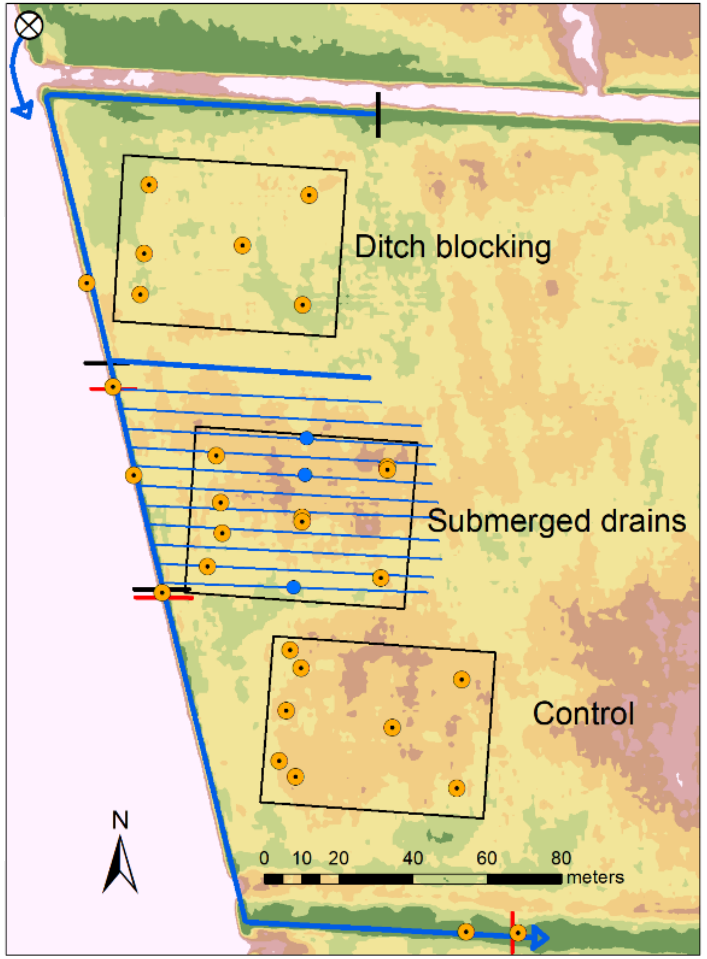
Bog - Ipweger Moor

Submerged drains

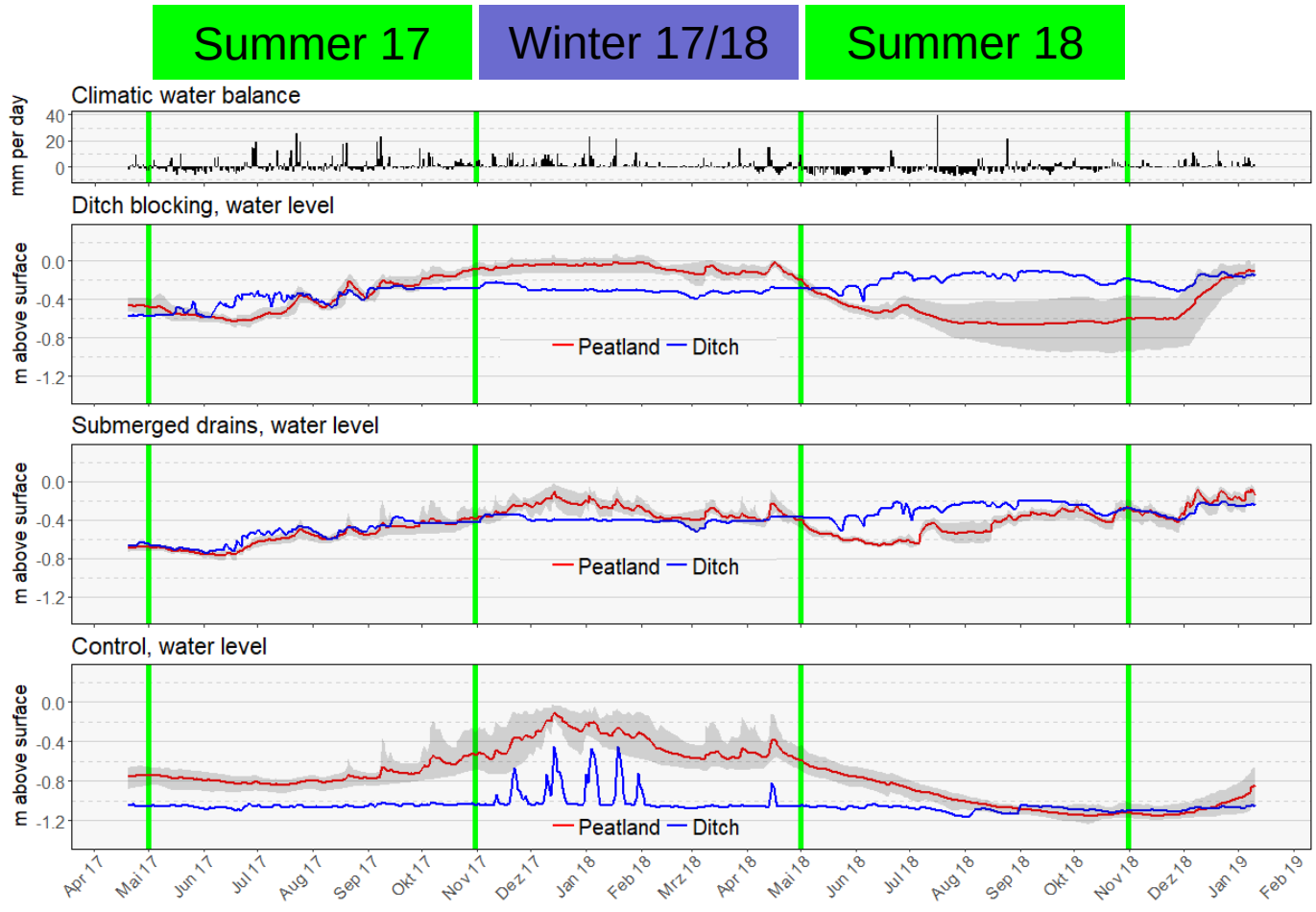
- diameter 8 cm
- depth below surface 70 cm
- distance between drains 5 m

Land surface at Ditch blocking is 8 cm below other treatments





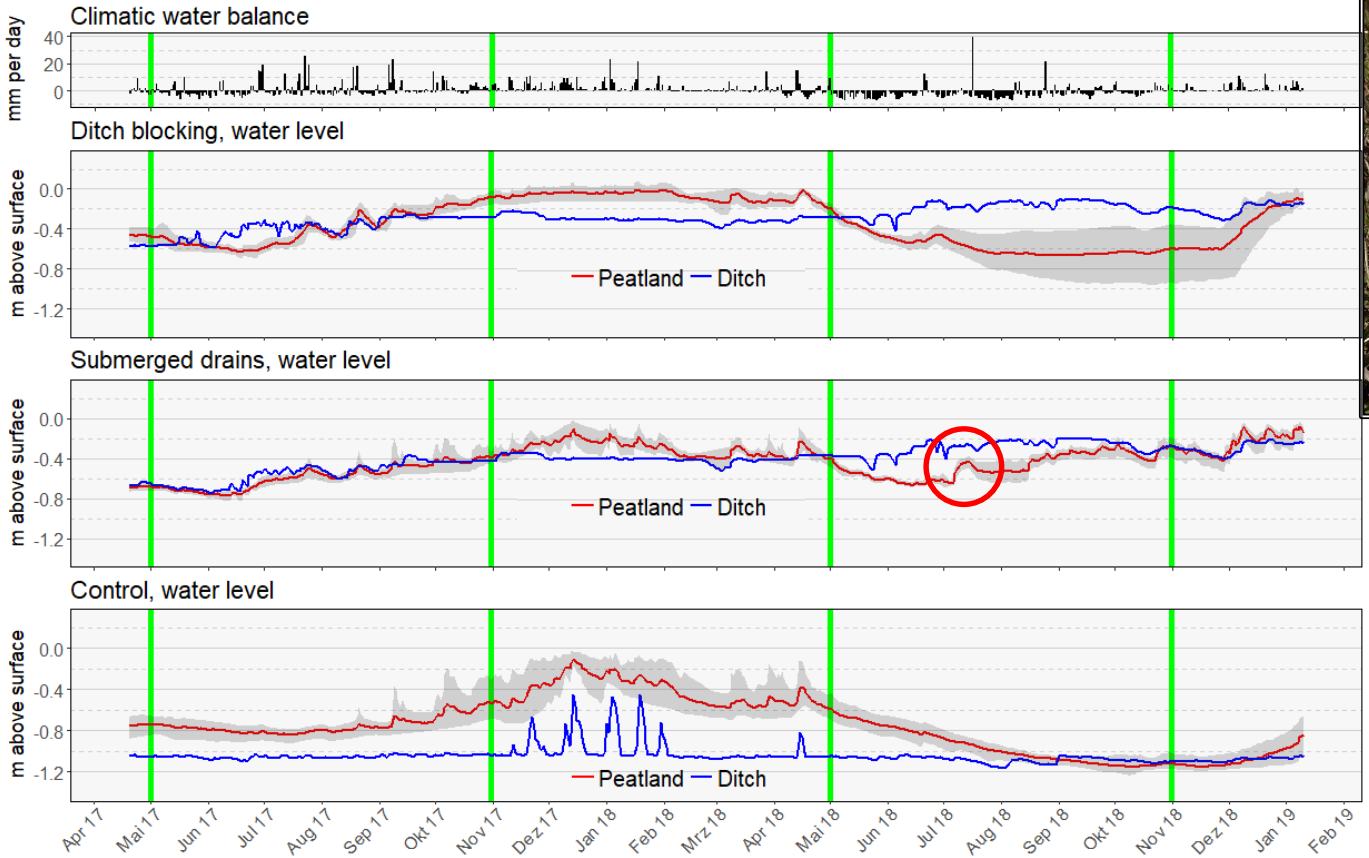
Bog - Ipweger Moor, water levels



Summer 2017	Winter 2017/18	Summer 2018
129	298	-359
-0.40	-0.07	-0.56
-0.39	-0.30	-0.19
-0.58	-0.30	-0.47
-0.54	-0.40	-0.29
-0.75	-0.42	-0.95
-1.05	-0.98	-1.08

Bog - Ipweger Moor, water levels

Summer 17 | Winter 17/18 | Summer 18



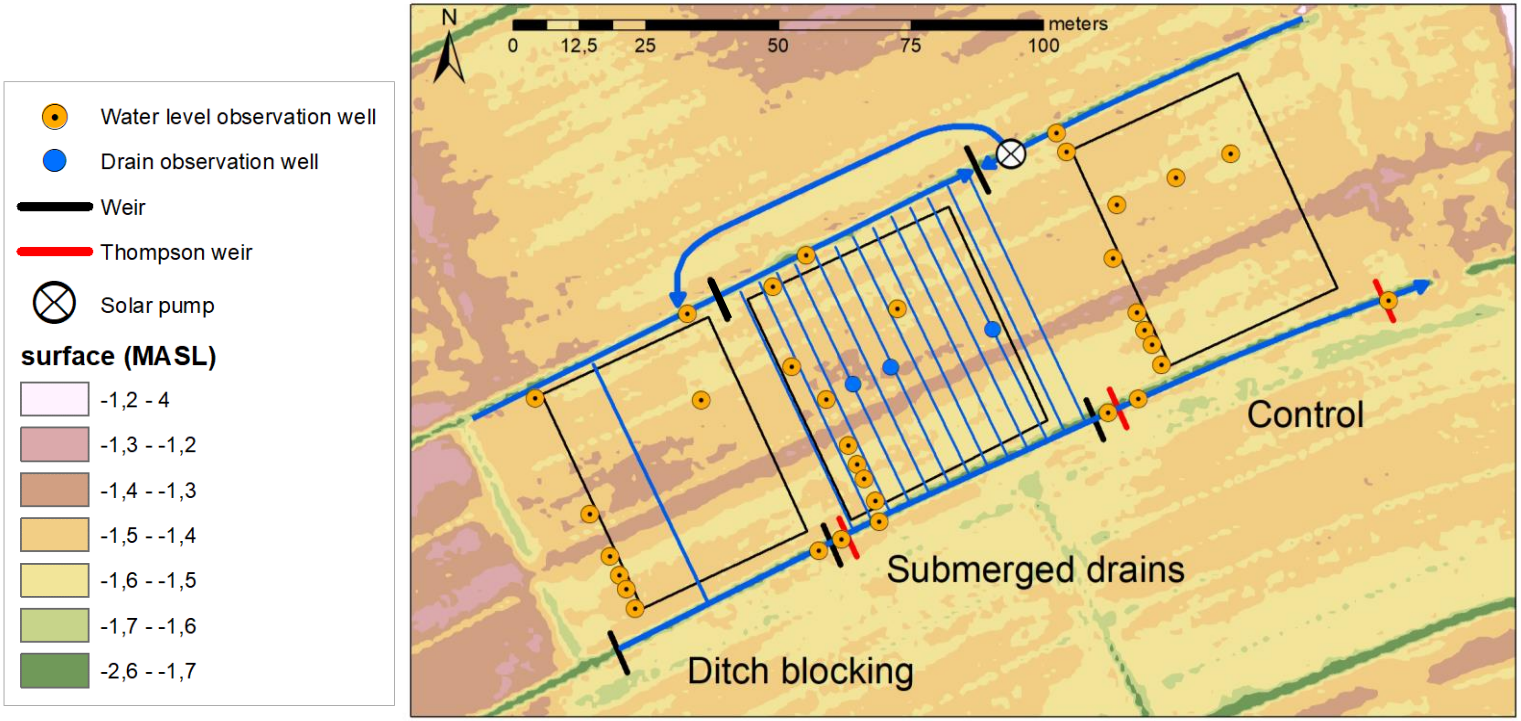
-0.58	-0.30	-0.47
-0.54	-0.40	-0.29
-0.75	-0.42	-0.95
-1.05	-0.98	-1.08

Fen – Hammelwarder Moor

Submerged drains

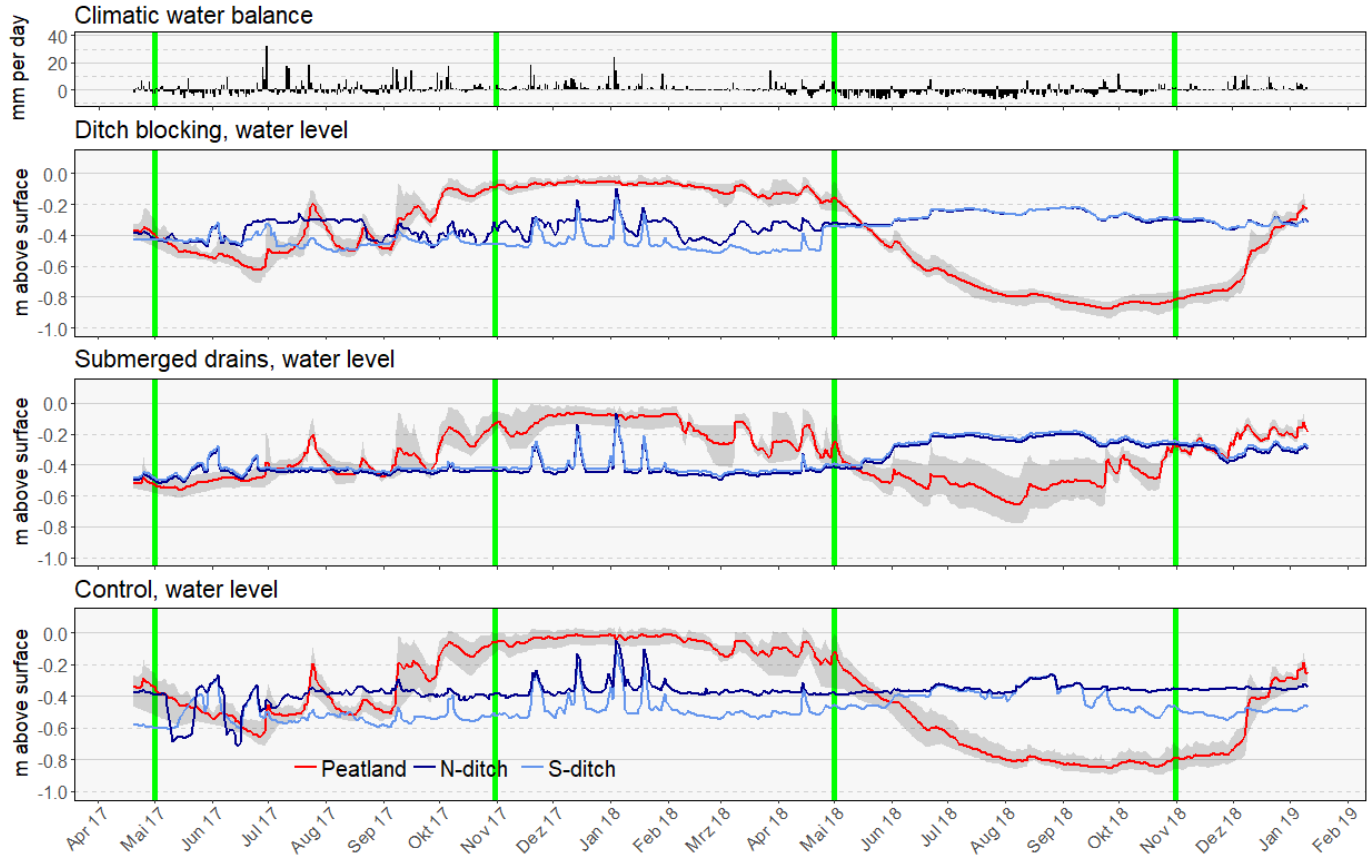
- diameter 8 cm
- depth below surface 55 cm
- distance between drains 4 m

Surface at Ditch blocking 4 cm above other treatments



Fen - Hammelwarder Moor, water levels

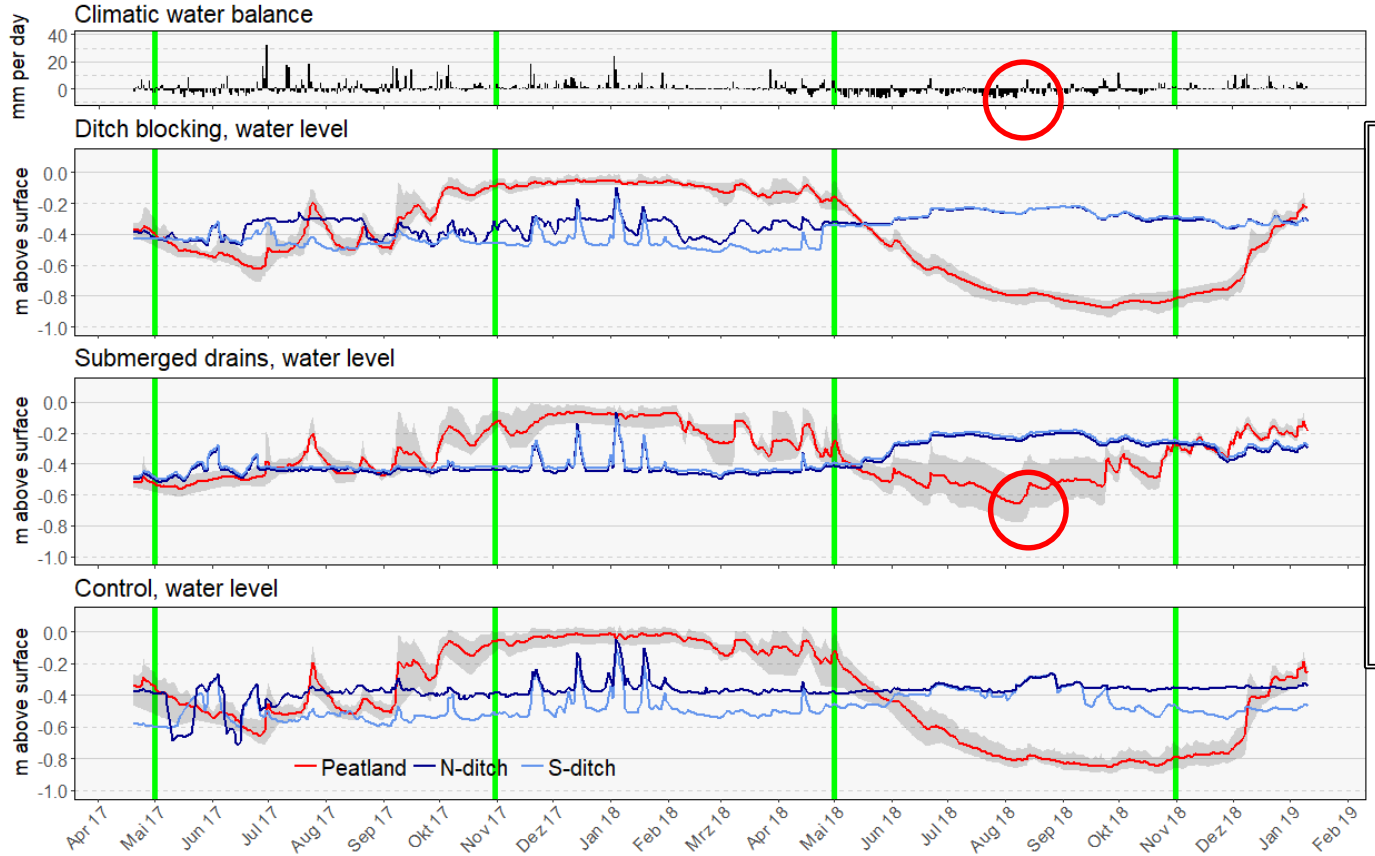
Summer 17 | Winter 17/18 | Summer 18



Summer 2017	Winter 2017/18	Summer 2018
91	264	-413
-0.39	-0.09	-0.68
-0.41	-0.40	-0.27
-0.40	-0.16	-0.49
-0.43	-0.42	-0.26
-0.39	-0.07	-0.68
-0.47	-0.41	-0.38

Fen - Hammelwarder Moor, water levels

Summer 17 | Winter 17/18 | Summer 18



Summer 2017	Winter 2017/18	Summer 2018
91	264	-413
-0.39	-0.07	-0.68
-0.47	-0.41	-0.38

13th August 10 mm rain, CWB + 6.6 mm

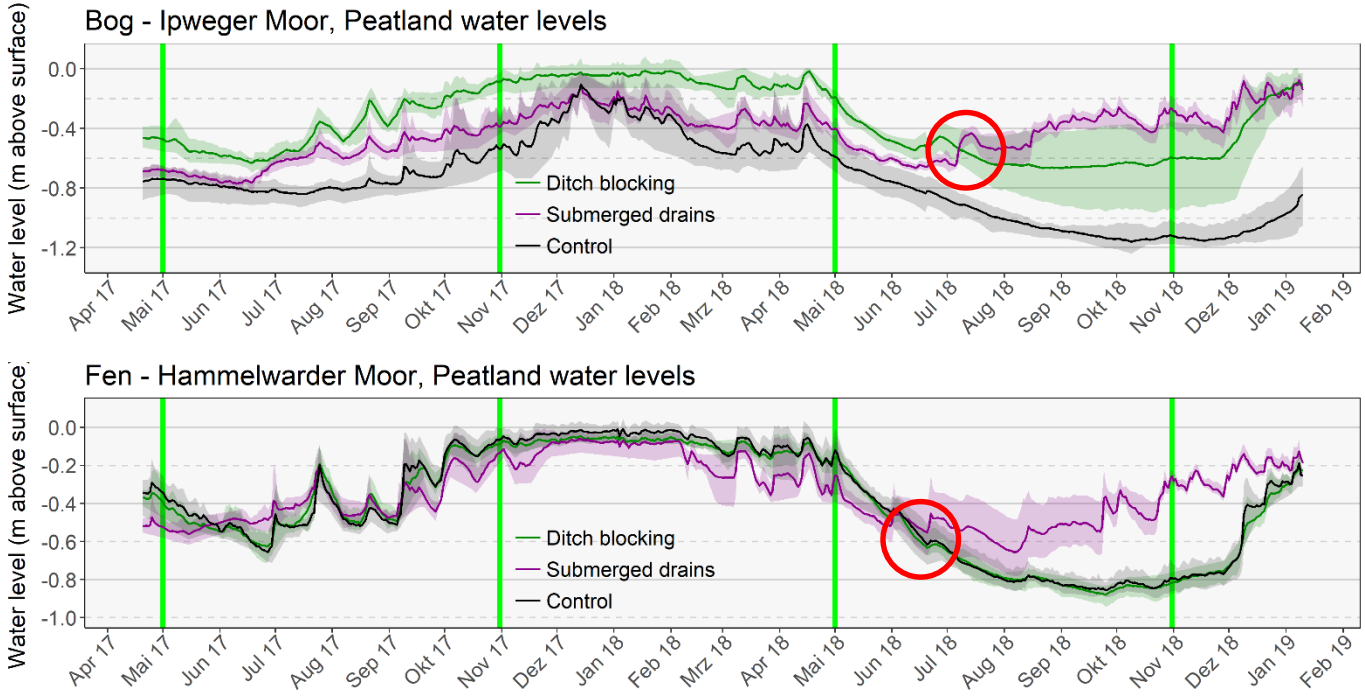
Mean monthly CWBs:

- May - 4.2 mm
- June - 2.0 mm
- July - 3.6 mm
- August - 2.1 mm
- September - 1.1 mm

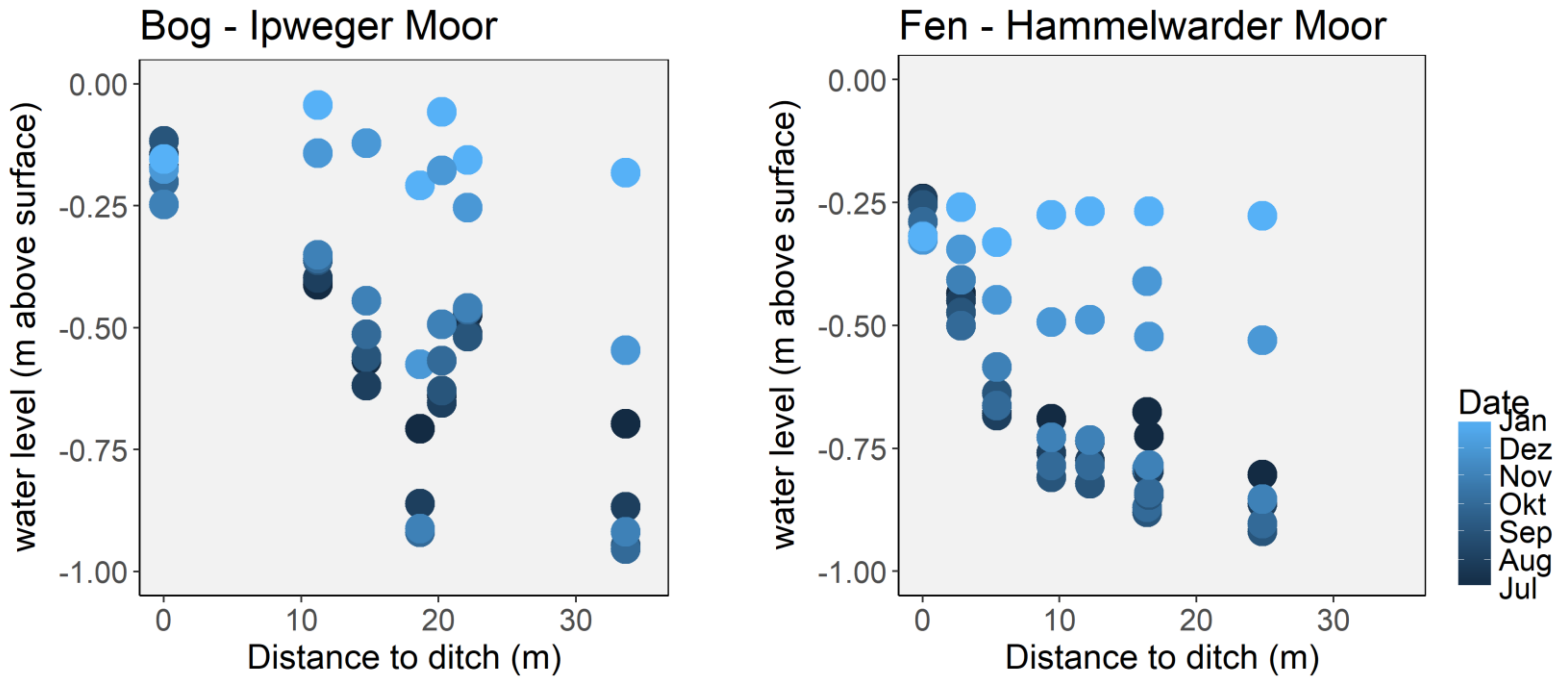
Summer 2018: - 2.2 mm

Peatland water levels

Summer 17 | Winter 17/18 | Summer 18

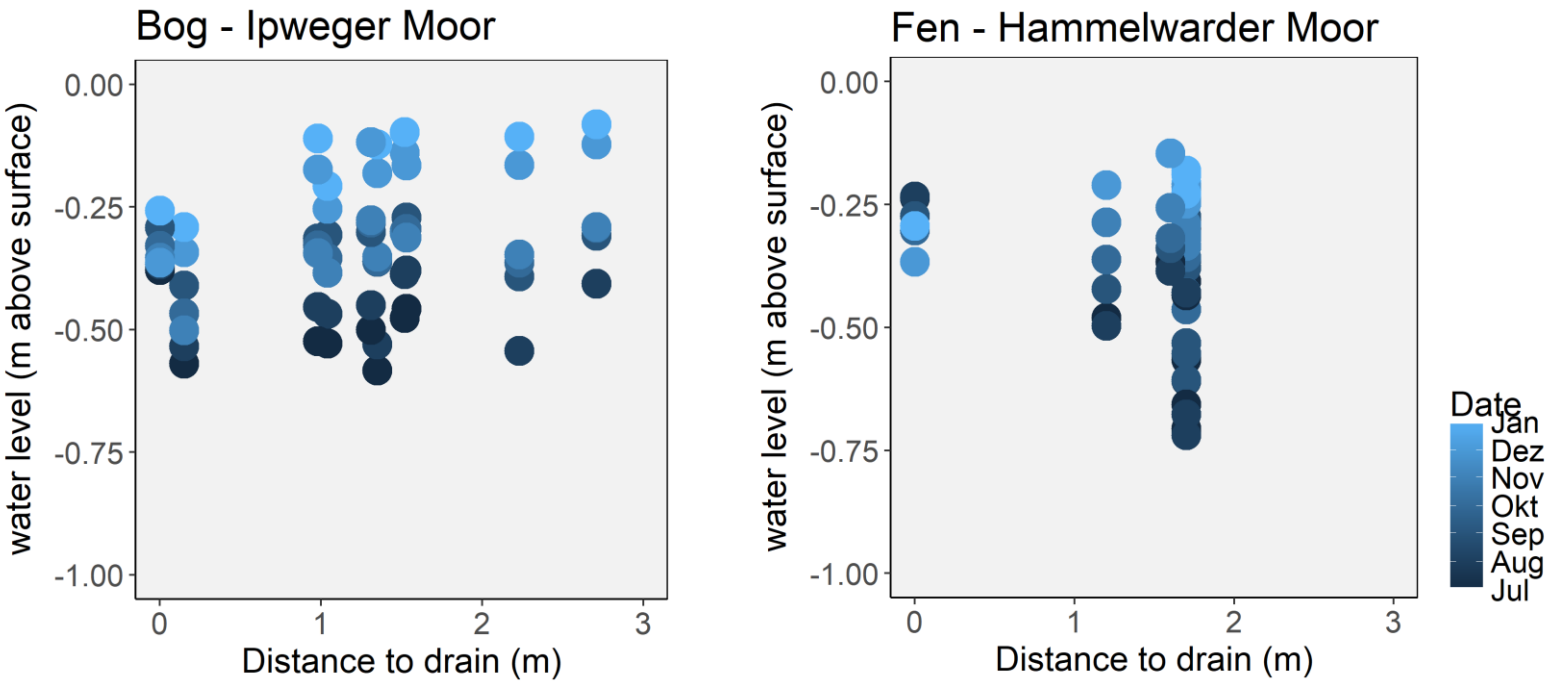


Ditch blocking



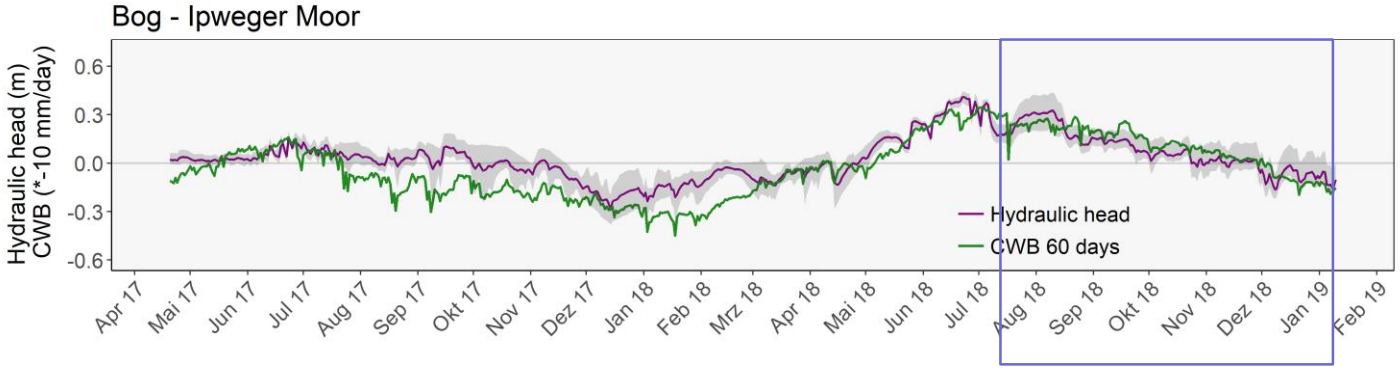
- Summer water levels decrease with distance to ditch

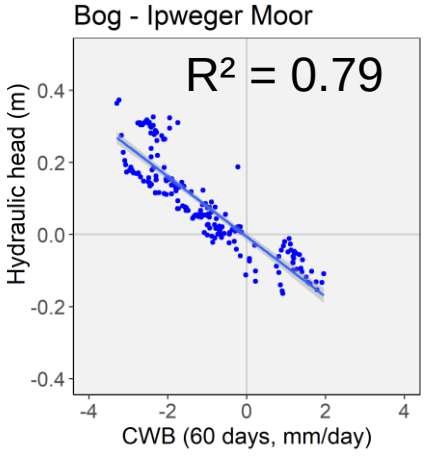
Submerged drains

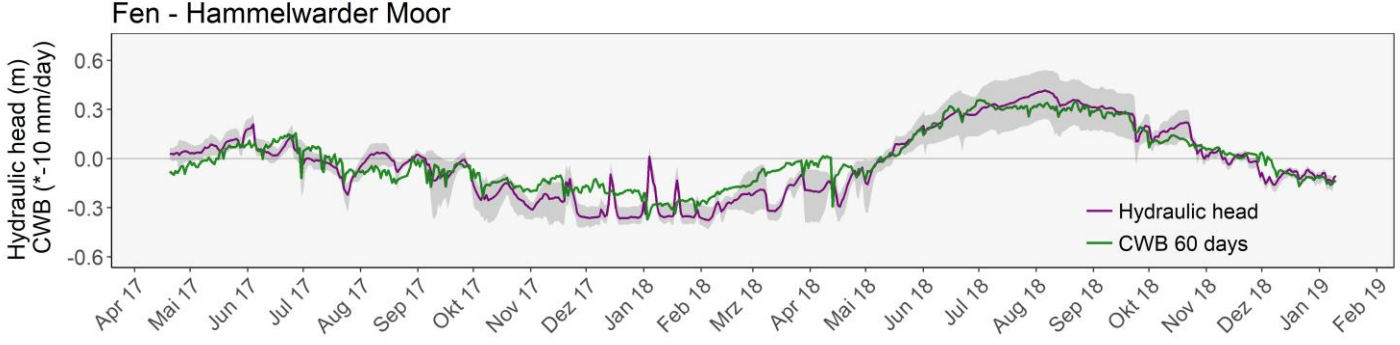


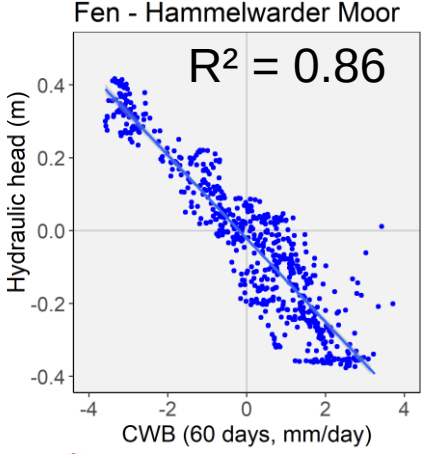
- Reduced distance to drain, small WL gradient in bog, large in fen

Hydraulic head is related to Climatic water balance

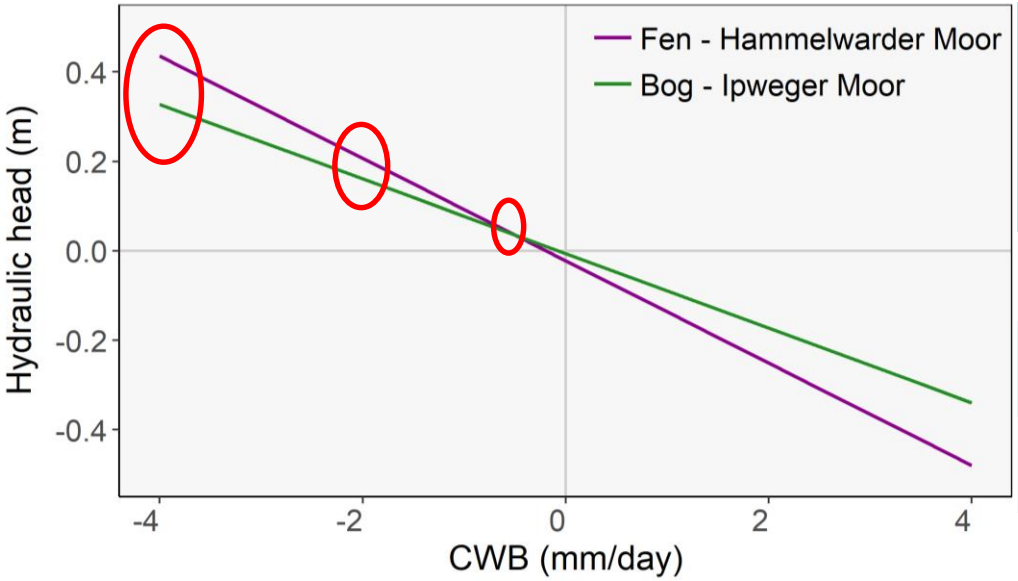








Hydraulic head required to achive target summer peatland water levels



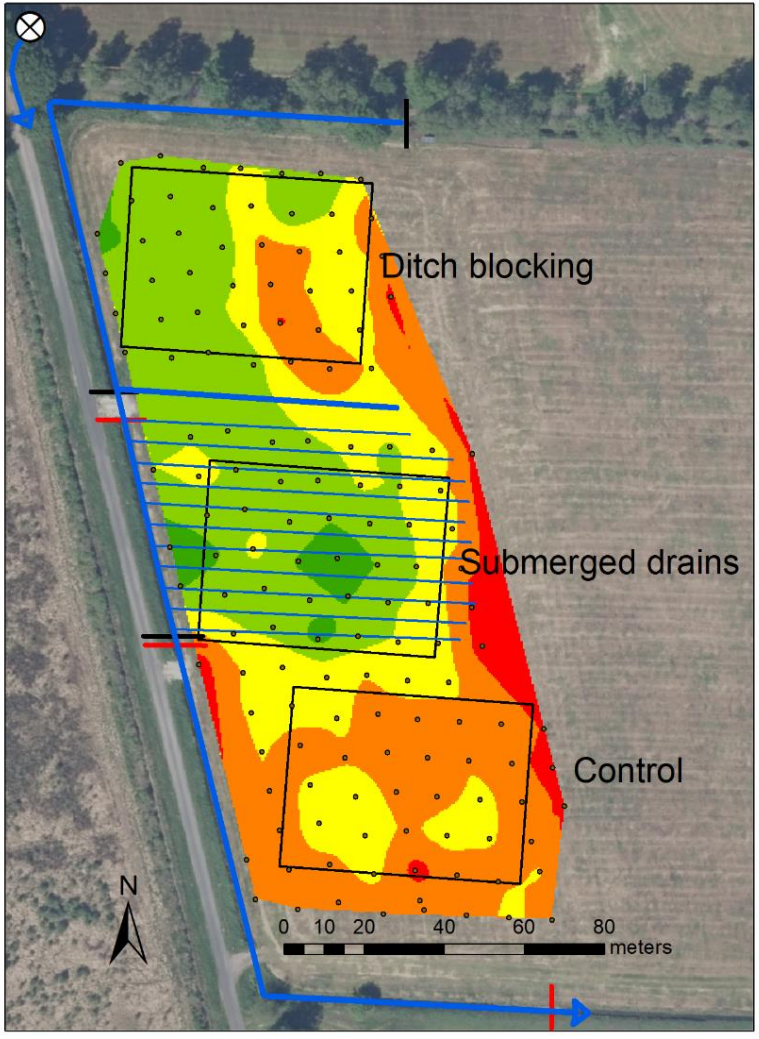
period	CWB (mm/d)	Hydraulic head (m)	
		Hammelwarder Moor *kf 8-10 cm/day*	Ipweger Moor *kf 9-15 cm/day*
May 2018	- 4	**0.44 m**	**0.33 m**
Summer 2018	- 2	**0.21 m**	**0.16 m**
Average summer	- 0.5	**0.04 m**	**0.04 m**

- CWB important for weir adjustment
- kf ≥ 10 cm/day is a minum in dry summers

Subsidence
Bog – Ipweger Moor

July 2016 to December 2018

Treatment	Mean (cm)	10% quantile	90% quantile	N
Ditch blocking	5.7	0.8	12.6	44
Submerged drains	4.3	-0.6	7.9	46
Control	11.5	7.9	14.7	48



Subsidence (m)

- 0,15 - 0,18
- 0,1 - 0,15
- 0,05 - 0,1
- 0 - 0,05
- -0,05 - 0

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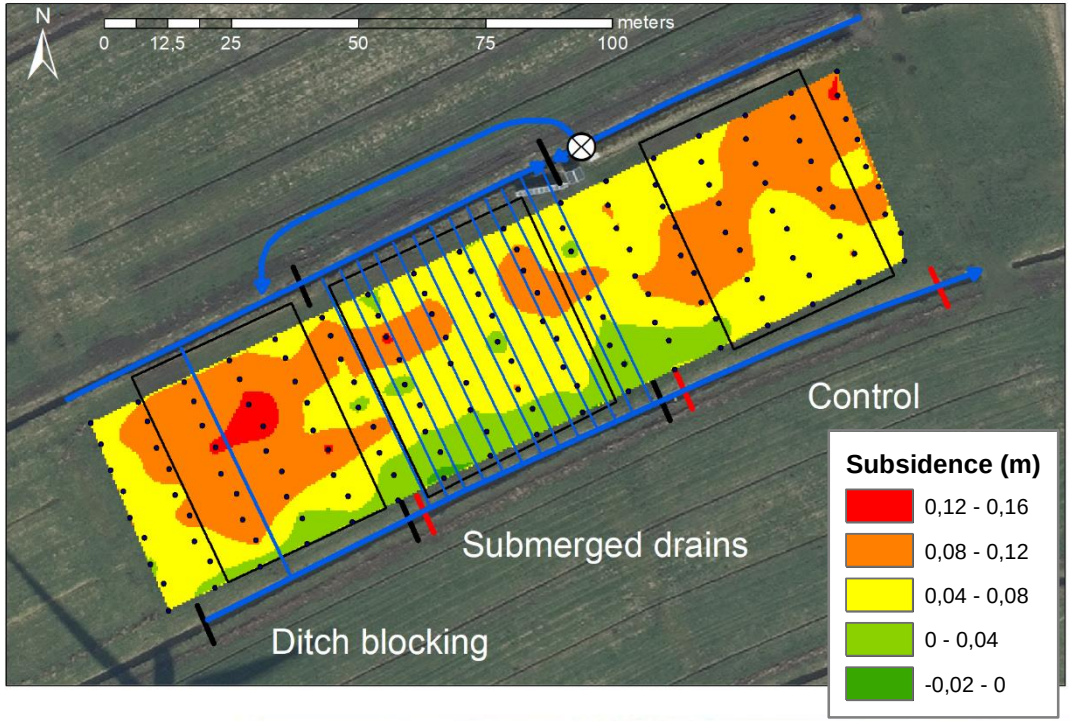
Subsidence
Fen – Hammelwarder Moor



July 2016 to January 2019

Treatment	Mean (cm)	10% quantile	90% quantile	N
Ditch blocking	7.8	3.5	11.6	45
Submerged drains	5.3	1.1	9.5	45
Control	7.9	4.3	10.6	45

Summary

- In the dry summer 2018 submerged drains provided for higher ground water levels as compared to ditch blocking and control.
- Submerged drains reduced subsidence; long term effects require further monitoring.
- Ditch blocking is an alternative, but too wet for farming in spring and dry in summer.
- Efficiency of submerged drains depends on saturated water conductivity of the peat. kf should be ≥ 10 cm/day
- CWB is an important driver of hydraulic head and useful for weir adjustment.
- Dry summers require high hydraulic heads (30 cm in the studied bog, 50 cm in the fen).
- Stable water levels of 30 cm below surface seem possible in average summers but require flat surface and good management of pumps, weirs and submerged drains.